FINAL

BASELINE ECOLOGICAL RISK ASSESSMENT
OPERABLE UNIT 1 & OPERABLE UNIT 2

OLIN CHEMICAL SUPERFUND SITE

51 EAMES STREET
WILMINGTON, MASSACHUSETTS

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51 EAMES STREET
WILMINGTON, MASSACHUSETTS

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LIST OF ACRONYMS

AMEC	AMEC Environment & Infrastructure, Inc.
ARCS	Assessment of Remediation of Contaminated Sediments
AWQC	Ambient Water Quality Criteria
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
COC	Constituent of concern
COI	Chemicals of interest
COPECs	Chemicals of Potential Ecological Concern
C-RAM Plan	Construction-Related Release Abatement Measure Plan
CSL	Calcium Sulfate Landfill
CSM	Conceptual Site Model
CTE	Central Tendency Exposure
EA	Exposure Area
ECOSAR	Ecological Structure Activity Relationships
ECO-SSL	Ecological Soil Screening Levels
EPCs	Exposure Point Concentrations
EPH	Extractable Petroleum Hydrocarbons
ERC	Environmental Risk Characterization
ESD	Equilibrium Partitioning Sediment Benchmarks
FRA	Focused Risk Assessment
HQ	Hazard Quotient
LCVs	Lowest Chronic Levels
LEL	Low-Effects Level
LFB	Landfill Brook
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transit Authority
mg/kg	milligrams per kilogram
MMB	Maple Meadow Brook
MSL	Mean Sea Level
NDMA	N-nitrosodimethylamine
NH3	unionized ammonia
NH4+	ionized ammonia
NOAEL	No-Adverse-Effect-Level
OCSS	Olin Chemical Superfund Site
Off-PWD	Off-Property West Ditch
Olin	Olin Corporation
OMEE	Ontario Ministry of Energy and Environment
On-PWD	On-Property West Ditch
ORNL	Oak Ridge National Library
OU	Operable Unit
PECs	Probable Effects Concentrations
Process Document	USEPA Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments

QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAGs	Risk Assessment Guidance for Superfund
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
SLERA	Screening Level Ecological Risk Assessment
SMB	Sawmill Brook
SOW	Statement of Work
SQL	Sample Quantitation Limit
SVOCs	Semivolatile Organic Compounds
TECs	Threshold Effects Concentrations
TNRCC	Texas Natural Resources Conservation Commission
TRV	Toxicity Reference Value
TSWQS	Texas Surface Water Quality Standards
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WDW	West Ditch Wetland

1.0 INTRODUCTION

Olin Corporation (Olin) is conducting a Remedial Investigation/Feasibility Study (RI/FS) for the Olin Chemical Superfund Site (OCSS) under the *Settlement Agreement and Administrative Order on Consent* (AOC) (USEPA, 2007) in accordance with the *Statement of Work (SOW), RI/FS, Olin Chemical Superfund Site* (Site), prepared by the United States Environmental Protection Agency (USEPA) Region I – New England and dated June 2007 (USEPA, 2007a).

The AOC and SOW identify RI requirements for three Operable Units (OUs). This Baseline Ecological Risk Assessment (BERA) has been developed for Operable Units 1 and 2, which Olin and USEPA have agreed to address in a combined Remedial Investigation (RI) Report. OU1 is defined in the SOW as the approximately 50-acre Olin Property (hereafter, the "Olin Property" or "Property"), including the former facility area, the established conservation area, the on-Property ditch system, the Calcium Sulfate Landfill (CSL), and the slurry wall/containment area. Soil and On-Property surface water and sediment are evaluated for OU1. OU2 is defined as off-Property surface water and sediment areas, including, at a minimum, the off-Property East Ditch, South Ditch and West Ditch. This document also addresses Landfill Brook (LFB), North Pond, and the Maple Meadow Brook (MMB) Wetland, which includes MMB, Sawmill Brook and surrounding areas.

This BERA has been developed by Amec Foster Wheeler Environment and Infrastructure, Inc. (formerly AMEC Environment and Infrastructure, Inc.) on behalf of Olin in accordance with the USEPA *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997), herein referred to as the "Process Document". The following documents were also used as guidance for conducting the BERA:

- Framework for Ecological Risk Assessment. USEPA, Risk Assessment Forum, Washington, DC, EPA/630/R-92/001. February 1992 (USEPA, 1992);
- Risk Assessment Guidance for Superfund (RAGS), Volume II: Environmental Evaluation Manual (USEPA, 1989);
- Guidelines for Ecological Risk Assessment (USEPA, 1998);
- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update (USEPA, 2001a); and
- EcoUpdates published by USEPA between 1991 and 2008.

The Process Document outlines an eight-step approach to ecological risk assessment. Steps 1 through 3 include the problem formulation, benchmark selection, and chemicals of potential ecological concern (COPEC) selection. Step 4 (Study Design and Data Quality Objectives Process) was incorporated into Section 4.0. Step 5 (Verification of Field Sampling Design) and Step 6 (Site Investigation and Data Analysis) were completed as part of the field sampling program. Step 7 (Risk Characterization) was addressed principally in Section 5.0 of this BERA. The results of this BERA will be used to make risk management decisions for OU1 and OU2 as part of Step 8 (Risk Management).

The objective of the BERA is to characterize risk to ecological receptors that are assumed to be potentially exposed to chemicals of interest (COIs) associated with historical operations at the Property, in the absence of any additional remedial measures. COIs are chemicals that have been associated with the former facility (as a raw material, product, or a constituent of waste streams or accidental releases) and that have been released to one or more environmental media.

The results of the BERA will be considered with other regulatory and technical information to evaluate the need for remedial action at OU1 and OU2, and if remedial action is required, to

develop and evaluate remedial alternatives. COIs were identified in the Executive Summary of the RI Report.

2.0 PREVIOUS ECOLOGICAL RISK ASSESSMENTS

Twelve separate ecological risk assessments have been conducted previously for portions of OU1 and OU2. This section summarizes the two comprehensive ecological risk assessments conducted for the Site that incorporate the bulk of the historical ecological risk assessment information. The section also summarizes previous evaluations of major ecological risk drivers and summarizes the overall findings of the previous risk assessments.

2.1 Ecological Risk Characterization (Supplemental Phase II Report), June 1997

While the Property was regulated under the Massachusetts Contingency Plan (MCP), a comprehensive environmental risk characterization (ERC) was completed as part of the Supplemental Phase II Report submitted to the Massachusetts Department of Environmental Protection (MassDEP) in June 1997 (ABB-ES, 1997). The 1997 Stage II ERC was conducted to assess risk to ecological receptors associated with the current and reasonably foreseeable land uses and activities at the facility and in surrounding areas within the Property boundaries (OU1).

The Stage II ERC built upon the information presented in the 1993 Screening Level Ecological Risk Assessment (SLERA) (ABB-ES, 1993) and incorporated additional information collected subsequent to the SLERA. Information used in the Stage II ERC included:

- Surface soil analytical data (from undeveloped portions of OU1 only);
- Surface soil data for earthworm toxicity testing;
- Surface water and sediment analytical data;
- Surface soil, sediment and surface water analytical data from background locations;
- Site-specific biological tissue data from small mammals, herbaceous plants, benthic macroinvertebrates, and amphibians

The 1997 Stage II ERC identified ecological habitats, exposure areas, receptors, and exposure pathways. The 1997 Stage II ERC evaluated the terrestrial habitat of the Property as a single unit and the semi-aquatic habitat of the Property as another single unit. Assessments for these two habitats were based on Property wide, area-weighted Exposure Point Concentrations (EPCs).

The 1997 Stage II ERC concluded there was no significant risk of harm from soil to terrestrial receptors (red fox, woodcock) from either direct toxicity via the food chain or indirect effects from reduced prey abundance (earthworms). The 1997 Stage II ERC did not evaluate smaller common terrestrial receptors such as the Short-tailed Shrew or the American Robin.

The 1997 Stage II ERC also concluded that there was no significant risk of harm from surface water and sediment to semi-aquatic receptors (green heron) from either direct toxicity via the food chain or indirect effects from reduced prey abundance (frogs). Toxicity tests indicated no significant risk to terrestrial invertebrates but could not support a finding of no significant risk of harm from surface water to amphibians (green frog) in the On-Property West Ditch. Primary risk contributors were identified as ammonia, chromium, and di-n-octyl-phthalate. Aluminum and iron were also identified as potential risk contributors. The On-Property West Ditch was subsequently remediated in 2000 (MACTEC, 2007).

2.2 Focused Risk Assessment, April 2000

A Focused Risk Assessment (FRA) was conducted in 2000 to demonstrate that future construction and operation of a warehousing facility on the Property would be associated with a condition of no significant risk as defined by the MCP. The 2000 FRA evaluated ecological risks for habitat expected to remain after the proposed development, and provided an update to the

1997 ERC. The FRA was submitted to MassDEP as a component of Part I of the Construction-Related Release Abatement Measure (C-RAM) Plan (GEI, 2000), however the proposed warehousing facility project was never implemented.

The 2000 FRA consisted of two elements. The first element addressed MassDEP's comments to the 1997 Stage II ERC requiring clarification on:

- The development of the various toxicity benchmarks and toxicity reference values (TRVs) employed in the ERC;
- The estimation of potential direct exposures to amphibians and indirect exposures to wildlife; and
- The characterization of environmental risks.

Responses to MassDEP comments and associated ERC revisions did not change the overall conclusions of the 1997 Stage II ERC.

The second element was a focused risk assessment which evaluated risk to ecological receptors from surface soil and sediment. The 2000 FRA evaluated the surface water, sediment, and soil data used in the 1997 Stage II ERC but excluded data from areas of the Property that would be affected by the proposed redevelopment or remediation. The 2000 FRA also included additional surface soil and sediment data collected after completion of the 1997 Stage II ERC.

The 2000 FRA evaluated the terrestrial habitat of the Property as a single unit and the semi-aquatic habitat of the Property as another single unit. Assessments for these two habitats were based on Property wide, area-weighted EPCs.

The results of the 2000 FRA supported a conclusion of no significant risk of harm to terrestrial wildlife (red fox, woodcock) and semi-aquatic wildlife (green heron) at the Property.

2.3 Evaluation of Ammonia in Surface Water

Ammonia was identified in previous risk assessments as posing a potential risk to receptors in the on-Property and off-Property ditches. In most cases, ecological risks have been identified for ammonia by comparing surface water concentrations to USEPA Ambient Water Quality Criteria (AWQC), derived to be protective of sensitive cold water fish species. No fish have ever been observed in any of the on-Property ditches. The presence of water in the on- and off-Property West Ditch is intermittent. Portions of the South Ditch go dry in the summer months and the downstream East Ditch is a man-made drainage ditch situated within railroad ballast. None of these ditches are known to support fish nor would they be expected to. Consequently, the screening benchmark that has been the basis for evaluations of potential ecological risk from ammonia in surface water likely overestimates risk.

Within the ditch system, ammonia surface water concentrations have been consistently greater than screening benchmarks. However, the ecological risk assessments conducted to date have not documented any significant impacts to aquatic life associated with surface water quality. Since the AWQC for ammonia is overly conservative for site habitat conditions, in this BERA, the ammonia AWQC will be calculated using USEPA equations that incorporate site-specific information and as such are more reflective of site-specific conditions.

2.4 Summary of Conclusions from Previous Ecological Risk Assessments

Previous ecological risk assessments conducted for the property have concluded the following:

- A condition of no significant risk of harm to the environment, based on Property-wide area weighted EPCs, exists for the soil at the Property;

- Based on risk assessments and sediment remedial activities in the on-Property West Ditch (on-PWD) Wetland and the Upper South Ditch, as well as the sediment removal and culverting of the on-PWD, there is negligible risk associated with sediments within most of the ditch system;
- The Lower South Ditch sediments require further risk evaluation;
- Risk associated with ammonia based on comparison to generic criteria is likely overestimated; and
- N-nitrosodimethylamine (NDMA) has not been identified as a driver for ecological risk, either on-Property or off-Property. NDMA has not been detected in soil or sediment samples. NDMA concentrations in surface water (post 2002) have been below published screening levels as reported in IRA submittals to MassDEP.

3.0 BASELINE PROBLEM FORMULATION

The problem formulation provides the framework upon which the risk assessment is organized. The problem formulation:

- Describes the nature and extent of contaminants at the Site (Section 3.1);
- Describes the physical and spatial features of the Site (Section 3.2);
- Describes topography (Section 3.3);
- Describes the hydrology (Section 3.4);
- Describes the habitats and exposure areas (Section 3.5);
- Identifies any endangered, threatened or State-listed species (Section 3.6);
- Identifies potential ecological receptors (Section 3.7);
- Identifies complete exposure pathways for ecological receptors (Section 3.8);
- Identifies assessment and measurement endpoints (Section 3.9);
- Describes the ecological conceptual site model (CSM) (Section 3.10);
- Conducts the data evaluation (Section 3.11);
- Selects COPECs (Section 3.12).

The problem formulation is based on the findings of numerous Site investigations, risk assessments and remedial actions conducted since 1978 to develop an understanding of the nature of environmental impacts at the Site.

3.1 Nature and Extent of Contamination

The Executive Summary of the OU1/OU2 RI Report identifies chemicals considered primary COIs for the Site (or chemicals that have been associated with the former facility as a raw material, product, or a constituent of waste streams or accidental releases) and that have been released to one or more environmental media.

Raw materials utilized during the operating history included diphenylamine, di-n-octylphthalate, bis(2-ethylhexyl)phthalate (BEHP), diisobutylene (trimethylpentene (TMP) mixture used at Plant B in the manufacture of dioctyldiphenylamine or Wytox ADP®), #415 Process Oil, nonylphenol, and formaldehyde (formalin), dimethylformamide, dinonylphenol, sodium nitrite, 2-ethylhexoic acid, butanol, ammonia (likely anhydrous), hydrazine, sodium dichromate, chlorosulfonic acid, diphenyl oxide, and ammonium hydroxide, benzonitrile, sodium nitrite, hydrochloric acid, sulfuric acid, phenol, and nonylphenol. Sodium dichromate was used as a catalyst in the manufacture of Kempore® until 1967, when its use was discontinued.

Constituents in liquid waste streams and unintentional releases included chromium, bis(2-ethylhexyl)phthalate, N-Nitrosodiphenylamine (NDPA), N-nitrosodipropylamine (NDPrA), diisobutylene (mixture of 2,4,4,-trimethyl-1-pentene and 2,4,4,-trimethyl-2-pentene), formaldehyde, dimethylformamide, Opex®, and Kempore®, sulfuric acid, hydrochloric acid, and numerous salts of sodium and ammonium (sulfates, chlorides, nitrates, and nitrites). Calcium sulfate (gypsum) was produced and precipitated when wastewaters were neutralized with lime (calcium hydroxide) – after the use of sodium dichromate had been discontinued. Polychlorinated biphenyls (PCBs) were used in electrical transformers at OU1 and some release to soil has been documented. Processing oil was released to soil and the subsurface in the area of the Plant B Tank Farm.

The sources, nature and extent of contaminants at the Site and the fate and transport of those contaminants are discussed in detail in Section 4.0 of the OU1/OU2 RI report.

3.2 Physical and Spatial Features

This section describes environmental physical settings of OU1 and OU2 of the Site.

3.2.1 OU1

OU1 was defined above and includes soil, sediment, and surface water within the bounds of the Olin Property as shown on **Figure 3.2-1**. The northern portion of the Property is the location of the former chemical manufacturing facility currently consisting of mowed fields, concrete slabs from former buildings, paved roads, parking areas, and several existing structures including: the Former Office Building, Former Lab, Plant A, Guard Shack, Butler Building, Plant B, Tank Farm, Water Tower, East Warehouse, and West Warehouse. In 2006, Olin installed a forty-foot office trailer and two metal storage trailers in the northeast quarter of the Property near the Plant B building which houses a groundwater recovery and treatment system.

The on-PWD and the West Ditch Wetland (WDW) are located to the west of the former chemical manufacturing facility area along the northwestern border of the Property. The WDW is an approximately 1-acre emergent and scrub-shrub wetland. The on-PWD begins at the southern end of the WDW. In addition to receiving water from the WDW, the on-PWD also receives treated groundwater from Plant B through an outlet located approximately 100 feet west of the West Warehouse. From there the on-PWD flows along the western side of the Property, and is contained in a culvert along the western side of the Containment Structure. The Containment Structure is an approximately 5.7-acre containment structure centrally located on the western side of the Property. To the south of the containment structure is the Storm Water Detention Basin that captures storm water from the cap over the Containment Structure and drains it into the South Ditch. Also at the south end of the Containment Structure, the culverted segment of the on-PWD terminates in a concrete outlet structure that discharges to the South Ditch.

The South Ditch is a shallow, approximately 1-foot deep by five feet wide, manmade ditch that flows from west to east, dividing the Property. The South Ditch begins at the Property boundary along the west side, and receives surface flow from the off-Property West Ditch (off-PWD), which is a storm water drainage ditch located adjacent to the western property boundary, and the on-PWD. The South Ditch runs to the eastern Property boundary where it widens into a 150 foot wide delta area before discharging into the East Ditch. The South Ditch is divided into an upper portion, where sediment was historically remediated, and a lower portion where sediment has not been remediated. To the north of the South Ditch, in the center of the property, is the 0.2-acre Central Pond. To the south of the South Ditch is the Ephemeral Drainage. During prolonged wet periods and following heavy precipitation events, flow in the Ephemeral Drainage may develop and join the South Ditch in vicinity of the eastern Property boundary.

The southern half of the Property, south of the South Ditch, is forested, except in the southwestern corner of the property where the closed Calcium Sulfate Landfill (CSL) is located. The CSL is an approximately 2.5-acre landfill that was capped, seeded with grass, and is currently maintained with periodic mowing. The forested area, north and east of the CSL and south of the South Ditch, is subject to the terms of an Environmental and Open Space Restriction that restricts future commercial development activities on that portion of the Property.

The land surrounding the Property is heavily developed by industrial facilities to the east, north, and west, and by the Woburn Town Landfill to the south. The Massachusetts Bay Transit Authority (MBTA) Commuter Rail line abuts the eastern property boundary. Further to the west of the property, along Main Street, Cook Avenue and Border Avenue, the primary land use is single-family homes with some commercial and light industrial development.

3.2.2 OU2

OU2 is defined above and includes off-Property surface water and sediment areas into which constituents from the Olin Property may have migrated. OU2 includes the East Ditch, the off-Property portion of the South Ditch, the off-PWD, MMB, Sawmill Brook (SMB), the MMB Wetland, and the North Pond (**Figure 3.2-2**). The off-PWD is a storm water drainage ditch located adjacent to the western Property boundary that discharges to the on-Property portion of the South Ditch. The primary source of water in the off-PWD is stormwater runoff from the Jewel Drive area. The South Ditch runs from the western Property boundary to the eastern Property boundary, dividing the Property. The South Ditch crosses the eastern Property boundary and opens into a 150 foot wide delta before discharging to the East Ditch. This section of the South Ditch between the eastern Property boundary and the East Ditch is approximately 150 feet long. The East Ditch is a railroad drainage ditch that runs parallel to the eastern Property boundary and the MBTA Commuter Rail line. South of the confluence of the East and South ditches, the East Ditch flows southeast and turns to the south into the New Boston Street Drainway. Further south, Landfill Brook, a drainage ditch associated with the Woburn Town Landfill, flows into the New Boston Street Drainway.

The MMB Wetland is approximately 1,300 feet northwest of the Olin Property. The MMB Wetland is a large (approximately 750 acre) wetland complex that includes the two named brooks, Maple Meadow Brook (MMB) and Sawmill brook (SMB). The MMB Wetland is located to the west of Main Street, Wilmington. Land use in the vicinity of the MMB Wetland is mixed residential.

The North Pond is a small (approximately 2 acre) pond located southeast of the Olin Property on the border of Wilmington and Woburn just south of Presidential Way. Land use in the vicinity of the North Pond is mixed industrial / commercial.

Landfill Brook is included in the BERA through COPEC selection only as the nature and extent evaluation in the RI found that Landfill Brook is not impacted by the OCSS.

3.3 Topography

The topography in the developed northern portion of the Property is essentially flat with a ground surface elevation of approximately 85 feet to 95 feet above mean sea level (MSL). The undeveloped, southern portion of the Property consists largely of wetlands and mature forest lands and has slightly more topographic relief including low lying wet depressions and a small knoll. The South Ditch, Central Pond, and Ephemeral Drainage lie within a depression located across the center of the Property. This low lying area is intersected at the Property boundaries by the East and West ditches. In the vicinity of the South Ditch and the Ephemeral Drainage, the ground surface elevation ranges from approximately 80 feet MSL in the west, sloping to an elevation of approximately 77 feet MSL to the east. A small upland knoll is present between the South Ditch and the Ephemeral Drainage, with a maximum elevation of 86 feet MSL.

The area surrounding the Property includes low lying wetlands and flat paved industrial areas. The land north of the Property is developed and generally flat. The MBTA rail line creates and occupies a topographic low along the eastern side of the Property. Most of the land east of the MBTA line is commercially developed and paved or landscaped and is generally flat with a gradual topographic rise directly to the east attaining elevations of approximately 115 feet above MSL. A low ridge runs along the southern boundary of the Property and reaches a maximum elevation of 108 feet MSL. The CSL was constructed on the western end of this ridge. Beyond the Woburn Landfill to the south, the elevation decreases (80 feet MSL) and the topography flattens.

The area immediately west of the northern portion of the Property is relatively flat. Land use includes commercially developed lots along Jewel Drive and Eames Street, beyond which are residential lots along Main Street. In the area immediately west of the southern portion of the Property are several residences along Cook Avenue and Border Avenue in Wilmington that sit on a small hill or knoll that extends to 140 feet MSL.

To the northwest of the Property, on the western side of Main Street in Wilmington, ground surface elevations are lower than at the Property at 80 feet MSL near and within the MMB Wetland. Topography near and within the MMB Wetland is relatively flat and bordered by upland areas to the west, and to the north by a broad ridge that runs parallel to Butters Row.

3.4 Hydrology

Groundwater on the Property is generally shallow. The depth to groundwater is 1–2 ft below ground surface (bgs) in proximity to South Ditch. The South Ditch is predominantly a gaining surface water body that receives discharging groundwater. Depth to groundwater is 1–2 feet bgs adjacent to the on-PWD in the northwest portion of the property. The depth to groundwater increases from 2–3 ft bgs to approximately 8–10 ft bgs toward the northern and northeastern property boundaries. Depth to groundwater also increases to approximately 10 ft bgs south of the Ephemeral Drainage.

Coincident with a bedrock high present in the north central portion of the Property is a groundwater high. This groundwater high helps maintain the position of the groundwater divide that runs through the property to the southwest toward Jewel Drive. Northwest of the divide shallow groundwater flows towards the MMB Wetland within the Ipswich River drainage basin. The area southwest of the divide, including nearly all of the Property, groundwater flow is to south and south east towards the South Ditch and East Ditch within the Aberjona River drainage basin.

3.5 Habitats & Exposure Areas

Habitats were identified from observations made during Site visits. This section discusses the habitats in OU1 and OU2 exposure areas. The BERA evaluates risk to ecological receptors in OU1 in two terrestrial exposure areas (**Figure 3.5-1**):

- Exposure Area 2 (EA2) (Section 3.5.1); and
- Exposure Area 4 (EA4) (Section 3.5.2).

The BERA does not evaluate ecological risk for terrestrial exposure areas EA1 or EA3 as those areas are heavily developed and do not provide significant habitat.

The BERA evaluates ecological risk in OU1 in five aquatic exposure areas (**Figure 3.5-2**):

- Central Pond (Section 3.5.3);
- Storm Water Detention Basin (Section 3.5.4);
- On-PWD/WDW(Section 3.5.5);
- Upper South Ditch (Section 3.5.6); and
- Lower South Ditch (Section 3.5.7).

The on-Property and off-Property portions of the Lower South Ditch are evaluated together as a single exposure area.

The BERA evaluates ecological risk in OU2 in one terrestrial exposure area:

- Exposure Area 5 (EA5) (Section 3.5.8).

The BERA evaluates ecological risk in OU2 in three aquatic exposure areas:

- Off-PWD (Section 3.5.9);
- MMB Wetland (Section 3.5.10);
- Landfill Brook (Section 3.5.11) – evaluation will only include COPEC selection;
- North Pond (Section 3.5-12).

North Pond is evaluated per request from USEPA. There is no current complete exposure pathway between the Property and North Pond. The current sediments in North Pond could not have been impacted by historical activities and releases associated with the Property.

As decided upon during the March 7, 2013 meeting with the USEPA and MassDEP, the East Ditch is assessed in a separate SLERA. The East Ditch SLERA is presented in Attachment 7.

An on-Property soil background area and an off-Property reference location were also identified for OU1 and OU2 and were incorporated in the risk characterization:

- Terrestrial Background (Section 3.5.13; **Figure 3.5-1**); and
- MMB Wetland Aquatic Background (or Reference) Area (Section 3.5.14; **Figure 3.5-3**).

3.5.1 Exposure Area 2 (OU1)

EA2 is the upland portion of an approximately 2.75-acre, 150-foot wide by 800-foot long section of the Property, running along the western Property boundary from the northwestern Property boundary to the Slurry Wall/Containment Area. EA2 consists only of the upland border of this area. Within this same portion of the Property is the On-PWD/WDW, which is evaluated separately in this BERA. Habitat in EA2 consists mixed stands of hardwoods and pines dominated by white pine (*Pinus strobus*), northern red oak (*Quercus borealis*), green ash (*Fraxinus pennsylvanica*), hemlock (*Tsuga canadensis*), and white ash (*Fraxinus americana*). Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potentially inhabit or periodically use EA2 are identified in **Table 3.5-1**.

3.5.2 Exposure Area 4 (OU1)

EA4 is an approximately 6.6-acre section of the Property consisting primarily of the uplands and wetlands surrounding the South Ditch to the north and south. EA4 consists of mixed stands of hardwoods and pines dominated by white pine, northern red oak, and white ash. Wetland areas within EA4 include the central wetland and a large wetland area south of the South Ditch. Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potentially inhabit or periodically use EA4 are identified in **Table 3.5-1**.

3.5.3 Central Pond (OU1)

The Central Pond is a shallow pond centrally located on the Property just north of the South Ditch channel. The Central Pond is generally round in shape, has an approximate area of 0.2 acres, and is approximately 100-feet wide.

Submerged vegetation in the Central Pond is nearly absent and emergent herbaceous growth is sparse. The edges of the pond are vegetated with shrubs and herbaceous plant species. The north and west edges of the pond are heavily vegetated, dominated by grey birch (*Betula populifolia*), red maple (*Acer rubrum*), the invasive glossy buckthorn (*Rhamnus frangula*) and chokecherry (*Prunus virginiana*). To the south and east of the pond is an area of grasses and sedges with scattered grey birch and red maple saplings. During the various field efforts and habitat surveys conducted throughout the numerous investigations, no fish have been observed

in the Central Pond and no evidence of stressed biota has been noted. Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potentially use the Central Pond are identified in **Table 3.5-1**.

3.5.4 Storm Water Detention Basin (OU1)

The Storm Water Detention Basin is a small, approximately 150-foot wide, man-made pond that captures storm water from the temporary cap over the Slurry Wall/Containment Area and drains it into the South Ditch. Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potentially use the Storm Water Detention Basin are identified in **Table 3.5-1**.

3.5.5 On-PWD/WDW (OU1)

The On-PWD/WDW is located within EA-2 and includes an open emergent wetland system with shrub species present along the perimeter. Soils in the WDW have been greatly disturbed by historic excavating, re-grading and filling in and around the borders of the wetland. The soils in the area are classified as Udorthents, and although the morphology has been altered, the soils are still considered hydric. The on-PWD/WDW includes some channelization where the stream is 3 to 4 feet wide with 3 to 6 inches of water. In other portions the channel is indistinguishable due to the presence of emergent vegetation. The plant community in the WDW is dominated by cattails (*Typha latifolia)*, meadowsweet (*Spiraea latifolia*), goldenrod (*Solidago sp.*) and purple loosestrife (*Lythrum salicaria*) with some glossy buckthorn. Red maple and gray birch are present in the shrub stratum along the perimeter of the wetland. Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potentially inhabit or use the on-PWD/WDW are identified in **Table 3.5-1**.

3.5.6 Upper South Ditch (OU1)

The Upper South Ditch is the upstream section of the South Ditch where sediment was remediated and restored previously. Base flow is generally minimal in the Upper South Ditch, and the water surface is sometimes covered with an algal film. During drier periods in summer months, the middle of the South Ditch tends to go dry.

Speckled alder (*Alnus rugosa*) shrubs line the banks of the upper portion of the South Ditch. Other vegetation observed along or within the ditch has included jewelweed (*Impatiens capensis*), skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), grasses, sedges, and mosses.

During the various field efforts and habitat surveys conducted throughout the numerous investigations, no fish have been observed in the South Ditch and no evidence of stressed biota has been noted. Considering that the South Ditch is ephemeral and dries up during summer months, it is likely incapable of sustaining populations of fish or benthic macroinvertebrates that require permanent or extended periods of inundation (*e.g.*, mayflies, stoneflies). Wildlife observed in the vicinity of the South Ditch during weekly weir inspections conducted from January 2008 to January 2013 that may potentially inhabit or use the Upper South Ditch are identified in **Table 3.5-1**.

3.5.7 Lower South Ditch (OU1 & OU2)

The Lower South Ditch includes the on-Property (OU1) portion of the South Ditch that has not been previously remediated and the small off-Property (OU2) area. Despite belonging to two operable units, the Lower South Ditch is assessed in this BERA as a single exposure area as the two sections are contiguous and similar in habitat conditions. Base flow is generally minimal in the Lower South Ditch. The algae present in the Upper South Ditch are generally absent in the downstream portion of the ditch, however, a flocculent material has been observed in the

water throughout the South Ditch. During drier periods in summer months, the wetted width diminishes to trickles along the channel edges and the delta dries to a moist mud.

The invasive glossy buckthorn (*Rhamnus cathartica*) dominates the shrub layer in the lower portions of the South Ditch. The lower portion of South Ditch has full canopy cover dominated by red maple with some scattered gray birch. Cattails and purple loosestrife have also been observed in the delta area. Other vegetation observed along or within the ditch has included jewelweed, skunk cabbage, sensitive fern, grasses, sedges, and mosses. Arrowhead (*Sagittaria latifolia*) was observed in the open, delta portion of the Lower South Ditch.

During the various field efforts and habitat surveys conducted throughout the numerous investigations, no fish have ever been observed in the South Ditch and no evidence of stressed biota has been noted. During field work, frogs are frequently observed in the South Ditch. No other wildlife has been directly observed in the South Ditch.

Considering that the South Ditch is ephemeral and dries up during summer months, it is likely incapable of sustaining populations of fish or benthic macroinvertebrates that require permanent or extended periods of inundation (e.g., mayflies, stoneflies). Wildlife observed in the vicinity of the South Ditch during weekly weir inspections conducted from January 2008 to January 2013 that may potentially inhabit or use the Lower South Ditch are identified in **Table 3.5-1**.

3.5.8 Exposure Area 5 (OU2)

Exposure Area 5 is a one-acre area surrounding the off-Property area of the Lower South Ditch. The invasive glossy buckthorn dominates the shrub layer in EA5 and the canopy is dominated by red maple with some scattered gray birch. Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potentially use EA5 are identified in **Table 3.5-1**.

3.5.9 Off-Property West Ditch (OU2)

The off-PWD is a storm water drainage ditch located adjacent to the western property boundary. The off-PWD is shallow, approximately 1-foot deep and 5-feet wide. The primary source of water in the off-PWD is stormwater runoff from the Jewel Drive area. Wildlife observed on the Property during weekly weir inspections conducted from January 2008 to January 2013 that may potential inhabit or use the off-PWD are identified in **Table 3.5-1**.

3.5.10 Maple Meadow Brook Wetland (OU2)

The MMB Wetland is a large wetland complex located approximately 2,000 feet northwest of the Olin property on the western side of Main Street. The MMB Wetland includes two named brooks, Maple Meadow Brook (MMB) and Sawmill Brook (SMB). The MMB flows from west to east. Sawmill Brook confluences with MMB to the west of the former Middlesex canal (**Figure 3.2-2**). From the confluence with SMB, MMB flows northeast and passes through a series of wetlands that ultimately discharge to the Ipswich River. As explained in Section 3 of the RI, there is a surface water (and groundwater) divide to the north and west of the Olin Property. Surface water (and groundwater) in the MMB Wetland north of the divide flows to the Ipswich River Watershed. Surface water (and groundwater) south and east of this divide (OU1, the East Ditch and Landfill Brook) flows to the Aberjona River Watershed.

Flow in MMB ranges from nearly stagnant conditions to high flows in spring runoff and depends on season and precipitation conditions. The portions of the brooks accessed for sampling ranged in width from a few feet to 15 feet. There were also segments where the brook channel was indiscernible within the emergent and scrub-shrub vegetation that dominates the wetland. The depth of water in the MMB Wetland ranges from several inches to 4 feet. The bottom substrate is composed primarily of unconsolidated, decaying, organic material, muck, and peat.

3.5.11 Landfill Brook (OU2)

Landfill Brook is located south of the Olin Property in Woburn (**Figure 3.2-2**). The brook flows from west to east along the southern boundary of the Woburn Landfill. The brook flows approximately 2,600 feet from its head waters in a series of small isolated wetlands south of Breed Avenue to the East Ditch. Landfill Brook enters the East Ditch immediately upstream of where the ED enters a culvert under New Boston Street just to the west of the MTBA rail line on the NSTAR property.

The brook is 6 to 10 feet wide with a depth that varies from 6 inches to 1 foot. The channel substrate observed during sampling was mostly unconsolidated mucky sediments. A reddish brown material that appeared to be iron oxide flocculent was observed throughout Landfill Brook. A series of palustrine emergent wetlands also occur in several areas along the upper portion of the brook.

Landfill Brook is evaluated only through COPEC selection only as the nature and extent evaluation in the RI found that Landfill Brook is not impacted by the OCSS.

3.5.12 North Pond (OU2)

The North Pond is located southeast of the Olin Property on the border of Wilmington and Woburn just south of Presidential Way. The North Pond is an approximately 2 acre surface water pond. In 1955 the area surrounding North Pond was largely undeveloped and the extent of North Pond was much larger (approximately 5 acres). Between 1960 and 1980 the North Pond area was developed with various commercial and industrial facilities. In 1980, the North Pond area was reworked, sediments were excavated and the area filled to construct Presidential Way.

3.5.13 Terrestrial Background

The terrestrial background area is an approximately 10-acre undeveloped area of the Olin Property. The background area is bounded to the south and west by the Property boundary. To the east the terrestrial background area is bounded by the CSL. To the north the terrestrial background area extends to approximately 150 feet south of the South Ditch. The terrestrial background area consists of mixed stands of hardwoods and pines. Background soil samples were collected from this area and submitted for laboratory analysis.

3.5.14 Aquatic Background

The aquatic background (reference) area is a tributary to the MMB that confluences with MMB by the Wildwood Street crossing. Samples collected from this tributary constitute the only aquatic background (reference) data used in this BERA. The surface water and sediment samples collected from this area were submitted for laboratory analysis. Since there is one sample each for surface water and sediment, these samples are referred to as reference area samples rather than background area samples (background conditions are typically characterized by multiple samples).

3.6 Endangered, Threatened or State Listed Species

Past consultations with the United States Fish and Wildlife Service (USFWS) have indicated that no federally-listed and proposed, endangered or threatened species are known to occur within the general vicinity of the site (MACTEC, 2004). The Mystic Valley Amphipod (*Crangonyx aberrans*) has historically been reported as occurring in the vicinity of the Property; however this species was delisted in 1997 by the Massachusetts Natural Heritage and Endangered Species Program.

On March 13, 2013, AMEC reviewed the information available on the USFWS Information, Planning, and Conservation System and confirmed that there are currently no federally-listed rare, threatened or endangered species known to occur on or in the vicinity of OU1 or OU2. AMEC also reviewed the information available on the MassDEP Natural Heritage and Endangered Species Program Interactive Priority and Estimated Habitats Online Viewer and confirmed that there are no estimated or priority habitats of State-listed species on or in the vicinity of OU1 or OU2. Attachment 3 presents the results of the USFWS and MassDEP endangered species reviews.

3.7 Receptor Identification

Receptors (*i.e.,* indicator species) were selected by focusing on species and communities that:

- Are indigenous to the area (taking into consideration the habitat types and areas available within the site);
- Are likely to be highly exposed to COPECs due to their habitat preference, behavioral traits, and home range; and
- Are representative of various feeding guilds or trophic levels (*e.g.*, herbivore, invertivore, carnivore);

Terrestrial portions of OU1 and OU2 provide habitat for a variety of receptors, including plants, soil invertebrates, and wildlife. The Central Pond, Storm Water Detention Basin, on-PWD/WDW, South Ditch, and the off-PWD do not support fish but can provide habitat for aquatic and wetland plants, benthic macroinvertebrates, amphibians and semi-aquatic wildlife.

Terrestrial, aquatic, and semi-aquatic receptors were selected based on their observed or likely presence in OU1 and OU2 and on indicator species previously evaluated in prior ecological risk assessments conducted for the Olin Property.

There is insufficient toxicological literature and inadequate development of toxicological models for reptiles, thus this group was not further evaluated.

3.7.1 Terrestrial Plant Communities

Terrestrial plant communities in OU1 and OU2 exposure areas were selected as receptors. As primary producers, plants are the basis of the food chain in terrestrial ecosystems. Plants provide forage for herbivores and habitat for terrestrial animal species. Terrestrial plants are important in soil stabilization in floodplain and upland communities. Terrestrial plants may be exposed to and accumulate COPECs from soil solution, where ions are freely available for absorption by plant roots (Brady & Weil, 1999). Plants may accumulate COPECs in roots, stems, leaves, or fruits which get transferred to herbivores when consumed. Detritus (dead plant material) may also contain COPECs and be consumed by detritivores. Herbivores and detritivores may, in turn, become a source of COPEC exposure for secondary consumers.

3.7.2 Soil Invertebrate Communities

Soil invertebrate communities in OU1 and OU2 exposure areas were selected as receptors. Soil invertebrates, such as earthworms and soil-dwelling insects, may be exposed to and accumulate COPECs. Exposure could result from direct contact between soil and their outer membranes and respiratory surfaces, from the direct ingestion of soil during feeding activities, and from the consumption of affected prey or detritus, depending upon specific feeding habits. Consumers, including amphibians, birds, and mammals may be exposed to COPECS accumulated in the tissues of soil invertebrate prey.

3.7.3 Terrestrial Bird Populations

The American robin was selected to represent songbirds which may be exposed to and accumulate COPECs through consumption of contaminated prey and OU1 and OU2 soil. Robins eat a variety of both plant and animal foods which may have significant direct contact with soil and may bioaccumulate COPECs (USEPA, 1993). Robins forage by hopping along the ground in search of ground-dwelling invertebrates, such as earthworms, and by searching for fruit in shrubs and low hanging tree branches. Robins forage on the ground in open areas, along habitat edges, or near edges of water. Nests are constructed with mud or vegetation and are located on or near the ground (USEPA, 1993). During breeding season, foraging is generally confined to a territory approximately 0.4 acres in size. During non-breeding roosting periods, robins are likely to return to the same foraging sites for many weeks (USEPA, 1993). Robins migrate, leaving breeding grounds in late summer and returning by early spring. Adult robins often return to the same territory in succeeding years.

Red-tailed hawk was selected to represent birds of prey which may be exposed to and accumulate COPECs through consumption of contaminated prey. Red-tailed hawks primarily prey on small terrestrial mammals such as mice, voles, shrews, rabbits and squirrels, and small birds such as robins. Depending on prey availability they will also consume snakes, reptiles, and large insects. Many of their prey items consume plant and animal foods which may have significant contact with soil and may bioaccumulate COPECs. Consumption of these prey items is a source of COPEC exposure to red-tailed hawks (USEPA, 1993). Red-tailed hawks inhabit areas with a mix of woodland, wetland, and open field habitats and primarily hunt from perches. Depending on habitat availability, the home range for a breeding pair of red-tailed hawks can be between 700 to 3,700 acres (USEPA, 1993). Red-tailed hawks that inhabit the northeastern United States are migratory, leaving their breeding grounds in the fall and returning in the early spring. Typically, red-tailed hawks return to the same territory in succeeding years (USEPA, 1993).

3.7.4 Terrestrial Mammalian Populations

The northern short-tailed shrew (*Blarina brevicauda*) was selected to represent small mammals which may be exposed to and accumulate COPECs through consumption of contaminated prey and OU1 and OU2 soil. The shrew may receive substantial exposure to and accumulate COPECs due to diet, high ingestion rate (Morrison *et al.*, 1957 *cited in* USEPA, 1993), and frequency of contact with surficial soils. Shrews have high metabolic rates and can eat their approximate weight in food each day, primarily in the form of earthworms and insects, which may have significant direct contact with soil (USEPA, 1993). Shrews require cool, moist habitats, and are common in areas with abundant vegetative cover (USEPA, 1993). Shrews are active all year and do not hibernate (USEPA, 1993). Shrews build underground nests and maintain underground runways, usually in the top 4 inches of soil but sometimes as deep as 20 inches. Habitat ranges from 0.07 acres when prey is abundant to 5.4 acres when food is scarce. Shrews and other small mammals may accumulate COPECs and be consumed by higher-order predators such as raptors and owls.

The red fox was selected to represent carnivorous mammals which may be exposed to and accumulate COPECs through consumption of prey and incidental ingestion of soil. The red fox is widespread throughout the northeastern United States and inhabits a wide range of habitats including forest and open fields. It preys primarily on small mammals such as mice, voles, rabbits and shrews but will also prey upon small birds, reptiles, amphibians and invertebrates. It will also eat a wide variety of plant materials and is a scavenger of carrion (USEPA, 1993). The red fox is active year round and has a range of approximately 250 to 2,500 acres per pair depending on habitat (USEPA, 1993).

3.7.5 Benthic Macroinvertebrate Communities

Benthic macroinvertebrate communities in OU1 and OU2 exposure areas were selected as receptors. Benthic macroinvertebrates may be exposed to and accumulate COPECs in sediment and surface water. Exposure could result from direct contact between sediment and their outer membranes and respiratory surfaces, from the direct ingestion of sediments during feeding activities, and from the consumption of affected prey or detritus, depending upon specific feeding habits. Benthic macroinvertebrates may, in turn, become a source of COPEC exposure for secondary consumers, including amphibians, birds, and mammals.

3.7.6 Amphibian Populations

The green frog (*Rana clamitans*) was selected to represent amphibians which may be exposed to and accumulate COPECs through consumption of prey and OU1/OU2 surface water and sediment. Exposure may result from direct dermal contact with sediment and surface water or from incidental ingestion from feeding behavior as well as from contaminated prey. Green frogs will consume a wide variety of insects, spiders, crustaceans, tadpoles, and other frogs which may be a source of COPEC exposure. Consumers, including birds, and mammals may be exposed to COPECS accumulated in the tissues of amphibian prey.

3.7.7 Semi-aquatic Bird Populations

The marsh wren (*Cistothorus palustris*) was selected to represent invertivorous semi-aquatic birds which may be exposed to and accumulate COPECs through consumption of contaminated prey and OU1/OU2 surface water and sediment. Marsh wrens are a common invertivorous species of waterfowl that inhabits fresh and salt water marshes throughout the northern United States. Marsh wrens may be exposed to COPECs through consumption of aquatic macroinvertebrates, surface water ingestion and incidental sediment ingestion. Marsh wrens require aquatic habitats with both emergent vegetation and open water for foraging and dense cattails, bulrushes or sedges for nesting (USEPA, 1993). The average territory for a male marsh wren is relatively small, ranging from 0.015 to 0.42 acres (USEPA, 1993). Marsh wrens are territorial and polygamous. Males may have up to three mates living in their territory (USEPA, 1993). Marsh wrens that breed in the northern United States are migratory and will typically leave their breeding grounds during September and October and return from April to June (USEPA, 1993).

The green heron (*Butorides virescens*) was selected to represent omnivorous semi-aquatic birds which may be exposed to and accumulate COPECs through consumption of contaminated prey and OU1 and OU2 surface water and sediment. Green herons are a widespread species of waterfowl that inhabit freshwater marshes, streams, and ponds throughout the Northern United States. Green herons may be exposed to COPECs through ingestion of surface water and incidental sediment ingestion. Green herons may also be exposed to COPEC through consumption of prey items including aquatic macroinvertebrates, frogs, and crustaceans, which comprise a large portion of the heron's diet (DeGraff & Rudis, 1983). Green herons that breed in the northern United States are migratory and will typically leave their breeding grounds during September and October and return from March to April (DeGraff & Rudis, 1983).

3.7.8 Semi-aquatic Mammal Populations

The muskrat (*Ondatra zibethicus*) was selected to represent herbivorous mammals which may be exposed to and accumulate COPECs through consumption of contaminated prey and OU1 and OU2 surface water and sediment. Muskrats consume primarily aquatic macrophytes which animal prey making up a small portion of their diet. Roots and basal portions of aquatic plants make up most of the muskrat's diet, although shoots, bulbs, stems, and leaves are also eaten (USEPA, 1993). When muskrats prey on animals, they typically eat invertebrates, including

crayfish and mollusks (USEPA, 1993). Muskrats may directly ingest sediment and surface water in the course of lodge or den construction and as they forage. Muskrats have relatively small home ranges, remaining in close proximity to their lodges or bank burrows. For example, one radio telemetry study found that muskrats remained within 500 feet of their primary dwelling 50 percent of the time and only rarely traveled more than 500 feet from the dwelling (USEPA, 1993).

Muskrats are ecologically important because they influence the species composition and density of vegetation within wetland areas. These chewed out areas of open water, sometimes referred to as muskrat eat-outs create a mosaic of open water and vegetation that are valuable to waterfowl. Muskrat dwellings may also be utilized as nesting sites by other species (Weller, 1981).

The raccoon (*Procyon lotor*) was selected to represent omnivorous mammals which may be exposed to and accumulate COPECs through consumption of contaminated prey and OU1 and OU2 surface water and sediment. Raccoons are opportunistic omnivores (USEPA, 1993) that forage along marsh edges (Weller, 1981). Raccoons may ingest COPECs through the consumption of prey, ingestion of drinking water, and incidental ingestion of sediment. The raccoon feeds on a variety of animal and vegetable matter, though plants are usually a more important component of the diet. Raccoons have large home ranges which vary between 400 to 1,180 acres (Kaufmann, 1982; DeGraff & Rudis, 1983).

3.8 Complete Exposure Pathways

Chemicals may move from environmental media to ecological receptors through several major biological exposure mechanisms:

- Uptake of chemicals from soil through roots (plants);
- Ingestion of chemicals bound to soil (terrestrial invertebrates, birds, mammals);
- Ingestion of chemicals bound to sediment (benthic invertebrates, amphibians, semi-aquatic birds, mammals);
- Ingestion of dissolved and particulate chemicals in surface water (benthic invertebrates, amphibians, semi-aquatic birds, mammals);
- Ingestion of chemicals through consumption of contaminated plants (herbivores, omnivores); and
- Ingestion of chemicals through consumption of contaminated prey (all predators).

Although inhalation and dermal absorption pathways are possibly complete for some receptors, these pathways are considered to be minor compared to dietary ingestion and are not evaluated.

Table 3.8-1 presents the exposure pathways and receptors that will be evaluated by exposure area.

3.9 Assessment and Measurement Endpoints

Assessment endpoints in the BERA define ecological attributes that are to be protected. Measurement endpoints are measurable characteristics of those attributes that can be used to gauge the degree of impact that has occurred or may occur. Assessment endpoints most often relate to attributes of biological populations or communities. They contain an entity (e.g., invertebrate populations) and an attribute of that entity (e.g., survival rate). The entity in the assessment endpoint is typically an individual species, population, or community, often referred to as a receptor species or receptor community, respectively. In the case of specially protected species, the assessment endpoint frequently focuses on individuals. Measurement endpoints

are related to the assessment endpoint and the effects that can be measured or observed (e.g., toxicity in invertebrate bioassays). Measurement endpoints are most often used as surrogates for assessment endpoints since in most cases the assessment endpoint itself cannot be readily measured or observed (Suter, 1993).

Measurement endpoints are assigned inference weights reflecting their relative importance in following the guidance provided by Menzie *et al.* (1997). Inference weights are determined by scoring the following attributes:

- The strength of association between the measurement endpoint and the assessment endpoint;
- The sensitivity of the measurement;
- The data quality and study design;
- The representativeness of the data; and
- The ability of the measurement to show correlation, causation and/or concurrence among measures.

Table 3.9-1 presents the decision rules for scoring these attributes and **Table 3.9-2** presents the attribute scores for each measurement endpoint.

Assessment and measurement endpoints are based upon receptor species identified at OU1. The following assessment and measurement endpoints will be evaluated in the BERA:

Assessment Endpoints		**Measurement Endpoints**		**Inference Weight**
1	Sustainability (richness, diversity, structure, and function) of terrestrial plant communities in Site exposure areas.	1A	Compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions.	Low
2	Sustainability (richness, diversity, structure, and function) of soil invertebrate communities in Site exposure areas.	2A	Compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions.	Low
3	Sustainability (survival, growth and reproduction) of populations of invertivorous birds in terrestrial Site exposure areas.	3A	Compare estimated daily dose for insectivorous song bird species (American Robin) based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published avian TRVs and compare to reference area conditions.	Medium / High
4	Sustainability (survival, growth and reproduction) of populations of omnivorous small mammals in terrestrial Site exposure areas.	4A	Compare estimated daily doses for omnivorous small mammal species (Short-tailed Shrew) based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published mammalian TRVs and to reference area conditions.	Medium / High
5	Sustainability (survival, growth and reproduction) of populations of birds of prey in terrestrial Site exposure areas.	5A	Compare estimated daily doses for carnivorous bird species (Red-tailed Hawk) based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published avian TRVs and compare to reference area conditions.	Medium / High

Assessment Endpoints		Measurement Endpoints		Inference Weight
6	Sustainability (survival, growth and reproduction) of populations of carnivorous mammals in terrestrial Site exposure areas.	6A	Compare estimated daily doses for carnivorous mammal species (Red Fox) based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published mammal TRVs and compare to reference area conditions.	Medium / High
7	Sustainability (richness, diversity, structure, function) of benthic invertebrate communities in aquatic Site exposure areas.	7A	Compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks.	Low
		7B	Compare sediment toxicity test results for the South Ditch sample to corresponding sediment toxicity test results for reference samples.	Medium / High
8	Sustainability (survival, growth and reproduction) of populations of amphibians in aquatic Site exposure areas.	8A	Compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks.	Low
9	Sustainability (survival, growth and reproduction) of populations of semi-aquatic birds in aquatic Site exposure areas.	9A	Compare estimated daily doses for invertivorous bird species (Marsh Wren) based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs.	Medium / High
		9B	Compare estimated daily doses for omnivorous bird species (Green Heron) based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs.	Medium / High
10	Sustainability (survival, growth and reproduction) of populations of semi-aquatic mammals in aquatic Site exposure areas.	10A	Compare estimated daily doses for semi-aquatic herbivorous mammal species (Muskrat) based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs.	Medium / High
		10B	Compare estimated daily doses for semi-aquatic omnivorous mammal species (Raccoon) based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs.	Medium / High

3.10 Ecological Conceptual Site Model

The ecological conceptual site models (CSMs) for terrestrial (**Figure 3.10-1**) and aquatic (**Figure 3.10-2**) exposure areas evaluated in this BERA illustrate initial estimates of contaminant fate and transport mechanisms, complete exposure pathways, and primary and secondary receptors. Ecological CSMs are based on the current understanding of Site conditions, and serve as a framework for evaluating ecological exposure and risk.

The ecological conceptual site models for exposure areas of the Site describe:

- The source areas - historical releases from plant operations;
- Transport mechanisms - processes that partition chemicals among various environmental media;
- Exposure media - those environmental media through which organisms may be exposed to constituents; and
- Receptors - receptor organisms based on ecological investigations.

Detailed information pertaining to the transport of contaminants within OU1 and OU2 is presented in Section 5 of the RI.

3.11 Data Evaluation

The data evaluation:

- Identifies data suitable to be used in the BERA;
- Identifies data not used in the BERA and explains the reasons for their exclusion; and
- Presents the methods used to group and summarize data for use in the BERA.

A summary of media and areas sampled and a description of the data quality is provided in Section 2.0 of the RI report.

3.11.1 Data Used in the BERA

Available data were selected for use in the BERA using the criteria established by USEPA in "*Guidance for Data Usability in Risk Assessment*" (USEPA, 1992b) as presented in **Attachment 1**. Sample collection and handling, laboratory analyses, and data Quality Assurance/Quality Control (QA/QC) procedures were performed in accordance with USEPA methods, as described in the project Quality Assurance Project Plan (QAPP). Section 2.0 of the RI report provides a detailed description of the sampling and analytical methods that were used to generate the data for the RI.

As shown in **Table 3.11-1**, the following data from OU1 and OU2 were grouped by medium and exposure for use in the BERA.

Soil

Soil samples used in the BERA include samples collected in support of the RI from the ground surface to one foot below the ground surface (0–1 ft bgs) and historical samples collected from the ground surface to less than 3 ft bgs. OU1, OU2 and background surface soil sample locations are shown on **Figure 3.5-1**. Soil data sets used in the BERA include:

- EA2: 22 samples collected from 1991 to 2012;
- EA4: 110 samples collected from 1991 to 2012;
- EA5: 47 samples collected from 2001 to 2012; and
- Background: 9 samples collected in 2009.

Surface Water

Surface water samples were collected as grab samples from beneath the water surface. OU1 and OU2 surface water sample locations are shown on **Figure 3.5-2**. Background surface water sample locations are shown on **Figure 3.5-3**. Surface water data sets used in the BERA include:

- South Ditch: 132 samples collected from 2009 to 2013;
- Central Pond: 1 sample collected in 2012;
- Storm Water Detention Basin: 1 sample collected in 2012;
- Off-PWD: 6 samples collected from 2011 to 2012;
- MMB Wetland: 23 samples collected from 2010 to 2011;
- Landfill Brook: 6 samples collected from 2010 to 2011;
- North Pond: 4 samples collected in 2013; and
- MMB Wetland Reference: 2 samples collected from 2010 to 2011.

Sediment

Sediment samples were collected as grab samples using gravity corer, hand corer, hand auger, trowel, or other equivalent equipment. Sediment samples were collected from 0–6 inches, representing the upper six inches of sediment. OU1 and OU2 sediment sample locations are shown on **Figure 3.5-2**. Background sediment sample locations are shown on **Figure 3.5-3**. Sediment data sets used in the BERA include:

- On-PWD/WDW: 33 samples collected from 2000 to 2013;
- Upper South Ditch: 27 samples collected from 2005 to 2013*;
- Lower South Ditch: 6 samples collected from 2005 to 2011*;
- Central Pond: 10 samples collected from 2005 to 2013;
- Storm Water Detention Basin: 2 samples collected in 2012;
- Off-PWD: 3 samples collected in 2010;
- MMB Wetland: 12 samples collected from 2010 to 2011;
- Landfill Brook: 3 samples collected in 2010;
- North Pond: 4 samples collected in 2013; and
- MMB Wetland Reference: 1 sample collected in 2010.

*South ditch sediment samples used in this BERA were collected after the remediation that occurred in 2000.

Data Not Used in the BERA

The following types of data were not evaluated in the BERA:

- Subsurface soil data collected at a depth greater than 0–1 ft bgs for samples collected in support of the RI and greater than 0-3 ft bgs for historical samples.
- Biological data and toxicity testing data for which conclusions about ecological risk have already been reached, as presented in previous submittals to USEPA.

3.11.2 Data Summary

The following procedures were applied when summarizing the analytical data for the BERA:

- Rejected data (“R” qualified results) were not used in the risk assessment.
- Results qualified as estimated (“J” qualified) were used in the risk assessment as detected values.
- For samples in which analyte concentrations were detected outside the calibration range, and the samples are diluted and reanalyzed, only the re-analysis results for the analytes responsible for the dilution were used in the risk assessment. The results of the original run were utilized for analytes that had results within the calibration range in the original, undiluted sample run.

- When calculating the arithmetic mean concentrations, one-half the value reported as the non-detect value (usually the sample quantitation limits (SQLs)) were used for results reported as not-detected.
- Field duplicate results are quality control samples and were not used in the risk assessment.
- Metal data for unfiltered (total recoverable) and filtered (dissolved) surface water samples were summarized separately.
- For datasets with fewer than 20 samples, duplicate samples were used along with their corresponding field samples to calculate composite "risk samples". The one exception to this rule is EA-4. "Risk samples" were calculated for the human health risk assessment of EA-4 because that assessment evaluates EA-4 as two separate exposure areas (EA-4 and EA-6). To be consistent with the data presented in the human health risk assessment, "risk samples" were used for EA-4 in the BERA also.

3.12 COPEC Selection Methods

COPECs were selected by the comparing maximum detected concentrations to screening benchmarks by exposure area and medium. Constituents with maximum detected concentrations greater than their corresponding benchmarks were selected as COPECs and retained for further evaluation in the BERA. Constituents with maximum detected concentrations less than corresponding benchmarks pose a negligible risk to ecological receptors and were eliminated from further evaluation.

Constituents for which screening benchmarks were not available were retained as COPECs. Constituents identified as essential nutrients including calcium, magnesium, potassium, and sodium were eliminated from further evaluation in the BERA. Essential nutrients are chemical elements that are required by most organisms, naturally present in the environment in high concentrations, and generally considered to be innocuous. Constituents with a low frequency of detection (*i.e.*, that were detected in less than 5% of samples for a given exposure area and medium), were not identified as COPECs. Comparison to background concentrations was not a component of this COPEC selection process.

3.12.1 Soil Screening Benchmarks

Ecological soil screening benchmarks (**Table 3.12-1**) were selected for detected chemicals using a multi-tiered hierarchy.

Benchmarks were preferentially selected as the lowest value among these sources:

- USEPA, 2013a. Ecological Soil Screening Levels (Eco-SSL) Guidance and Documents Webpage: http://www.epa.gov/oswer/riskassessment/ecorisk/ecossl.htm
- Efroymson, R.A., M.E., Will, and G.W. Suter II, 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.
- Efroymson, R.A., M.E., Will, and G.W. Suter II and A.C. Wooten, 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision.* Oak Ridge National Laboratory, Oak Ridge, TN.

Lacking a value from the sources listed above, benchmarks were selected as the lowest value among:

- Friday, G.P., 1998. *Ecological Screening Values for Surface Water, Sediment, and Soil.* Westinghouse Savannah River Company, Savannah River Technology Center, (WSRC-

TR-98-00110), Aiken, SC 29808. Cited in: USEPA, 2001b. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. November 30, 2001 update.

- USEPA Region 5, 2003. USEPA, Region 5, RCRA Ecological Screening Levels. August 22, 2003.

Benchmarks for chemicals that still lacked a screening value were estimated based on structure activity relationships using the methodology developed by the Texas Natural Resources Conservation Commission (TNRCC) for the Texas Surface Water Quality Standards (TSWQS) (TNRCC, 2000) as shown in Equation 1:

$$NOAEL = LC50 / f \qquad \textit{(Equation 1)}$$

Where:

NOAEL = No-Observable-Adverse-Effects-Level (mg/kg);
LC50 = 14-day earthworm LC50s (mg/kg); and
f = factor to convert LC50s to NOAELs

LC50s (*i.e.*, the lethal concentrations affecting 50% of the test population) were obtained from *Ecological Structure Activity Relationships* (*ECOSAR*), *Database v.1.11* (USEPA, 2012). Aquatic organisms for which ECOSAR values were available are limited to three generic receptors: green algae, daphnids, and fish. Although fish have not been observed in the on property ditch system, the ECOSAR values for fish are generally the most conservative. Fish were used as surrogates for amphibians which do inhabit the site.

The conversion factor, f, was obtained from TNRCC (2000) and depends on the chemical's degree of persistence and tendency to bioaccumulate. The value for a given chemical was selected as follows:

- f=10 for non-persistent chemicals;
- f=20 for persistent but non-bioaccumulating chemicals; and
- f=100 for persistent and bioaccumulating chemicals.

Persistent chemicals are defined as those that are either listed as Persistent Organic Pollutants under the Stockholm Convention (UNEP, 2001) or have half lives in soil or surface water longer than 2 months, as calculated in *Persistent, Bio-accumulating, and Toxic, Profiler v.1.301* (USEPA, 2010). Calculations of persistence in the PBT Profiler excluded net advection and sediment burial and organic compounds with Log K_{OW}< 3.0 which are assumed to not significantly accumulate in biological tissue (Jager, 1998). Attachment 4 presents the ECOSAR values and calculations used to derive screening benchmarks using this methodology.

Benchmarks for chemicals (formaldehyde) which still lacked a screening value were obtained from:

- *Toxicological Benchmarks for Wildlife: 1996 Revision*. (Sample et al., 1997). The selected value is for the short-tailed shrew (*Blarina sp*.).

For bis(2-ethylhexyl)phthalate, a soil screening benchmark was selected from the European registration, evaluation, authorization and restriction of chemicals (REACH) database. The value selected was the lowest available NOEC for soil invertebrates.

3.12.2 Surface Water Screening Benchmarks

Ecological surface water screening benchmarks (**Table 3.12-2**) were selected for detected chemicals using a multi-tiered hierarchy. Benchmarks were preferentially selected as the lowest value among these sources:

- USEPA, 2013b. Freshwater Ambient Water Quality Criteria - Chronic Continuous Concentration.
- Suter, G.W, and C.L. Tsao, 1997.Oak Ridge National Laboratory Tier II Secondary Chronic Values. Cited in Buchman, 2008, *Screening Quick Reference Tables* (SQuiRTs from NOAA).
- USEPA Region 4, 2001c. Chronic - USEPA Region 4 freshwater chronic values. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment.
- USEPA, 2007b. USEPA Region III BTAG Screening Benchmarks for Freshwater.

Calculations for hardness dependent surface water screening benchmarks are presented in **Table 3.12-3**. Lacking a value from the sources listed above, benchmarks were estimated based on structure activity relationships using the TSWQS methodology described in Section 3.12.1. Predicted toxicity levels for surface water in the USEPA's 2012 *ECOSAR Database* (*v.1.11*) are presented as chronic toxicity values equal to one tenth of an LC50 value. To derive screening benchmarks, these values were converted to LC50s by multiplying by ten and then converted to NOAELs using the methodology described in Section 3.12.1. Attachment 4 presents the ECOSAR values and calculations used to derive screening benchmarks using this methodology.

For specialty compounds hydrazine, 4-nonylphenol, and Kempore screening benchmarks were selected from the lowest NOEC values available for aquatic invertebrates in the REACH database.

3.12.3 Sediment Screening Benchmarks

Ecological sediment screening benchmarks (**Table 3.12-4**) were selected for detected chemicals from the sources listed below in order of preference:

- USEPA Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures ($C_{OC,PAHi,FCVi}$) (USEPA, 2003a).
- USEPA Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics. Freshwater Conventional ESBs (USEPA, 2008).
- MacDonald, *et al.* Threshold Effects Concentrations (TECs) (MacDonald, *et al.,* 2000).
- USEPA Region 4 Sediment Screening Values (USEPA, 2001b).
- Ontario Ministry of Energy and Environment (OMEE) Low-Effect Levels (LELs) (Persaud *et al.,* 1993; cited in Jones, Suter & Hull, 1997).
- USEPA Region 5 Ecological Screening Levels (USEPA, 2003b).
- Assessment and Remediation of Contaminated Sediments (ARCS) Program Threshold Effects Concentrations (TECs) (USEPA, 1996).
- USEPA Region 3 BTAG Screening Benchmarks for Freshwater and Sediment (USEPA, 2007b).
- ORNL Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).
- MassDEP (2007), Sediment Toxicity of Petroleum Hydrocarbon Fractions.

The screening benchmark for bis(2-ethylhexylphthalate was selected from the REACH database. The value selected was the lowest available NOEC for aquatic invertebrates.

3.13 COPEC Screening Results

This section summarizes COPECs selected by exposure area and medium. COPEC selection is shown in detail in **Table 3.13-1** through **Table 3.13-19**. The list of COPECs includes parameters with maximum concentrations above screening levels as well as those parameters

for which screening levels are unavailable. The COPEC selection process did not include a comparison of detected concentrations to background area or reference area concentrations (some selected COPECs may be present at concentrations consistent with background or reference area concentrations). The majority of COPECs are not site related COIs (see Section 3.1).

EA2 - Soil

Analytes identified as COPECs in EA2 soil (**Table 3.13-1**) include:

- Volatile organic compounds (VOCs): acetaldehyde;
- Semivolatile organic compounds (SVOCs): benzaldehyde, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, diphenyl ether, fluoranthene, phenanthrene, and pyrene;
- Pesticides: 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT;
- Metals: aluminum, arsenic, cadmium, chromium, copper, iron, lead, mercury, selenium, vanadium, and zinc; and
- Inorganics: chloride and ammonia.

EA4 - Soil

Analytes identified as COPECs in EA4 soil (**Table 3.13-2**) include:

- VOCs: acetaldehyde;
- SVOCs: benzaldehyde, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, fluoranthene, naphthalene, phenanthrene, and pyrene;
- Pesticides: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-BHC, and gamma-BHC/lindane;
- Metals: aluminum, arsenic, cadmium, chromium, hexavalent chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, vanadium, and zinc;
- Inorganics: chloride, total cyanide, ammonia, and sulfate; and
- Extractable petroleum hydrocarbon (EPH) fractions: C11-C22 aromatics, C19-C36 aliphatics, and C9-C18 aliphatics.

EA5 - Soil

Analytes identified as COPECs in EA5 soil (**Table 3.13-3**) include:

- VOCs: acetaldehyde;
- SVOCs: aniline, benzaldehyde, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, diphenyl ether, fluoranthene, n-nitrosodi-n-propylamine, phenanthrene, and pyrene;
- Pesticides: 4,4'-DDD and hexachlorobenzene;
- Metals: aluminum, antimony, arsenic, cadmium, chromium, hexavalent chromium, copper, iron, lead, mercury, silver, thallium, tin, vanadium, and zinc;
- Inorganics: total cyanide, ammonia, and sulfate; and
- EPH fractions: C11-C22 aromatics C19-C36 aliphatics, and C9-C18 aliphatics.

South Ditch - Surface Water

Analytes identified as COPECs in South Ditch surface water (**Table 3.13-4**) include:

- SVOCs: azobenzene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, n-nitrosodi-n-propylamine;
- Total metals: aluminum, barium, beryllium, chromium, cobalt, copper, iron, lead, manganese and silver;

- Filtered metals: aluminum and chromium; and
- Inorganics: bromide, chloride, nitrite as N, and ammonia.

Central Pond - Surface Water

Analytes identified as COPECs in Central Pond surface water (**Table 3.13-5**) include:

- Total metals: aluminum, barium, manganese and silver; and
- Inorganics: bromide, nitrite as N, and ammonia.

Storm Water Detention Basin - Surface Water

Analytes identified as COPECs in Storm Water Detention Basin surface water (**Table 3.13-6**) include:

- SVOCs: n-nitrosodiphenylamine;
- Total metals: aluminum, barium, iron, lead and silver; and
- Inorganics: nitrite as N, and ammonia.

Off-PWD - Surface Water

Analytes identified as COPECs in Off-PWD surface water (**Table 3.13-7**) include:

- VOCs: carbon disulfide;
- SVOCs: 3 & 4 methylphenol, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, phenanthrene and pyrene;
- Total metals: aluminum, barium, chromium, iron, lead, manganese and zinc; and
- Inorganics: bromide, nitrite as N, and ammonia.

MMB Wetland - Surface Water

Analytes identified as COPECs in MMB Wetland surface water (**Table 3.13-8**) include:

- SVOCs: benzo(a)pyrene, caprolactam, and n-nitrosodi-n-proplyamine;
- Total metals: aluminum, barium, copper, iron, lead, and manganese; and
- Inorganics: bromide.

Landfill Brook - Surface Water

Analytes identified as COPECs in MMB Wetland surface water (**Table 3.13-9**) include:

- SVOCs: 3 & 4 methylphenol, benzo(a)anthracene, benzo(a)pyrene,
- benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene,
- indeno(1,2,3-cd)pyrene, phenanthrene and pyrene;
- Total metals: aluminum, barium, cadmium, copper, iron, lead, manganese, and zinc; and
- Inorganics: chloride and ammonia.

North Pond - Surface Water

Analytes identified as COPECs in MMB Wetland surface water (**Table 3.13-10**) include:

- SVOCs: benzo(a)anthracene, benzo(a)pyrene, caprolactam, and pyrene;
- Total metals: aluminum, barium, iron, lead, manganese, and silver; and
- Inorganics: bromide and chloride.

Upper South Ditch - Sediment

Analytes identified as COPECs in Upper South Ditch sediment (**Table 3.13-11**) include:

- VOCs: 2,4,4-trimethyl-1-pentene, 2,4,4-trimethyl-2-pentene 4-iso-propyltoluene acetaldehyde, and formaldehyde;
- SVOCs: 3&4 methylphenol, acetophenone, benzaldehyde, caprolactum, diphenyl ether, di-n-octylphthalate, diphenylmethanone, and phenol;
- Metals: arsenic, barium, beryllium, chromium, hexavalent chromium, iron, silver, and vanadium;
- Inorganics: chloride, ammonia, and sulfate;
- EPH fractions: C11-C22 aromatics, C19-C36 aliphatics, and C9-C18 aliphatics; and
- Specialty compounds: hydrazine and dimethylformamide.

Lower South Ditch - Sediment

Analytes identified as COPECs in Lower South Ditch sediment (**Table 3.13-12**) include:

- VOCs: 2,4,4-trimethyl-1-pentene, 2,4,4-trimethyl-2-pentene, acetaldehyde, acetone, and formaldehyde;
- SVOCs: aniline, benzaldehyde, bis(2-ethylhexyl)phthalate, di-n-octylphthalate, diphenyl ether, and diphenylamine;
- Pesticides: 4,4`-DDT and hexachlorobenzene;
- Metals: barium, beryllium, cadmium, chromium, hexavalent chromium, mercury, nickel, silver, tin and vanadium;
- Inorganics: chloride, ammonia, and sulfate;
- EPH fractions: C11-C22 aromatics C19-C36 aliphatics, and C9-C18 aliphatics; and
- Specialty compounds: hydrazine.

On-PWD/WDW - Sediment

Analytes identified as COPECs in on-PWD/WDW sediment (**Table 3.13-13**) include:

- VOCs: acetone;
- Nonionic Organics: benzene; and
- Metals: barium, beryllium, cadmium, chromium, lead, mercury and vanadium.

Central Pond - Sediment

Analytes identified as COPECs in Central Pond sediment (**Table 3.13-14**) include:

- VOCs: 2,4,4-trimethyl-1-pentene, 2,4,4-trimethyl-2-pentene, acetone and methyl tertbutyl ether;
- SVOCs: 3&4 methylphenol, acetophenone, benzaldehyde, and phenol;
- PAHs: benzo(b)fluoranthene, fluoranthene, phenanthrene, and pyrene;
- Metals: barium, beryllium, chromium, hexavalent chromium, lead, manganese, tin and vanadium; and
- Inorganics: chloride, ammonia, and sulfate.

Storm Water Detention Basin - Sediment

Analytes identified as COPECs in Storm Water Detention Basin sediment (**Table 3.13-15**) include:

- VOCs: 2,4,4-trimethyl-1-pentene, 2,4,4-trimethyl-2-pentene and acetone;
- SVOCs: 3&4 methylphenol, acetophenone, benzaldehyde, and phenol;
- PAHs: benzo(a)pyrene.
- Metals: arsenic, barium, beryllium, chromium, tin and vanadium; and
- Inorganics: chloride, ammonia, and sulfate.

Off-PWD - Sediment

Analytes identified as COPECs in off-PWD sediment (**Table 3.13-16**) include:

- VOCs: 2,4,4-trimethyl-1-pentene, 2,4,4-trimethyl-2-pentene and formaldehyde;
- SVOCs: 4-chlorophenyl phenyl ether, carbazole, diphenyl ether, and
- diphenylmethanone;
- Metals: arsenic, barium, beryllium, chromium, copper, silver and vanadium;
- Inorganics: chloride, ammonia, and sulfate; and
- Specialty compounds: hydrazine.

MMB Wetland - Sediment

Analytes identified as COPECs in MMB Wetland sediment (**Table 3.13-17**) include:

- VOCs: acetaldehyde, acetone, and formaldehyde;
- SVOCs: 3&4 methylphenol, 4-nitrophenol, benzaldehyde, benzyl alcohol, caprolactam, and carbazole;
- Metals: aluminum, arsenic, barium, beryllium, cadmium, copper, iron, lead, manganese, mercury, nickel, thallium, tin, vanadium, and zinc; and
- Inorganics: chloride, ammonia, and sulfate.

Landfill Brook - Sediment

Analytes identified as COPECs in Landfill Brook sediment (**Table 3.13-18**) include:

- VOCs: sec-butylbenzene;
- Metals: arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, mercury, tin, vanadium, and zinc; and
- Inorganics: chloride, ammonia, and sulfate.

North Pond - Sediment

Analytes identified as COPECs in North Pond sediment (**Table 3.13-19**) include:

- VOCs: 2,4,4-trimethyl-1-pentene, acetone and carbon disulfide;
- SVOCs: carbazole;
- Metals: arsenic, barium, beryllium, cadmium, chromium, hexavalent chromium, copper, iron, lead, manganese, thallium, tin, vanadium, and zinc; and
- Inorganics: chloride, ammonia, and sulfate.

3.14 Ammonia Screening

Detected concentrations of ammonia in many surface water samples collected from the Site are above their respective screening criteria. The potential for aquatic effects from exposure to ammonia, however, is known to be modified by a number of different factors (*i.e.,* pH, temperature, dissolved oxygen, salinity, and calcium). Toxicity of total ammonia, for example, increases with increasing temperature and pH (USEPA, 1999a). Additionally, concentrations

are known to vary seasonally with lower ammonia-nitrogen concentrations in the summer due to increased uptake by plants and decreased solubility at higher water temperatures (ICPS, 1986 and USEPA, 1999a). While some of these factors are taken into account by the site specific ammonia screening criteria used in this BERA, they are not all considered and those which are accounted for vary considerably across the Site. As such, the screening criteria used for ammonia may be overly conservative.

Additionally, the concentration of total ammonia (which is the total fraction analytically measured in the surface water samples and reported as 'Nitrogen, as Ammonia') is the sum of ionized ammonia (NH_4^+) and unionized ammonia (NH_3). The relative concentrations of these constituents (NH_4^+ and NH_3) are highly depended on pH and temperature, with a higher pH and temperature resulting in higher concentrations of NH_3 and lower concentrations of NH_4^+ (Camargo & Alonso, 2006). Aquatic toxicity is highly dependent on the ratio of each of these constituents to the total ammonia concentration, with un-ionized ammonia (NH_3) identified as the principal toxic form of ammonia in the aquatic environment (USEPA, 1999a and CCME, 2010). For example, raising the pH by one unit can cause the un-ionized and more toxic ammonia to increase nearly 10 fold, while a 5 degree Celsius increase in temperature can cause a 40% to 50% increase in toxicity (CCME, 2010). As such, the scientific literature conventionally expresses ammonia toxicity in terms of the more toxic un-ionized ammonia (USEPA, 1999a). Once again, this may indicate that the screening criterion used for ammonia in the BERA is overly conservative.

Additionally, ammonia originates from a variety of man-made point source discharges as well as natural and man-made non-point sources, making it difficult to attribute detected concentrations at the Site to any one particular source. Generally speaking, ammonia in the environment originates from a combination of municipal, agricultural, industrial, and natural processes. Primary point sources include municipal effluent discharges, as well as industrial plants that may produce fertilizers, steel, petroleum, leather, inorganic chemicals, non-ferrous metals, and meat processing plants (IPCS, 1986). A majority of ammonia discharged to surface water from these types of point sources (>95%) (IPCS, 1986). Major nonpoint sources of ammonia for surface water include fertilizer runoff, nitrogen fixation, excretion of nitrogenous waste from animals, precipitation and urban runoff (ICPS, 1986, USEPA, 2009b, and CCME 2010). Ammonia found in urban runoff typically originates from natural and man-made sources, including but not limited to wastes from wildlife, decaying vegetation, material originally present in soil, as well as precipitation (reflecting local atmospheric conditions) (ICPS, 1986). Natural sources of ammonia include decomposition of organic water matter, gas exchange with the atmosphere, forest fires, animal waste, discharge of ammonia by biota, and nitrogen fixation processes (CCME, 2010).

Given the large number of point, non-point, and natural sources of ammonia in the aquatic environment, is unlikely that the ammonia detected in surface water at the Site (other than South Ditch and Off-PWD) is, in fact, Site-related.

4.0 BASELINE EXPOSURE AND EFFECTS ESTIMATE

This BERA evaluates risk to ecological receptors from exposure to COPECs by:

- Compare concentrations in environmental media to effects benchmarks and reference concentrations;
- Sediment toxicity tests (Lower South Ditch only); and
- Food chain modeling and TRV-based risk calculations.

This section:

- Presents the methods used to calculate the EPCs used in the BERA (Section 4.1);
- Presents the methods (Section 4.2) and results (Section 4.3) of the effects benchmark comparisons;
- Presents the methods (Section 4.4) and results (Section 4.5) of the food chain modeling assessment; and
- Presents the methods and results of the Lower South Ditch sediment toxicity test (Section 4.6)
- Presents an analysis of the uncertainty associated with the evaluations (Section 4.7).

Interpretation of the results of the Baseline Exposure and Effects Estimate is reserved for the Risk Characterization (Section 5.0). Results will be interpreted in part using the two and four way interpretive risk summary matrices provided by USEPA.

4.1 Exposure Point Concentrations

This BERA evaluates risk to ecological receptors using Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) EPCs. The RME EPC provides an upper estimate of exposure concentrations. In accordance with USEPA guidance (USEPA, 2002), RME EPCs used in the BERA are based on the lesser of the 95% Upper Confidence Limit (UCL) on the arithmetic mean concentration or the maximum detected concentration.

The 95% UCL values are calculated using the ProUCL software (v. 4.1.00; USEPA, 2011). The ProUCL software performs a goodness-of-fit test that accounts for data sets without any non-detect observations, as well as data sets with non-detect observations. The software then determines the distribution of the data set for which the EPC is being derived (e.g., normal, lognormal, gamma, or non-discernable), and then calculates a conservative and stable 95% UCL value in accordance with the framework described in "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (USEPA, 2002). The software includes 5 parametric and 10 non-parametric methods for calculating 95% UCL values. These calculations are documented in **Attachment 2.**

The CTE represents the concentration to which a population of receptors would most likely be exposed across an exposure area and over time. CTE EPCs are average (arithmetic mean) concentrations calculated using ½ the SQL for non-detects. If the average concentration of a COPEC in an exposure area is greater than the maximum concentration, as occurs where the frequency and magnitude of detections is minimal, the lesser of the maximum or RME EPC is used as the CTE EPC.

Table 4.1-1 through **Table 4.1-15** show the selections of EPCs by exposure area and medium.

4.2 Effects Benchmark Comparison Methods

For measurement endpoints 1A, 2A, 7A and 8A listed in Section 3.9, RME and CTE EPCs were compared to effects benchmarks to calculate Hazard Quotients. This section first describes the

sources used to develop effects benchmarks; then describes the method used for calculating Hazard Quotients (HQs); and finally presents the results by exposure area and receptor.

4.2.1 Effects Benchmarks

Effects benchmarks represent concentrations at or above which adverse effects are possible. Effects benchmarks are typically based on toxicity tests and experimental observations published and summarized in the scientific literature. Effects benchmarks are typically reported based on the degree of measured response observed (*e.g.*, EC50, concentration effecting 50% of the test organisms). Effects benchmarks differ from screening benchmarks that identify concentrations below which adverse effects are not expected to occur.

The likelihood that an effect will occur if a COPEC concentration is above a benchmark depends on a number of factors including bioavailability, similarity of species used to measure effect, and similarity between experimental conditions and site conditions. Both screening and effects benchmarks generally assume 100 percent bioavailability, which is a conservative assumption. Bioavailability is the extent to which a substance can be absorbed from an environmental medium by a living organism, potentially causing an adverse response. The bioavailability of metals is related to the extent to which a metal can desorb, dissolve, or otherwise dissociate from the environmental medium in which it occurs (Bernhard & Neff, 2001). When available, studies with species and habitats similar to those at the Property were examined to establish effects benchmarks.

Soil Effects Benchmarks

Ecological soil effects benchmarks (**Table 4.2-1**) were selected separately for terrestrial invertebrates, and plants.

Soil effects benchmarks for terrestrial invertebrates were selected from published screening values and from estimated benchmarks derived using the ECOSAR Calculated Screening Value methodology described in Section 3.12-1 and applying a multiple of 10 to convert from a NOAEL to a Lowest-Observed-Adverse-Effect-Level (LOAEL). Sources of published screening values are listed in order of preference:

- USEPA, 2013a. Ecological Soil Screening Levels (Eco-SSL) Guidance and Documents Webpage: http://www.epa.gov/oswer/riskassessment/ecorisk/_ecossl.htm. Values for terrestrial invertebrates.
- Efroymson, R.A., M.E., Will, and G.W. Suter II. 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.

Soil effects benchmarks for terrestrial plants were selected from published screening values. Sources of published screening values are listed in order of preference:

- USEPA, 2013a. Ecological Soil Screening Levels (Eco-SSL) Guidance and Documents Webpage: http://www.epa.gov/oswer/riskassessment/ecorisk/_ecossl.htm. Values for plants.
- Efroymson, R.A., M.E., Will, and G.W. Suter II and A.C. Wooten. 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.

Surface Water Effects Benchmarks

Ecological surface water effects benchmarks (**Table 4.2-2**) were selected for COPECs using a multi-tiered hierarchy. Benchmarks were preferentially selected from the same hierarchy used to select screening benchmarks; however, acute values were used for effects benchmarks whereas chronic values were used for screening.

Benchmarks were preferentially selected as the lowest value among these sources:

- USEPA, 2013b. Freshwater Ambient Water Quality Criteria - Chronic Maximum Concentrations.
- Suter, G.W, & C.L. Tsao, 1997.Oak Ridge National Laboratory Tier II Secondary Acute Values. Cited in Buchman, 2008, *Screening Quick Reference Tables* (SQuiRTs from NOAA).
- USEPA Region 4, 2001e. Acute - USEPA Region 4 freshwater acute values. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment.
- USEPA Region 3, 2007b. USEPA Region III BTAG Screening Benchmarks for Freshwater.

Lacking a value from the sources listed above, benchmarks were estimated based on structure activity relationships using the methodology described in Section 3.12-2 and applying a multiple of 10 to convert from a NOAEL to a LOAEL.

Sediment Effects Benchmarks

Ecological sediment effects benchmarks (**Table 4.2-3**) were selected for COPECs using a multi-tiered hierarchy. Benchmarks were preferentially selected from a similar hierarchy to that used to select screening benchmarks; however, where possible, acute values were used for effects benchmarks whereas chronic values were used for screening.

Ecological sediment effects benchmarks were selected for detected chemicals from the sources listed below in order of preference:

- MacDonald, *et al.* Probable Effects Concentrations (PECs) (MacDonald, *et al.,* 2000).
- USEPA Region 4 Sediment Screening Values (USEPA, 2001b).
- USEPA Region 3 BTAG Screening Benchmarks for Freshwater and Sediment (USEPA, 2007b).
- ORNL Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).
- Assessment and Remediation of Contaminated Sediments (ARCS) Program Probable Effects Concentrations (PECs) (USEPA, 1996).
- MassDEP (2007), Sediment Toxicity of Petroleum Hydrocarbon Fractions.

4.2.2 Methods Used to Calculate HQs

An HQ is a ratio of exposure levels to benchmark levels, as shown in Equation 2:

$$\text{Hazard Quotient} = \text{EPC} / \text{Benchmark} \qquad \textit{(Equation 2)}$$

Where:

EPC	= RME EPC or CTE EPC
Benchmark	= Effects Benchmark

An RME EPC coupled with a screening benchmark provides a conservative estimate of risk, while a CTE EPC coupled with an effects benchmarks provides a more realistic estimate of risk.

Therefore, an HQ less than 1 based on a RME and a screening benchmark indicates that the contaminant alone is unlikely to cause adverse ecological effects, while an HQ greater than 1 based on a CTE and effects benchmark suggests that a COPEC may be present at a concentration at which adverse effects are possible.

The risk characterization also includes an evaluation of incremental risks, which take into account the contribution of reference concentrations to the overall site risks. Incremental risk was calculated as shown in Equation 3:

Incremental Risk HQ = Site HQ – Reference HQ *(Equation 3)*

For this BERA, reference area data were available for terrestrial exposure areas (EA2, EA4, and EA5) and for the MMB Wetland. No reference data were available for the other aquatic exposure areas evaluated in this BERA.

4.3 Effects Benchmark Comparison Results

HQs calculated by comparing RME and CTE EPCs to effects benchmarks are presented in **Table 4.3-1** through **Table 4.3-17.** Interpretation of these results is reserved for Section 5.0 Risk Characterization.

4.4 Food Chain Modeling Methods

Exposure of terrestrial and semi-aquatic wildlife (*i.e.*, birds and mammals) to COPECs was estimated using food chain models. Soil, sediment, and surface water EPCs were entered into the food chain model to calculate an estimated daily intake (EDI) to which the receptor may be exposed. EPCs for prey items (tissue) were estimated using literature based bioaccumulation factors (BAFs), except for estimating chromium concentrations in invertebrate tissue. Chromium is a site-related COI frequently detected in site media and therefore was carefully evaluated. The scientific literature indicates there is no meaningful positive correlation between soil/sediment concentration and invertebrate tissue concentrations (Sample *et al.*, 1998a,b; USEPA, 1999b). Because no defensible soil- or sediment-to-invertebrate chromium BAFs are available in the scientific literature, a fixed value of 20 mg Cr/kg invertebrate tissue dry weight (equivalent to 4 mg/kg wet weight assuming invertebrates are 80% water) is used instead. The rationale for this approach is discussed in detail in Section 4.7 (the uncertainty discussion) and in Attachment 5 and Attachment 8.

Models incorporate a site foraging frequency (SFF), which accounts for the proportion of a receptor's diet and incidental ingestion of soil or sediment that is obtained from an exposure area. If the exposure area is larger than the receptor's foraging range, it is assumed that the receptor obtained all of its food from within that exposure area. If the exposure area is smaller than the receptor's foraging range, it is assumed to obtain a fraction of its food from the exposure area. That fraction is calculated by dividing the exposure area by the foraging range.

Estimated Daily Intakes (EDIs) for individual COPECs were compared to wildlife TRVs, expressed as milligrams per kilogram (mg/kg) body weight (BW) per day, to evaluate the effect of exposure on representative species. The comparison was quantified using the HQ approach, as shown in Equation 4:

Hazard Quotient = EDI / TRV (Equation 4)

Where:

EDI	=	Estimated daily intake calculated from the food chain model (mg/kg BW-day)
TRV	=	Toxicity Reference Value (mg/kg BW-day)

TRVs were obtained from studies published in primary literature resources or review articles that reported NOAEL and LOAELs with survival, growth, or reproductive endpoints. Chronic studies were generally selected over acute or subchronic studies. USEPA-derived TRVs established to calculate Eco-SSLs were used preferentially when available (USEPA, 2013a). NOAEL and LOAEL TRVs are roughly analogous to screening and effects benchmarks used for other media, except that they represent screening and effects doses, rather than concentrations. Wildlife TRVs used in the food chain model are presented and discussed in greater detail in Attachment 5.

The details of the food chain models, including exposure assumptions, BAFs, and TRVs, are provided in Attachment 5 along with the food chain modeling spreadsheets.

Incremental risks were also calculated for food chain risks as explained in Section 4.2.2 above.

4.5 Food Chain Modeling Results

Results of the food chain modeling are presented in **Table 4.5-1** through **Table 4.5-11**. Interpretation of these results is reserved for Section 5.0 Risk Characterization.

4.6 Sediment Toxicity Test Methods & Results

In 2011, one sediment sample was collected from location ISCO-2 in Lower South Ditch, and from two reference locations (SDBK-002 and MMB-SW/SD-1) for toxicity testing. All three samples were submitted to EnviroSystems, Inc. (ESI) laboratory in Hampton, NH for a 42-day survival, growth and reproduction test using *Hyalella azteca* and following the procedures outlined in:

- Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates (ASTM Method E 1706-05, 2010),
- Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates (US EPA 2000); and
- Standard Methods for the Examination of Water and Wastewater, 20th Edition (APHA 1998).

ISCO-2 was selected to represent Lower South Ditch because it had the highest sediment HQs, calculated using ecological screening benchmarks.

Survival was measured on the 28th day of the test. Survival in ISCO-2 (42%) was below the laboratory control (93%) and below both reference samples (96% and 95%), a statistically significant reduction ($p<0.05$). Since a statistically significant reduction in survival was observed, growth and reproduction are not further considered. The full laboratory report is provided in Attachment 6. Attachment 9 includes the South Ditch Toxicity Test Memorandum previously submitted to USEPA and dated April 29, 2015. The memorandum provides a summary of the sediment samples, the test procedures, and the results of the test. Survival, growth, and reproduction for sample ISCO-2 were significantly lower than both reference samples. These results clearly demonstrate that the sediment sample ISCO2 exhibited significantly greater toxicity to Hyalella azteca than the two reference samples and the laboratory control. A review of the analytical data suggests that toxicity in ISCO2 was likely the result of concentrations of BEHP (480 mg/kg) and chromium (3,000 mg/kg) that were orders of magnitude higher than concentrations in reference samples, where BEHP was not detected in either sample (reporting limit < 0.3 mg/kg) and where chromium concentrations were reported at 5 mg/kg and 11 mg/kg. The available information indicates that remedial alternatives for Lower South Ditch sediments should be evaluated.

4.7 Uncertainty Analysis

There is uncertainty associated with estimates of risk in any BERA because the risk estimates are based on a number of assumptions regarding exposure and toxicity. There is uncertainty associated with the exposure and modeling assumptions, toxicological data, and risk characterization (USEPA, 1997). A thorough understanding of the uncertainties associated with risk estimates is critical to understanding predicted risks and placing them into proper perspective. Major uncertainties and assumptions are summarized below.

Exposure and Modeling Uncertainties

Uncertainties associated with the exposure assessment step of the BERA affect the interpretation of the significance of the HQs. The main uncertainties are associated with the EPCs, exposure parameters, estimating BAFs for various environmental media, assumptions of bioavailability of COPECs, and inhalation and dermal exposure pathways.

Data Summary/Exposure Point Concentrations

Risks were assessed for analytes that were detected in at least one sample in a given medium and exposure area; analytes that were not detected were assumed to pose no significant risk.

There are, as shown in **Table 5.0-1** of the RI Report, however, numerous raw materials, components of liquid waste streams, and products of the manufacturing facility for which there are not commercially available and USEPA-approved analytical methods. Twenty-two of these raw materials and components of liquid waste streams are inorganic compounds including salts (e.g., sodium chloride, sodium dichromate), acids (e.g., sulfuric acid), and bases (e.g., ammonium hydroxide). Although there are not analytical methods for these specific compounds, consistent with standard remedial investigation procedures and protocols, environmental media were analyzed for the components of these inorganic compounds such as aluminum, sodium, chloride, chromium, sulfate, ammonia, nitrate, nitrite, and zinc.

Other raw materials or potential components of liquid waste streams without available analytical methods include 2-ethylhexanol (an alcohol), 2-ethylhexanoic acid, hexamethylenetetramine, benzonitrile, butyl alcohol, paraformaldehyde (polymer of formaldehyde), and urea. Analysis of environmental media included methods for some components of these compounds (formaldehyde, ammonia, etc) and the alcohols likely have reacted in the environment and/or have degraded. Products for which there are no available analytical methods include Wytox ADP, Wytox 345/355/436 (polymeric phosphate), Nitropore OT, Wytox 312, Wytox Pap, Actafoam R-3, Nitropore 5PT, and Phenolic and Urea/Formaldehyde Resins. The facility would have focused on the production and shipment of commercial products and minimizing releases (or loss) of revenue-producing product. None-the-less, the lack of analytical methods does introduce some uncertainty in the nature and extent of any releases and the potential associated risks associated with those materials that may have been released to environmental media. Reports of specific releases of products to the environment were not found in the records reviewed. The resins that were manufactured did not have any liquid waste streams associated with them. The lack of analytical methods for the resins is unlikely to have underestimated releases of those products.

Analytes not selected as COPECs were not evaluated further in the BERA. However, because concentrations of these analytes were below conservative screening values, their overall contribution to risk is negligible, so their exclusion is expected to have an insignificant impact on the risk characterization.

Small data sets increase uncertainty in the UCL calculations. Only one or two samples were collected in Central Pond surface water and sediment, and Storm Water Detention Basin

surface water and sediment. Also, some miscellaneous individual COPECs (*e.g.* pesticides and cyanide in EA-5) were analyzed in only one or two samples. Confidence in risk conclusions based on small data sets is generally low. In order to minimize uncertainty, risk was characterized using a weight-of-evidence approach and within the framework of the conceptual site model.

There is uncertainty associated with 95% UCLs derived from data sets from chemicals with less than 50% frequency of detection. To minimize this uncertainty, Pro-UCL output were reviewed to ensure the proper statistics were being used.

In some cases, surface water EPCs are based on total (*i.e.* unfiltered) metals concentrations. Concentrations reported for total metals may include contaminants sorbed to suspended particulates and that are not bioavailable, and thus overestimate actual exposure and introduce uncertainty. Where possible, this uncertainty was minimized by characterizing risk based on dissolved (filtered) concentrations.

Exposure Parameters

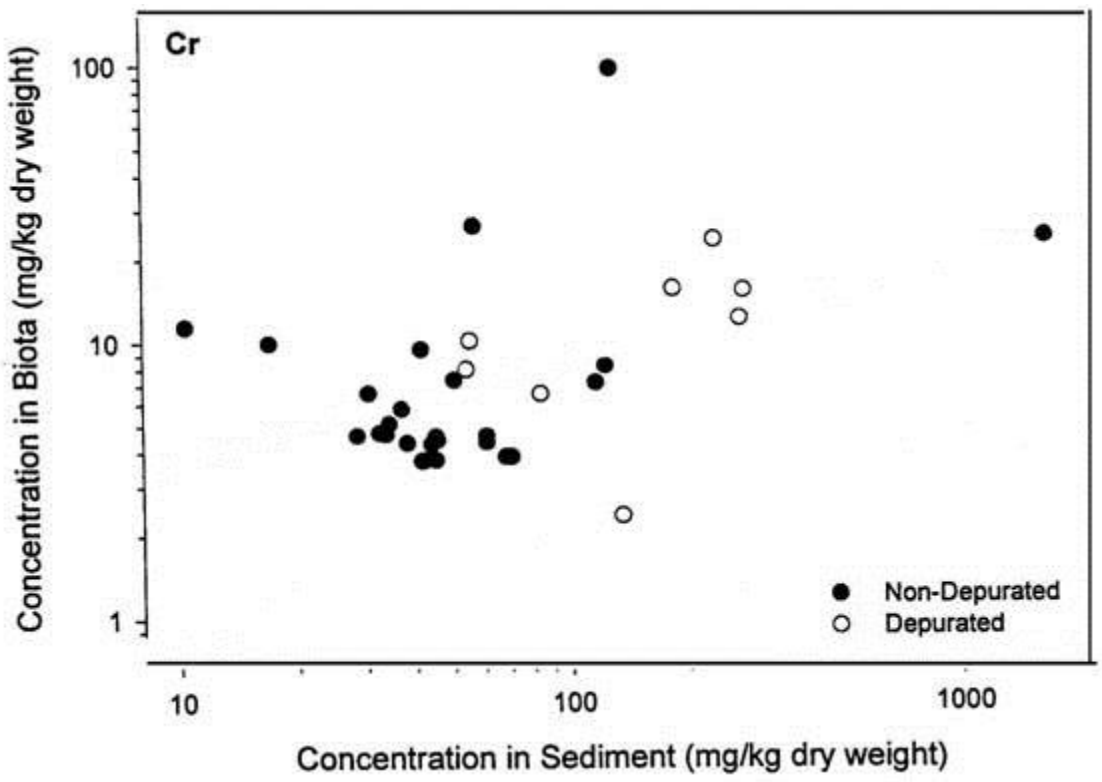
The relationship between receptor size and dietary intake is a critical factor in estimating exposure. In addition, dietary composition affects exposure because different food sources contain varying levels of COPECs. Although values for parameters such as body weight, ingestion rate, and dietary composition are available from the scientific literature, there is a natural level of variability in these parameters within a population of organisms. Uncertainty is inherent in the use of these values because they were generated from literature sources rather than being measured at the Site. Therefore, use of literature-derived exposure parameters increases uncertainties that may over- or underestimate actual exposures encountered by receptors in OU1 & OU2 exposure areas.

There are uncertainties associated with the assumed foraging ranges of wildlife receptors. Foraging ranges obtained from the literature were incorporated into the food chain model by applying a SFF which is the fraction of daily intake assumed to be obtained from within the exposure area. SFF is calculated by dividing the exposure area by foraging range. The use of forage ranges obtained from the scientific literature may have over- or underestimate risks for terrestrial receptors.

Bioaccumulation Factors

Literature-based BAFs were used to estimate uptake from soil and sediment into other food chain components, except for estimates of chromium concentrations in invertebrate tissue. Literature-based BAFs are generally considered to be more conservative than Property-specific factors, and therefore their use for some COPECs may overestimate associated risks. BAFs were obtained from the scientific literature and publications considered standard to ecological risk assessment.

Chromium is a site-related COI frequently detected in site media and therefore was carefully evaluated. No defensible sediment-to-invertebrate or soil-to-invertebrate BAFs are available in the scientific literature. Sample *et al.* (1998b) plotted sediment concentrations versus measured invertebrate tissue concentrations:

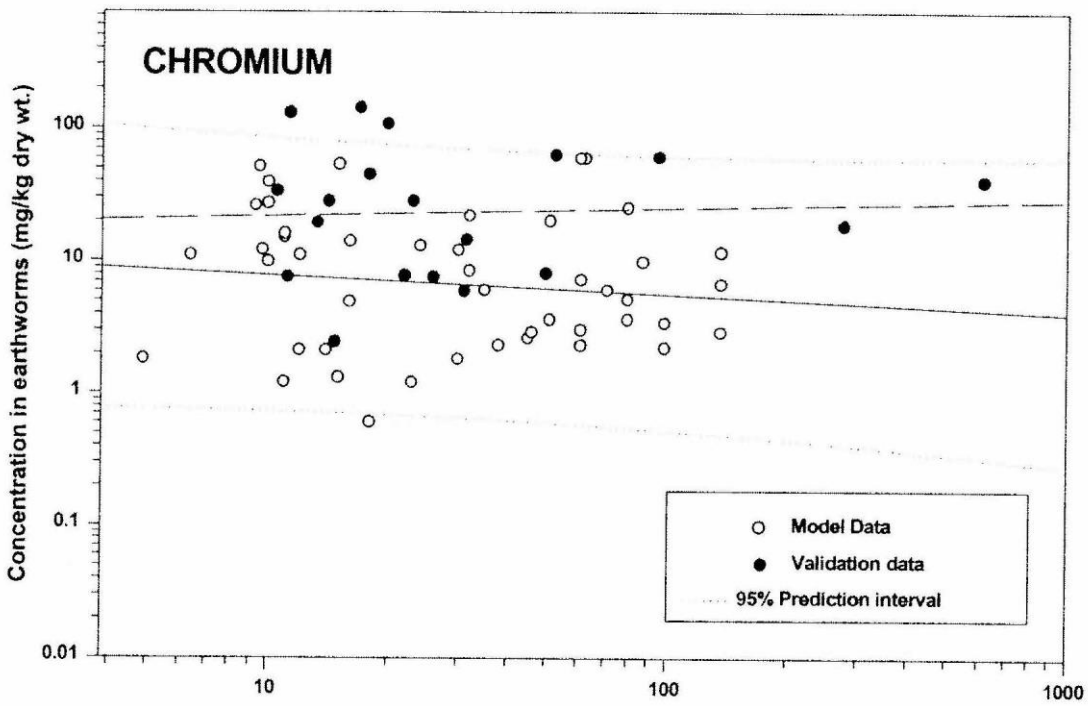


Notes:
r^2= 0.20 (*i.e.* poor correlation)
Note log scales on x- and y-axis
Highest shown sediment concentration is approximately 1,500 mg/kg.
Source: Sample *et al.,* 1998b

Using this set of 34 data points, Sample *et al.* (1998b) attempted but failed to find a meaningful regression equation (all r^2 values were between 0.16 and 0.2). In lieu of using a regression, the authors recommend using a default value based on a percentile of the data (they provide median and 90th percentiles). However, whether the regression equation or default percentiles are used, the underlying data fail to show a meaningful relationship between measured sediment concentrations and measured tissue concentrations. This sediment scatterplot does not show a positive correlation between sediment and tissue chromium concentrations. BAFs discussed in Sample *et al.* (1998b) were considered unreliable and not used in the food chain models. The underlying dataset does however provide a defensible upper bound for chromium in tissue regardless of sediment concentration.

USEPA (1999b) also presents several BAFs for invertebrates. These BAFs are also questionable because they are based on single studies, and range several orders of magnitude between 0.001 to 0.39. Taken together, these BAFs also suggest that there is not a strong positive correlation between sediment chromium concentrations and tissue concentrations. Therefore, BAFs discussed in USEPA (1999b) were considered unreliable and not used in the food chain models.

Sample *et al.*, (1998a) developed a soil-to-earthworm BAF. This publication also clearly demonstrates that empirical earthworm chromium concentrations are independent of soil concentrations. The authors themselves state that these data could not be used to develop a BAF. A scatterplot of these data shows no substantial correlation between soil concentrations and earthworm tissue concentrations:



Notes:
Trend line r^2= 0.04 (*i.e.* poor correlation)
Note log scales on x- and y-axis
Source: Sample *et al.*, 1998a.

Regression of earthworm tissue concentrations and soil concentrations for chromium did not produce a significant model fit (r^2 = 0.04). The chromium soil scatterplot does not indicate an increasing tissue concentration trend associated with increasing soil concentration (tissue concentrations almost appear to be independent of soil concentrations). The tissue concentration associated with a soil concentration of approximately 600 mg/kg was only approximately 30 mg/kg (the tissue concentration was only 5% of the corresponding soil concentration). The scatterplot suggests little correlation between soil and tissue concentrations, and the ratio of tissue concentrations to soil concentrations appears to decrease as soil concentrations increase from approximately 10 mg/kg (ratio of approximately 3) to approximately 600 mg/kg (ratio of approximately 0.05). At concentrations higher than 600 mg/kg, one might expect that the ratio is even lower.

None of these three sources provide a defensible approach to estimate soil- or sediment-to-invertebrate uptake for chromium.

In the absence of a defensible BAF or regression equation, a chromium tissue concentration of 20 mg/kg dry weight (dw) (corresponding to a 4 mg/kg wet weight (ww) concentration assuming invertebrates are 80% water) has been selected as representative of chromium concentrations in soil and aquatic invertebrates. For aquatic invertebrates, the 20 mg/kg dw concentration was obtained from the Sample *et al.*, (1998b) scatterplot which shows a measured tissue concentration of approximately 20 mg/kg dw associated with a measured sediment concentration of about 1,300 mg/kg, which on the log scale lie in close proximity to the highest sediment RME and CTE concentrations in the aquatic exposure areas. This 20 mg/kg concentration appears to be a baseline or background concentration in invertebrate tissue that is not affected by chromium concentrations in sediment.

For soil invertebrates, the 20 mg/kg dw concentration was obtained from the Sample *et al.* (1998a) scatterplot that shows that earthworm tissue chromium concentrations are independent of soil chromium concentrations. 20 mg/kg dw is an estimate of the median chromium earthworm concentration across all soil concentrations.

Sample *et al.* (1998b) also state that the available BAFs and regression models "are appropriate for use in screening ecological risk assessments" and cautions against using them "as the sole basis for a definitive characterization of risk." Risks in the BERA have been characterized with this uncertainty in mind.

Attachment 8 includes the Chromium Bioaccumulation Memorandum, previously submitted to USEPA and dated March 26, 2015. That memorandum includes a presentation and discussion of co-located soil and earthworm tissue sample chromium concentrations (collected from the OCSS) that further supports the technical approach utilized in this BERA for food chain modeling of chromium in soil.

Bioavailability of COPECs

The degree of certainty that an effect will occur in OU1 & OU2 exposure areas if a COPEC concentration is above a benchmark depends on a number of factors including bioavailability, similarity of species used to measure the effect, and similarity between experimental conditions and site conditions. Screening and effects benchmarks (and TRVs) generally assume 100 percent bioavailability. Bioavailability is the extent to which a substance can be absorbed or otherwise ingested by a living organism, potentially causing an adverse response. The bioavailability of metals is related to the extent to which a metal can desorb, dissolve, or otherwise disassociate from the environmental medium in which it occurs (Bernhard and Neff, 2001). Factors such as total organic carbon (TOC), AVS, grain size, salinity, pH, may affect the bioavailability of COPECs in soil and sediment. The assumption of 100 percent bioavailability when applying benchmarks likely overestimates risk.

In addition to TRVs, assumptions about bioavailability are made in each step of the food chain model: from medium to prey, from prey to predator, and from medium directly to predator via incidental ingestion. Bioavailability of COPECs at each step depends on a number of factors including particle size, matrix/tissue type, tissue chemistry (*e.g.,* stomach pH), and an organism's ability to detoxify and eliminate a COPEC. For many species, this information is not available, thus the food chain models assumes 100 percent bioavailability so as not to underestimate risk. In some cases, this assumption leads to a risk conclusion that is overly-conservative considering the uncertainties involved. Overestimations, where they occur, will be discussed in the Risk Characterization.

Inhalation and Dermal Exposure Pathways

Dermal exposures to wildlife were not evaluated because there are few data relating dermal exposure to toxic responses in wildlife. An assumption was made that fur or feathers limit dermal exposures of most wildlife. Inhalation exposures were not assessed.

Toxicological Uncertainties

Uncertainties associated with effects assessment steps for the BERA also affect the interpretation of the significance of the HQs. The main uncertainties are associated with the literature-derived toxicity data.

Literature-Derived TRVs and Benchmarks

TRVs used in the BERA are based on an extensive search of both primary peer-reviewed literature and secondary literature, such as government reports and technical conference proceedings. The number and types of information sources reviewed is adequate to capture the majority of sources of ecotoxicological information.

However, there is also uncertainty associated with the extrapolation of literature-derived toxicity endpoints to measurement endpoint receptors at the Property because of differences in exposure conditions. The majority of the literature-based toxicity data evaluated in the BERA were derived from laboratory studies. Laboratory settings do not necessarily represent field conditions and exposures, and typically are designed to control various factors in order to isolate one parameter in particular. Several measures, discussed below, were instituted to minimize these uncertainties.

Chronic studies with NOAEL endpoints were selected preferentially in developing TRVs. However, available toxicological data are not always associated with chronic exposure duration. Other test durations (for example, subchronic NOAELs, LC50 values) were sometimes selected to identify TRVs. When an endpoint other than a chronic NOAEL was selected as a TRV, an uncertainty factor was applied to the reported value to provide an additional level of conservatism in the risk estimation process, consistent with standard industry practice. Application of conservative application factors to the TRVs may result in risks being overestimated for some COPECs.

The availability of TRVs in the toxicological literature is limited for some specific receptors (*e.g.*, predatory birds, omnivorous mammals). Applying TRVs to broad classes of receptors may over- or underestimate risks, depending on the sensitivity of the receptor relative to that of the test organism, which often has not been determined.

Surface water, sediment, and surface soil screening benchmarks used in comparison tables were generally the lowest available screening value for a particular analyte. Since screening benchmark values typically varied by up to several orders of magnitude, selection of the lowest available value likely resulted in a severe overestimation of risk. Effects benchmarks, where available, were considered to be more appropriate for characterizing risk.

Some COPECs had very little or no toxicological data (TRVs, benchmarks) available (**Table 4.7-1**). When appropriate, toxicity data for similar chemicals were used as surrogates for these COPECs. Use of such surrogate toxicity data may underestimate or overestimate risks from the COPECs. In some cases, no appropriate toxicity or surrogate data were identified in the toxicological literature. The lack of toxicological data means that risk from some COPECs could not be quantified. This may underestimate ecological risks at the Property. However, where possible, COPECs lacking benchmarks or TRVs were compared to reference conditions to estimate incremental difference above reference. Reference data were available for EA2, EA4, EA5 and MMB Wetland exposure areas only. Most important COIs have benchmarks (*e.g.* chromium, BHEP), minimizing uncertainty from site-related sources.

Uncertainty in Risk Characterization

The largest source of uncertainty associated with risk characterization involves the interpretation of HQs. The Two-Way and Four-Way risk matrices (Section 5.0) recommended by USEPA, are set up to provide a logical decision process for interpreting sometimes complex scenarios based on various permutation of benchmarks, TRVs, and EPCs. However, even with this systematic approach, some amount of professional judgment is required when weighing uncertainties.

Effects benchmarks were not available for all COPECs identified in exposure area. As a result, not all COPECs could be evaluated using these measurement endpoints.

TRVs were not available for all COPECs identified in soil, surface water and sediment in exposure areas evaluated. As a result not all COPECs could be evaluated using the food chain model. Risk to ecological receptors from COPECs that could not be evaluated using food chain models will be discussed further in the Risk Characterization (Section 5.0).

5.0 RISK CHARATERIZATION

This section characterizes risk to ecological receptor populations and communities exposed to environmental media in OU1 and OU2 of the Olin Chemical Superfund Site.

Risk characterization includes three major components: risk estimation, risk description, and uncertainty analysis. Risk estimation consists of integrating the exposure profiles with the effects information. Risk description provides information important for interpreting the risk results. The uncertainty analysis was conducted in Section 4 discusses potential sources of uncertainty, and the relative certainty associated with estimates of risk. In this section, each of the assessment endpoints are reviewed, results for measurement endpoints are analyzed, and the relationship between assessment and measurement endpoints is discussed, including the confidence in the relationships relative to characterizing risk. A weight-of-evidence approach is used to make conclusions regarding overall risk of harm.

Ideally, risk characterization based on food chain model HQs would be based on a dose-response curve for each COPEC and receptor combination. However, for most ecological receptors, sufficient information to establish dose-response curves is not available in the published scientific literature. Instead, the likelihood of adverse population level effects was determined using the following Four-Way Interpretative Risk Matrix developed for USEPA Region I that incorporates all four EPC/TRV combinations:

Four-Way Interpretative Risk Matrix					
RME/ NOAEL HQ	**RME/ LOAEL HQ**	**CTE/ NOAEL HQ**	**CTE/ LOAEL HQ**	**Risk Conclusion:** Adverse population-level effects:	**Confidence Level**
≤ 1	≤ 1	≤ 1	≤ 1	Unlikely	High
> 1	≤1	≤ 1	≤ 1	Unlikely	High
> 1	> 1	≤ 1	≤ 1	Unlikely	Moderate
> 1	≤ 1	> 1	≤ 1	Possible	Low
> 1	> 1	> 1	≤ 1	Possible	Moderate
> 1	> 1	> 1	> 1	Possible	High (increases with higher HQs)

When possible, incremental risk HQs (Equation 3) from food chain models have been used as the basis for the risk characterization. Incremental risk HQs are the most appropriate HQ for characterizing site-related risk because the account for non-site sources.

If incremental risk HQs could not be calculated due to a lack of background data, then HQs calculated with Equation 2 were used. In rare instances where incremental risk HQs based on the various EPC and TRV combinations did not fit exactly into the matrix (*e.g.* aluminum HQs for raccoon in MMB Wetland, **Table 4.5-10**), professional judgment was used to determine the outcome and associated confidence. HQs calculated for terrestrial plants, soil invertebrates, benthic invertebrates and amphibians were based on effects benchmarks factored with the RME and CTE scenarios, so only two sets of HQ conditions were calculated. In such cases, the Two-Way Interpretative Risk Matrix, also developed for USEPA, was used as a guide to address the range of risk conclusions and confidence levels:

Two-Way Interpretative Risk Matrix			
RME/Effects Benchmark HQ	**CTE/Effects Benchmark HQ**	**Risk Conclusion:** Adverse population-level effects:	**Confidence Level**
≤ 1	≤ 1	Unlikely	High
> 1 and ≤ 10	≤ 1	Unlikely	Moderate
>10	≤ 1	Possible	Low
> 1	> 1	Possible	High (increases with higher HQs)

The Four-Way and Two-Way risk matrices were the first steps to estimate and characterize risk. Then, as demonstrated in the following sub-sections, underlying assumptions and uncertainties and site-specific factors such as robustness of sample size, bioavailability, or confidence in an individual benchmark, were considered to derive final risk conclusions.

Risk is characterized by exposure area and assessment/measurement endpoints, beginning with the terrestrial exposure areas and concluding with the semi-aquatic exposure areas.

5.1 EA-2 – Surface Soil

Risk to terrestrial plants in EA-2 was assessed using Measurement Endpoint 1A (compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions; *low* inference weight). The Two-Way interpretative matrix (**Table 4.3-1**) suggested that adverse effects to the plant community from aluminum, selenium, and vanadium, may be possible, but confidence in these conclusions are low. Confidence in the effects benchmarks, for these three COPECs, which are based on ORNL values, is low (Efroymson, 1997). Also, background concentrations of aluminum and vanadium are well above effects concentrations, indicating that these benchmarks may not be appropriate to regional conditions. In addition, visual observations of plant communities made during several years of site inspection and investigation activities have recorded the presence of a healthy plant community. Furthermore, aluminum, selenium, and vanadium are not considered site-related COIs. Considering these factors, site-related adverse effects to the terrestrial plant community from COPECs in EA-2 soil are unlikely.

Risk to soil invertebrates in EA-2 was assessed using Measurement Endpoint 2A (compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions; *low* inference weight). The Two-Way interpretative matrix (**Table 4.3-1**) suggested that adverse effects to the soil invertebrate community from COPECs in EA-2 soil are unlikely.

Risk to populations of invertivorous songbirds (robins) was evaluated with Measurement Endpoint 3A (compare estimated daily dose for robin based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published avian TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-1**) suggested that adverse effects from BEHP to populations of invertivorous songbirds in EA-2 soil may be possible. Incremental risk HQs for BEHP range from 3 to 200, indicating a degree of uncertainty. Confidence in these findings from the Four-Way matrix decreases with decreasing HQ, particularly in the CTE-LOAEL case. Considering these factors, actual adverse effects to populations of invertivorous songbirds from COPECs in EA-2 soil are unlikely.

Risk to omnivorous small mammals (shrews) was evaluated with Measurement Endpoint 4A (compare estimated daily doses for omnivorous small mammal species based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published mammalian TRVs and to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-1**) suggested that adverse effects from BEHP and aluminum to populations of omnivorous small mammals in EA-2 soil may be possible. Incremental risk HQs for BEHP (<1 to 20) are generally low, particularly in the LOAEL-based HQs. Confidence in these findings from the Four-Way matrix decreases with decreasing HQ. Also, aluminum is not considered a site-related COI. Considering these factors, actual adverse site-related effects to populations of omnivorous mammals from COPECs in EA-2 soil are unlikely.

Risk to birds of prey (hawk) was evaluated with Measurement Endpoint 5A (compare estimated daily doses for carnivorous bird species based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published avian TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-1**) suggested that adverse effects to populations of birds of prey from COPECs in EA-2 soil are unlikely.

Risk to carnivorous mammals (fox) was evaluated with Measurement Endpoint 6A (compare estimated daily doses for carnivorous mammal species based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published mammal TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-1**) suggested that adverse effects to populations of carnivorous mammals from COPECs in EA-2 soil are unlikely.

All of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to EA-2 soil.

5.2 EA-4 – Surface Soil

Risk to terrestrial plants in EA-4 was assessed using Measurement Endpoint 1A (compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions; *low* inference weight). The Two-Way interpretative matrix (**Table 4.3-2**) suggested that adverse effects to the plant community from COPECs in EA-4 soil are unlikely.

Risk to soil invertebrates in EA-4 was assessed using Measurement Endpoint 2A (compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions; *low* inference weight). The Two-Way interpretative matrix (**Table 4.3-2**) suggested that adverse effects to the soil invertebrate community from sulfate may be possible. However, the CTE-based HQ is low (2.3). Considering that confidence in the findings of the Two-Way risk matrix decreases with decreasing HQ, there is low confidence that adverse effects may be possible. Adverse effects to the soil invertebrate community from COPECs in EA-4 soil are therefore unlikely.

Risk to populations of invertivorous birds (robins) was evaluated with Measurement Endpoint 3A (compare estimated daily dose for robin based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published avian TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-2**) suggested that adverse effects from BEHP to populations of invertivorous songbirds in EA-4 soil may be possible. Incremental risk HQs for BEHP (1 to 50) are generally low, particularly in the CTE-LOAEL case. Confidence in these findings from the Four-Way matrix decreases with decreasing HQ. Considering these factors, actual adverse effects to populations of invertivorous songbirds from COPECs in EA-4 soil are unlikely.

Risk to omnivorous small mammals (shrews) was evaluated with Measurement Endpoint 4A (compare estimated daily doses for omnivorous small mammal species based on ingestion of

prey and incidental ingestion of soil in terrestrial Site exposure areas to published mammalian TRVs and to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-2**) suggested that adverse effects from BEHP to populations of omnivorous small mammals in EA-4 soil may be possible. Incremental risk HQs for BEHP (<1 to 6) are generally low, particularly in the LOAEL-based HQs. Confidence in these findings from the Four-Way matrix decreases with decreasing HQ. Considering these factors, actual adverse effects to populations of omnivorous mammals from COPECs in EA-4 soil are unlikely.

Risk to birds of prey (hawk) was evaluated with Measurement Endpoint 5A (compare estimated daily doses for carnivorous bird species based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published avian TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-2**) suggested that adverse effects to populations of birds of prey from COPECs in EA-4 soil are unlikely.

Risk to carnivorous mammals (fox) was evaluated with Measurement Endpoint 6A (compare estimated daily doses for carnivorous mammal species based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published mammal TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-2**) suggested that adverse effects to populations of carnivorous mammals from COPECs in EA-4 soil are unlikely.

All of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to EA-4 soil.

5.3 EA-5 – Surface Soil

Risk to terrestrial plants in EA-5 was assessed using Measurement Endpoint 1A (compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions; *low* inference weight). The Two-Way interpretative matrix (**Table 4.3-3**) suggested that adverse effects to the terrestrial plant community from aluminum, chromium, mercury, tin, and vanadium in EA-5 soil may be possible. However, aluminum, mercury, tin and vanadium are not considered site-related COIs.

Risk to soil invertebrates in EA-5 was assessed using Measurement Endpoint 2A (compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions; *low* inference weight). The Two-Way interpretative matrix (**Table 4.3-3**) suggested that adverse effects from chromium and mercury to soil invertebrate communities in EA-5 soil may be possible. However, mercury is not considered a site-related COI.

Risk to populations of invertivorous birds (robins) was evaluated with Measurement Endpoint 3A (compare estimated daily dose for robin based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published avian TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-3**) suggested that adverse effects from BEHP, chromium, and tin to populations of invertivorous birds in EA-5 soil may be possible. However, tin is not considered a site-related COI.

Risk to omnivorous small mammals (shrews) was evaluated with Measurement Endpoint 4A (compare estimated daily doses for omnivorous small mammal species based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published mammalian TRVs and to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-3**) suggested that adverse effects from BEHP, aluminum, chromium, and tin to populations of omnivorous small mammals in EA-5 soil may be possible. However, aluminum and tin are not considered site-related COIs.

Risk to birds of prey (hawk) was evaluated with Measurement Endpoint 5A (compare estimated daily doses for carnivorous bird species based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published avian TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-3**) suggested that adverse effects to populations of birds of prey from COPECs in EA-5 soil are unlikely.

Risk to carnivorous mammals (fox) was evaluated with Measurement Endpoint 6A (compare estimated daily doses for carnivorous mammal species based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published mammal TRVs and compare to reference area conditions; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-3**) suggested that adverse effects to populations of carnivorous mammals from COPECs in EA-5 soil are unlikely.

Most of the measurement endpoints found that adverse effects may be possible for ecological receptor populations and communities exposed to EA-5 soil. Food chain models for robins and shrews, and plant and invertebrate effects benchmark comparisons all indicated that adverse site-related effects may be possible from chromium in EA-5 soil. Adverse effects from BEHP to robins and shrews may also be possible.

5.4 Central Pond – Surface Water and Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight). Risk from some inorganic COPECs (bromide and nitrate) in surface water could not be evaluated because they lacked effects benchmarks. The Two-Way matrix (**Table 4.3-5**) suggested that adverse effects to the benthic invertebrate community from COPECs in Central Pond surface water are unlikely. The Two-Way matrix (**Table 4.3-12**) suggested that adverse effects from acetone and phenol in sediment to the benthic invertebrate community in Central Pond may be possible. However, acetone and phenol were analyzed in only two samples. Such a limited number of samples increases uncertainty in the EPC calculations. Furthermore, these HQs do not take into account background concentrations unrelated to site activities. Acetone is also not considered a site-related COI. Confidence that adverse effects to the benthic invertebrate community may be possible from COPECs in Central Pond sediment (phenol) is therefore low.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-5** and **Table 4.3-12**) also apply to amphibians. Therefore, adverse effects to the amphibian community from COPECs in Central Pond surface water are unlikely. Confidence that adverse effects to the amphibian community may be possible from COPECs in Central Pond sediment (phenol) is low.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-7**) suggested that adverse effects to populations of semi-aquatic invertivorous birds in Central Pond are unlikely.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic

exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-7**) suggested that adverse effects to populations of semi-aquatic omnivorous birds from COPECs in Central Pond are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-7**) suggested that adverse effects to populations of semi-aquatic herbivorous mammals from COPECs in Central Pond are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-7**) suggested that adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in Central Pond are unlikely.

Most of the measurement endpoints found that adverse effects are unlikely for ecological receptor populations and communities exposed to media in Central Pond. The sediment benchmark comparison found that there is low confidence that phenol is a risk to benthic invertebrates and amphibians. However, the sediment benchmark comparison carries a low inference weight. Medium/high weighted measurement endpoints (food chain models) did not identify risks from phenol. Considering the low confidence and the low weight associated with the sediment benchmark comparison, the overall weight-of-evidence indicates that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to Central Pond surface water and sediment.

5.5 Storm Water Detention Basin – Surface Water and Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight). The Two-Way matrix (**Table 4.3-6**) suggested that adverse effects to the benthic invertebrate community from aluminum may be possible. However, HQs are low (1.2), are based on a single sample, and were analyzed for total metals which tends to overestimate bioavailability. Also, aluminum is not considered a site-related COI. Considering these uncertainties, adverse site-related effects to the benthic invertebrate community from COPECs in the Storm Water Detention Basin surface water are unlikely.

The Two-Way matrix (**Table 4.3-13**) suggested that adverse effects to the benthic invertebrate community from COPECs in Storm Water Detention Basin sediment from acetone and phenol may be possible. However, acetone and phenol were analyzed in only two samples. Such a limited number of samples increases uncertainty in the EPC calculations. Furthermore, these HQs do not take into account background concentrations unrelated to site activities. Also, acetone is not considered a site-related COI. Confidence that adverse effects to the benthic invertebrate community may be possible from COPECs in the Storm Water Detention Basin sediment (from phenol) is low.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-6** and **Table 4.3-13**) also apply to amphibians. Therefore, adverse effects to the amphibian community from COPECs in Storm

Water Detention Basin surface water are unlikely. Confidence that adverse effects to the amphibian community may be possible from COPECs in the Storm Water Detention Basin sediment (from phenol) is low.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-8**) suggested that adverse effects to populations of semi-aquatic invertivorous birds in Storm Water Detention Basin are unlikely.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-8**) suggested that adverse effects to populations of semi-aquatic omnivorous birds from COPECs in the Storm Water Detention Basin are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-8**) suggested that adverse effects to populations of semi-aquatic herbivorous mammals from COPECs in the Storm Water Detention Basin are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-8**) suggested that adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in the Storm Water Detention Basin are unlikely.

Most of the measurement endpoints found that adverse effects are unlikely for ecological receptor populations and communities exposed to media in the Storm Water Detention Basin. The sediment benchmark comparison found that there is low confidence that phenol may pose risks to benthic invertebrates and amphibians. However, the sediment benchmark comparison carries a low inference weight. Medium/high weighted measurement endpoints (food chain models) did not identify risks from phenol. Considering the low confidence and the low weight associated with the sediment effects benchmark comparison, the overall weight-of-evidence indicates that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to Strom Water Detention Basin surface water and sediment.

5.6 On-PWD/WDW – Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment concentrations to sediment and effects benchmarks; *low* inference weight). The Two-Way matrix (**Table 4.3-11**) suggested that adverse effects to the benthic invertebrate community from acetone in On-PWD/WDW sediment may be possible. However, acetone was detected in only 2 of 8 samples. However, acetone is not considered a site-related COI. Considering these factors, adverse site-related effects to the benthic invertebrate community from COPECs in the On-PWD/WDW sediment is unlikely.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-11**) also apply to amphibians. Therefore, adverse site-related effects to amphibians from COPECs in On-PWD/WDW sediment are unlikely.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight The Four-Way interpretative matrix (**Table 4.5-6)** suggested that adverse effects to populations of semi-aquatic invertivorous birds in On-PWD/WDW are unlikely.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-6**) suggested that adverse effects to populations of semi-aquatic omnivorous birds from COPECs in the On-PWD/WDW are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). Based on the Four-Way interpretative matrix (**Table 4.5-6**), adverse effects to populations of semi-aquatic herbivorous mammals from COPECs in On-PWD/WDW are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). Based on the Four-Way interpretative matrix (**Table 4.5-6**), adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in On-PWD/WDW are unlikely.

All of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to On-PWD sediment.

5.7 South Ditch – Surface Water and Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight). The Two-Way matrix (**Table 4.3-4**) suggested that adverse effects to the benthic invertebrate community from aluminum, chromium, and ammonia in surface water may be possible. However, aluminum is not considered a site-related COI.

The Two-Way matrix (**Table 4.3-9**) suggested that adverse effects to the benthic invertebrate community from COPECs in Upper South Ditch sediment from phenol, chromium silver, and EPH may be possible. HQs for phenol (1.7 to 2.3), EPH C19-C36 aliphatics (2.9 to 4.4), chromium (3.6 to 8.3), and silver (3.7 to 9.5) are low, particularly in the CTE-based HQs. Confidence in these findings from the Two-Way matrix decreases with decreasing HQ. Also, these HQs do not take into account background concentrations unrelated to site activities.

Considering these factors, actual adverse effects to the benthic community from phenol, C19-C36 aliphatics, and metal COPECs in Upper South Ditch Sediment are unlikely; risk from C11-C22 aromatic EPH is possible though a site-related source has not been identified.

The Two-Way matrix (**Table 4.3-10**) suggested that adverse effects to the benthic invertebrate community in Lower South Ditch sediment from acetone, EPH, chromium, and silver may be possible. Acetone and silver are not considered site-related COIs. EPH was analyzed in only two samples, introducing uncertainty into those respective EPCs. Also, a source for the EPH has not been identified. Adverse effects to the benthic invertebrate community in Lower South Ditch sediment from chromium may be possible.

Risk to benthic invertebrates in Lower South Ditch was also evaluated with Measurement Endpoint 7B (compare sediment toxicity test results for the South Ditch sample to corresponding sediment toxicity test results for reference samples; *medium/high* inference weight). The one sediment toxicity test that was conducted demonstrated statistically significant effects to survival (42%) versus the laboratory control (93%) and two reference samples (95% and 96%). The sample location (ISCO-2) was selected because it showed the highest sediment HQs based on screening level benchmarks and so exposure conditions are biased high. This toxicity test demonstrates that in the worst case, adverse effects to the benthic invertebrate may be possible.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-4**, **Table 4.3-9**, and **Table 4.3-10**) also apply to amphibians. Therefore, adverse site-related effects to the amphibian community from surface water chromium, and ammonia may be possible. Adverse site-related effects to the amphibian community from COPECs in Upper South Ditch sediment may be possible from C11-C22 aromatic EPH, though a site-related source has not been identified. Adverse site-related effects to the amphibian community in Lower South Ditch sediment may be also be possible.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). In the Upper South Ditch, the Four-Way interpretative matrix (**Table 4.5-4**) suggested that adverse effects from BEHP to populations of semi-aquatic invertivorous birds may be possible. HQs for BEHP (2 to 90) span a wide range, indicating uncertainty. Overall, HQs for BEHP are low, particularly in the LOAEL-based HQs. Confidence in these findings from the Four-Way matrix decreases with decreasing HQ. Considering these factors, adverse effects to populations of semi-aquatic invertivorous birds from COPECs in the Upper South Ditch are unlikely.

In the Lower South Ditch, the Four-Way interpretative matrix (**Table 4.5-5**) suggested that adverse effects from BEHP (HQs 5 to 90) to populations of semi-aquatic invertivorous birds may be possible.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). In Upper South Ditch, the Four-Way interpretative matrix suggested that adverse effects to populations of semi-aquatic omnivorous birds from COPECs (**Table 4.5-4**) are unlikely.

In Lower South Ditch, the Four-Way interpretative matrix suggested that adverse effects to populations of semi-aquatic invertivorous birds (marsh wren) from BEHP and chromium (**Table 4.5-5**) may be possible. HQs for BEHP (<1 to 3) and chromium (<1 to 2) are low, particularly in the LOAEL-based HQs. Confidence in these findings from the Four-Way matrix decreases with decreasing HQ. Also, these HQs do not take into account background concentrations unrelated to site activities. Considering these factors, actual adverse effects to populations of semi-aquatic omnivorous birds from COPECs in Lower South Ditch are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight In Upper South Ditch the Four-Way interpretative matrix (**Table 4.5-4**) suggested that adverse effects to populations of semi-aquatic herbivorous mammals from COPECs are unlikely.

In Lower South Ditch, the Four-Way interpretative matrix suggested that adverse effects to populations of semi-aquatic herbivorous mammals (muskrat) (**Table 4.5-5**) are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-4**; **Table 4.5-5**) suggested that adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in Upper and Lower South Ditch are unlikely.

In the Upper South Ditch, most of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to sediment there. The sediment benchmark comparison found that site-related risks to benthic invertebrate and amphibian communities from the C11-C22 aromatic EPH fraction are uncertain. The sediment benchmark comparison carries a low inference weight. Other medium/high weighted measurement endpoints (food chain models) found that adverse site-related effects from COPECs in Upper South Ditch were unlikely. Considering that a source for EPH has not been identified and considering the low weight associated with the sediment benchmark comparison, the overall weight-of-evidence indicates that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to Upper South Ditch sediment. The surface water benchmark comparison indicates that adverse site-related effects or ecological receptors from chromium and ammonia may be possible.

In the Lower South Ditch, most of the measurement endpoints found that adverse effects may be possible for ecological receptor populations and communities exposed surface water and sediment there. The sediment benchmark comparison found that adverse site-related effects to benthic invertebrate and amphibian communities from chromium may be possible; site-related risks from the EPH fraction are uncertain. The sediment benchmark comparison carries a low inference weight. The sediment toxicity test, which carries a medium/high inference weight, indicated that the worst-case conditions in the Lower South Ditch adversely affect the benthic community. The marsh wren food chain model, which also carries a medium/high inference weight, suggested that BEHP may pose a risk. Three other food chain models (green heron, muskrat, raccoon) also carry a medium/high inference weight found that adverse effects from COPECs in Lower South Ditch are unlikely. The overall weight-of-evidence indicates that adverse site-related effects for ecological receptor populations and communities exposed to Lower South Ditch sediment may be possible from chromium and BEHP. The surface water

benchmark comparison indicates that adverse site-related effects or ecological receptors from chromium and ammonia may be possible.

5.8 Off-PWD – Surface Water and Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight). The Two-Way matrix (**Table 4.3-7**) suggested that adverse effects to the benthic invertebrate community from surface water SVOCs (the PAHs: benzo(a)pyrene, phenanthrene, and pyrene), aluminum, and ammonia may be possible. HQs for aluminum and ammonia are low (<2), and as explained in Section 3.14, ammonia in Off-PWD is not site-related. EPCs for PAHs and aluminum are based on total fractions that tend to overestimate bioavailability. Also, aluminum is not considered a site-related COI. Considering these factors, adverse site-related effects to the benthic invertebrate community from surface water COPECs in the Off-PWD are unlikely.

The Two-Way matrix (**Table 4.3-14**) suggested adverse effects to the benthic invertebrate community from COPECs in Off-PWD sediment from chromium (HQs 12 to 22) and silver (HQs 12 to 21) may be possible. Silver is not considered a site-related COI.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-7** and **Table 4.3-14**) also apply to amphibians. Therefore, adverse site-related effects to the amphibian community from COPECs in Off-PWD surface water are unlikely. Adverse site-related effects to the amphibian community from COPECs in the Off-PWD sediment (chromium) may be possible.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way matrix (**Table 4.5-9**) suggested that adverse effects from beryllium and chromium to populations of semi-aquatic invertivorous birds in Off-PWD may be possible. HQs for beryllium (<1 to 4) are low, particularly in the LOAEL-based HQs. Also, beryllium is not considered a site-related COI. HQs from chromium (1 to 7) are low, particularly in the LOAEL-based HQs. Confidence in these findings from the Four-Way interpretative matrix decreases with decreasing HQ. Also, these HQs do not take into account background concentrations unrelated to site activities. Considering these factors, adverse site related effects to populations of semi-aquatic invertivorous birds from COPECS in the Off-PWD are unlikely.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-9**) suggested that adverse effects to populations of semi-aquatic omnivorous birds from COPECs in the Off-PWD are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference

weight). The Four-Way interpretative matrix (**Table 4.5-9**) suggested that adverse effects to populations of semi-aquatic herbivorous mammals from COPECs in Off-PWD are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-9**) suggested that adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in the Off-PWD are unlikely.

Most of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to media in the Off-PWD, including the surface water benchmark comparison and all four food chain models (marsh wren, green heron, muskrat, and raccoon). The sediment benchmark comparison suggested that there may be site-related adverse effects from chromium; however the sediment benchmark comparison carries a low inference weight. Medium/high weighted measurement endpoints did not identify risk from chromium. Considering the low confidence and the low weight associated with the sediment benchmark comparison, the overall weight-of-evidence indicates that adverse effects are unlikely for populations and communities of ecological receptors exposed to COPECs in Off-PWD surface water and sediment.

5.9 Maple Meadow Brook Wetland – Surface Water and Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight). The Two-Way matrix (**Table 4.3-8**) suggested that adverse effects to the benthic community from COPECs in MMB Wetland surface water are unlikely.

Two-Way matrix (**Table 4.3-16**) suggested that adverse effects to the benthic invertebrate community from COPECs in MMB Wetland sediment are unlikely.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-8** and **Table 4.3-16**) also apply to amphibians. Therefore, adverse effects to the amphibian community from COPECs in the MMB Wetland surface water and sediment are unlikely.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way matrix (**Table 4.5-10**) suggested that adverse effects from beryllium and copper to marsh wren may be possible. HQs for beryllium (<1 to 4) and copper (<1 to 5) are low, particularly in the LOAEL-based HQs. Also, beryllium is not considered a site-related COI. Considering that confidence in the findings of the Four-Way risk matrix decreases with decreasing HQ, actual adverse effects to populations of semi-aquatic invertivorous birds from COPECs in the MMB Wetland are unlikely.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way

interpretative matrix (**Table 4.5-10**) suggested that adverse effects to populations of semi-aquatic omnivorous birds from COPECs in the MMB Wetland are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-10**) suggested that adverse effects from aluminum to populations of semi-aquatic herbivorous mammals in MMB Wetland may be possible. HQs for aluminum (<1 to 5) are low, particularly in the LOAEL-based HQs. Also, aluminum is not considered a site-related COI. Therefore, adverse site-related effects to populations of semi-aquatic herbivorous mammals from COPECs in the MMB Wetland are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight The Four-Way interpretative matrix (**Table 4.5-10**) suggested that adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in the MMB Wetland are unlikely.

All of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to MMB Wetland surface water and sediment.

5.10 North Pond – Surface Water and Sediment

Risk to benthic invertebrates was evaluated with Measurement Endpoint 7A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight). The Two-Way matrix (**Table 4.3-9**) suggested that adverse effects from pyrene in surface water may be possible. However, the low concentration (0.39 ug/L) is most likely attributable to non-site related sources such as storm water runoff from the asphalt roadways and parking lots which surround North Pond and encroach upon its edges. Considering the possible influence of other sources, adverse site-related effects to the benthic invertebrate from COPECs in North Pond surface water are unlikely.

The Two-Way matrix (**Table 4.3-17**) suggested that adverse effects to the benthic invertebrate community from COPECs in North Pond sediment may be possible for acetone, carbon disulfide, and chromium. Acetone and carbon disulfide are not considered site-related COIs. Chromium was detected in all four sediment samples collected in the North Pond at concentrations ranging from 20 mg/kg to 780 mg/kg. The maximum detection is at 603 and is roughly seven times greater than all other concentrations (20 mg/kg, 170 mg/kg and 140 mg/kg). The CTE EPC (278 mg/kg) is higher than the concentrations in the three other samples. The chromium CTE EPC is biased toward the maximum detection and therefore overestimates exposure. Risk to the benthic invertebrate community from chromium in North Pond is therefore uncertain.

Risk to amphibians was evaluated with Measurement Endpoint 8A (compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks; *low* inference weight), which is essentially the same as Measurement Endpoint 7A. As such, Measurement Endpoint 8A is essentially the same as 7A, and the findings for the benthic community previously described above (**Table 4.3-9** and **Table 4.3-17**) also apply to amphibians. Adverse effects to the amphibian community from COPECs in North Pond surface

water are unlikely. Adverse site-specific effects to the amphibian community from COPECs in North Pond sediment (chromium) may be possible; however considering that the chromium CTE EPC may severely overestimate exposure, risk to the benthic invertebrate community from chromium in North Pond is therefore uncertain.

Risk to populations of semi-aquatic invertivorous birds (marsh wren) was evaluated with Measurement Endpoint 9A (compare estimated daily doses for invertivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight). The Four-Way matrix (**Table 4.5-11**) suggested that adverse effects from beryllium, chromium, and copper to marsh wren may be possible. HQs for beryllium (<1 to 3), chromium (<1 to 5), and copper (2 to 5) are low, particularly in the LOAEL-based HQs. Considering that confidence in the findings of the Four-Way risk matrix decreases with decreasing HQ, adverse effects to populations of semi-aquatic invertivorous birds from beryllium, chromium, and copper, in North Pond are unlikely.

Risk to populations of semi-aquatic omnivorous birds (green heron) was evaluated with Measurement Endpoint 9B (compare estimated daily doses for omnivorous birds based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs; *medium/high* inference weight The Four-Way interpretative matrix (**Table 4.5-11**) suggested that adverse effects populations of semi-aquatic omnivorous birds from COPECs in North Pond are unlikely.

Risk to populations of semi-aquatic herbivorous mammals (muskrat) was evaluated with Measurement Endpoint 10A (Compare estimated daily doses for semi-aquatic herbivorous mammal species based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-11**) suggested adverse effects from to populations of semi-aquatic herbivorous mammals from COPECs in North Pond are unlikely.

Risk to populations of semi-aquatic omnivorous mammals (raccoon) was evaluated with Measurement Endpoint 10B (Compare estimated daily doses for semi-aquatic omnivorous mammal species based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs; *medium/high* inference weight). The Four-Way interpretative matrix (**Table 4.5-11)** suggested that adverse effects to populations of semi-aquatic omnivorous mammals from COPECs in North Pond are unlikely.

Most of the measurement endpoints found that adverse site-related effects are unlikely for ecological receptor populations and communities exposed to media in North Pond, including the surface water benchmark comparison and the four food chain models (wren, muskrat, heron, and raccoon). The sediment benchmark comparison was inconclusive due to concern that the chromium CTE EPC may severely overestimate exposure. However, the sediment benchmark comparison carries a low inference weight. Medium/high weighted endpoints (food chain models) and another low weighted measurement endpoint (surface water benchmark comparison) did not identify risks from chromium. Considering the low confidence and the low weight associated with the sediment benchmark comparison, the overall weight-of-evidence indicates that adverse effects associated with releases at or from OU1 and OU2 are unlikely for ecological receptor populations and communities exposed to COPECs in North Pond surface water and sediment.

6.0 CONCLUSIONS

This BERA for OU1 and OU2 of the OCSS found that adverse effects associated with releases at or from OU1 and OU2 to ecological receptors are unlikely in the following exposure areas and media:

- EA-2 soil;
- EA-4 soil;
- Central Pond surface water and sediment;
- Storm Water Detention Basic surface water and sediment;
- On-PWD/WDW surface water and sediment;
- Upper South Ditch sediment;
- Off-PWD surface water and sediment;
- Maple Meadow Brook surface water and sediment; and
- North Pond surface water and sediment.

The BERA for OU1 and OU2 of the OCSS also found that adverse effects may be possible in the following exposure areas and media:

- EA-5 soil, due to chromium and BEHP;
- Upper South Ditch surface water, due to chromium and ammonia; and
- Lower South Ditch surface water due to chromium, and ammonia; and sediment due to chromium and BEHP.

North Pond was evaluated per request from USEPA. Adverse effects to populations and communities of ecological receptors exposed to North Pond surface water and sediment are unlikely.

7.0 REFERENCES

ABB-ES, 1993. Screening Level Ecological Risk Assessment. Olin Corporation Facility. December.

ABB-ES, 1997. Stage II Environmental Risk Characterization. Olin Corporation Wilmington Facility. DEP RTN: 3-0471. June.

Bernhard, T. & J. Neff, 2001. Issue Papers – Metals Bioavailability in the Navy's Tiered Ecological Risk Assessment Process. http://web.ead.anl.gov/ecorisk/issue/pdf/BioavailNavy.pdf.

Brady, N.C. & R.R. Weil, 1999. *Elements of the Nature and Properties of Soils.* Prentice Hall, NJ.

Camargo & Alonso, 2006. Ecological and Toxicological Effects of Inorganic Nitrogen Pollution in Aquatic Ecosystems; a Global Assessment. *Environment International* 32:(831-849).

Canadian Council of Ministers of the Environment (CCME), 2010. Canadian water quality guidelines for the protection of aquatic life: Ammonia. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

DeGraff, R.M. and D.D. Rudis, 1983. New England Wildlife: Habitat, Natural History, and Distribution. U.S. Department of Agriculture. Northeastern Forest Experiment Station. General Technical Report NE-108.

Efroymson, R.A., M.E., Will, and G.W. Suter II, 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.

Efroymson, R.A., M.E., Will, and G.W. Suter II and A.C. Wooten, 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.

Friday, G.P, 1998. Ecological Screening Values for Surface Water, Sediment, and Soil. Westinghouse Savannah River Company, Savannah River Technology Center, (WSRC-TR-98-00110), Aiken, SC 29808. Cited in: USEPA, 2001a. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. November 30, 2001 update.

GEI, 2000. Part 1 of Construction Related Abatement Measure (C-RAM) Plan. Olin Corp. Property, 51 Eames St., Wilmington, MA, RTN: 3-0471. April.

IPCS (International Programme on Chemical Safety), 1986. Environmental Health Criteria 54: Ammonia. United National Environment Programme, International Labour Organization, World Health Organization.

Jager, T, 1998. Mechanistic approach for estimating bioconcentration of organic chemicals in earthworms. *Environmental Toxicology and Chemistry* 17: 2080-2090.

Johnson, C. E., 1925. The Muskrat in New York: its Natural History and Economics. *Roosevelt Wildlife Bulletin* 3: 205-321 *cited in* USEPA, 1993.

Jones, D.S., G.W. Suter II, & R.N. Hull, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision; Oak Ridge National Laboratories (ES/ER/TM-95/R4); November 1997.

Kaufmann, J.H, 1982. Raccoons and Allies. In: Chapman, J.A. and Feldhamer, G.A. (eds). Wild Mammals of North America: Biology, Management, Economics. John Hopkins University Press, Baltimore, MD. Pps. 567-585.

MacDonald, D.D., C.G. Ingersoll, &T.A. Berger, 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20-31.

MACTEC, 2004. Phase II Focused Environmental Risk Characterization Report, East Ditch and Downstream Areas, 51 Eames St., Wilmington, MA. RTN 3-0471.

MACTEC, 2007. Draft Focused Remedial Investigation Report, Olin Chemical Superfund Site, Wilmington, Massachusetts. October, 2007.

MassDEP, 2007. Sediment Toxicity of Petroleum Hydrocarbon Fractions. Office of Research and Standards. September, 2007.

Menzie, C.M., M. Henning, J. Cura, K. Finklestein, J. Gentile, J. Maughn, D. Mitchell, S. Petron, B. Potocki, S. Svirsky, and P. Tyler, 1997. A weight-of-evidence approach for evaluating ecological risks: report of the Massachusetts Weight-of-Evidence Work Group. *Human and Ecological Risk Assessment* 2(2): 277-304.

Morrison, P. R., M. Pierce and F.A. Ryser, 1957. Food Consumption and Body Weight in the Masked and Short-tailed Shrews (genus Blarina) in Kansas, Iowa, and Missouri. *Annals of the Carnegie Museum* 51: 157-180 *cited in* USEPA, 1993.

Persaud, D., R. Jaagumagi, and A. Hayton, 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto. *Cited in* Jones, Suter and Hull, 1997.

REACH, 2014. European Chemicals Registry – Information on Registered substances. Available at http://echa.europa.eu/web/guest/information-onchemicals/registered-substances). Accessed January 2014.

Sample, *et al.*, 1998a. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation; U.S. Department of Energy; Oak Ridge National Laboratories, BJC/OR-112; August 1998.

Sample *et al.*, 1998b. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridg)e Reservation; U.S. Department of Energy; Oak Ridge National Laboratories, BJC/OR-112; August 1998.

Sample, B.E., D.M. Opresko, & G.W. Suter II, 1997. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for U.S. Department of Energy. ES/ER/TM-86/R3. June 1997. Values are for Short-tailed Shrew (*Blarina* sp.).

Science Advisory Board for Contaminated Sites in British Columbia (SABCS). 2010. Guidance for a Weight-of-Evidence Approach in Conducting Detailed Ecological Risk Assessments (DERA) in British Columbia. Submitted to BC Ministry of the Environment, October.

Suter, G.W, & C.L. Tsao, 1997.Oak Ridge National Laboratory Tier II Secondary Chronic Values. Cited in Buchman, 2008, Screening Quick Reference Tables (SQuiRTs from NOAA).

Suter, G.W., 1993. *Ecological Risk Assessment*. Lewis Publishers. Ann Arbor, Michigan.

Texas Natural Resource Conservation Commission (TNRCC), 2000. Texas Natural Resource Conservation Commission Texas Surface Water Quality Standards. 30 TAC Chapter 307. Effective August 17, 2000.

United Nations Environmental Programme (UNEP), 2001. Stockholm Convention on Persistent Organic Pollutants. May 22, 2001.

USEPA, 2013a. Ecological Soil Screening Levels (Eco-SSL) Guidance and Documents Webpage: http://www.epa.gov/oswer/riskassessment/ecorisk/ecossl.htm

USEPA, 2013b. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

USEPA, 2012. Ecological Structure Activity Relationship Model. Microsoft Windows version 1.11. March, 2012. Available at: http://www.epa.gov/oppt/newchems/tools/21ecosar.htm

USEPA, 2011. Software for Calculating Upper Confidence Limits. ProUCL Version 4.00.1. Technical Support Center for Monitoring and Site Characterization.

USEPA, 2010. Persistent, Bio-accumulating, and Toxic, Profiler v.1.301.

USEPA, 2009. Draft 2009 Update of Aquatic Life Ambient Water Quality Criteria for Ammonia – Freshwater. EPA-822-D-09-001. December, 2009.

USEPA, 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics. EPA/600/R-02/016. March 2008.

USEPA, 2007a. Statement of Work (SOW), RI/FS, Olin Chemical Superfund Site (Site), prepared by the United States Environmental Protection Agency (USEPA) Region I – New England and dated June 2007.

USEPA, 2007b. USEPA Region 3 BTAG Screening Benchmarks for Freshwater and Sediment. July, 2006.

USEPA, 2003. USEPA Region 5 RCRA Ecological Screening Levels. August 22, 2003 (http://www.epa.gov/reg5rcra/ca/ESL.pdf)

USEPA, 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA/600/R-02/013. November 2003.

USEPA, 2003. USEPA Region 5 RCRA Ecological Screening Levels. August 22, 2003.

USEPA, 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. Office of Solid Waste and Emergency Response/Office of Solid Waste and Remedial Response. OSWER 9285.6-10. December 2002.

USEPA, 2001a. The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update.

USEPA, 2001b. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. 2001.

USEPA, 1999a. 1999 Update of Ambient Water Quality Criteria for Ammonia. EPA-822-R-99-014. December 1999.

USEPA, 1999b. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Facilities Peer Review Draft, November 1999. Appendix C: Media to Receptor Bioconcentration Factors.

USEPA, 1998. Guidelines for Ecological Risk Assessment. Office of Research and Development.EPA-630-R-95-002F. April, 1998.

USEPA, 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-007. June 1997.

USEPA, 1996. Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod *Hyalella Azteca and* the Midge *Chironomus Riparius*. Great Lakes National Program Office. EPA-905-R96-08. September, 1996.

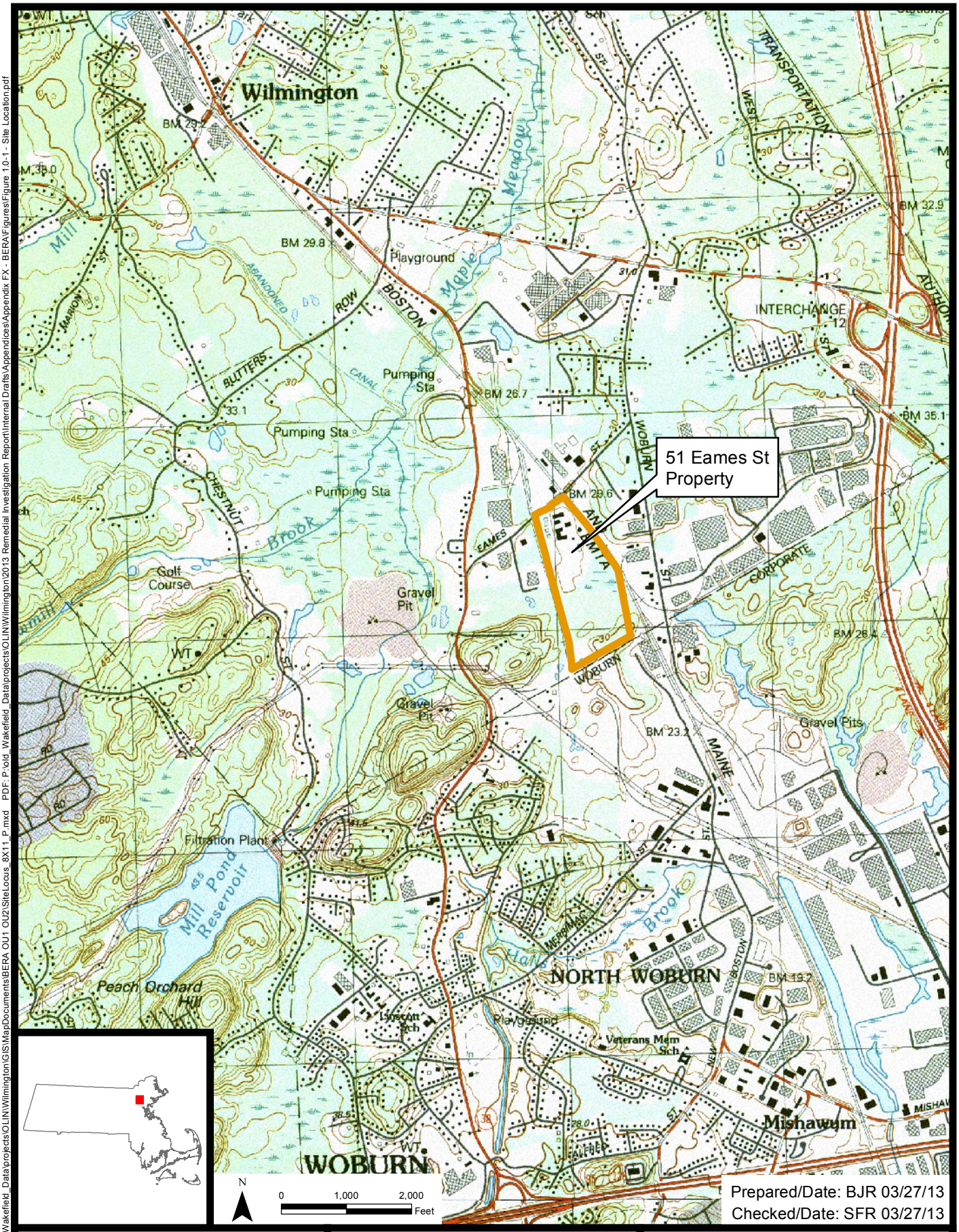
USEPA, 1993. Wildlife Exposure Factors Handbook. EPA/600/R-93/187. December, 1993.

USEPA, 1992. Framework for Ecological Risk Assessment. EPA-630-R-92-001. February, 1992.

USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS), Volume II: Environmental Evaluation Manual. 1989.

Weller, M.W, 1981. *Freshwater Marshes Ecology and Wildlife Management.* University of Minnesota Press. Minneapolis.

FIGURES



Prepared/Date: BJR 03/27/13
Checked/Date: SFR 03/27/13

Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, MA

amec

Figure 1.0-1
Site Locus

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Former Office Building
Guard Shack
Former Lab
Butler Building
Former Plant B Tank Farm
Pilot Lab
Plant B Production Area
EPH/VPH Area
Boston and Maine Railroad
Plant A
Plant B Treatment Bldg.
Maintenance Shop
Finished Product Storage
Boiler House
Plant C-1
Plant C-2
Plant C-3
Stockroom
MBTA Rail Line
Plant D Tank Farm
Plant D
West Pit
East Pit
Drum Storage Area
Lake Poly
West Ditch Wetland
East Ditch
East Warehouse
West Warehouse
Former Wastewater Treatment Plant
Plant B Discharge
Buried Debris Area
Acid Pits
Drum Area A
Lined Lagoon I
Drum Area B
On-Property West Ditch
Lined Lagoon II
Central Wetland
Off-Property West Ditch
Central Pond
Delta
Central Pond Drainage Areas
Detention Basin
South Ditch
Off-Property South Ditch
Weir
Conservation Easement
Ephemeral Drainage
Biocell
Calcium Sulfate Landfill
Town of Wilmington
City of Woburn

Legend

- Town Line
- Drain/Sewer Line
- Fence
- Trail
- Paved Road
- Unpaved Road
- Railroad
- Structure
- Surface Water
- Wetland Boundary
- 51 Eames St Property Boundary
- Containment Structure

AMEC Environment & Infrastructure
2 Robbins Rd
Westford, MA 01886

N

0 100 200 400 Feet

Figure 3.2-1
OU1 Site Features (Current and Historic)
Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 03/27/13 | Checked/Date: SFR 03/27/13

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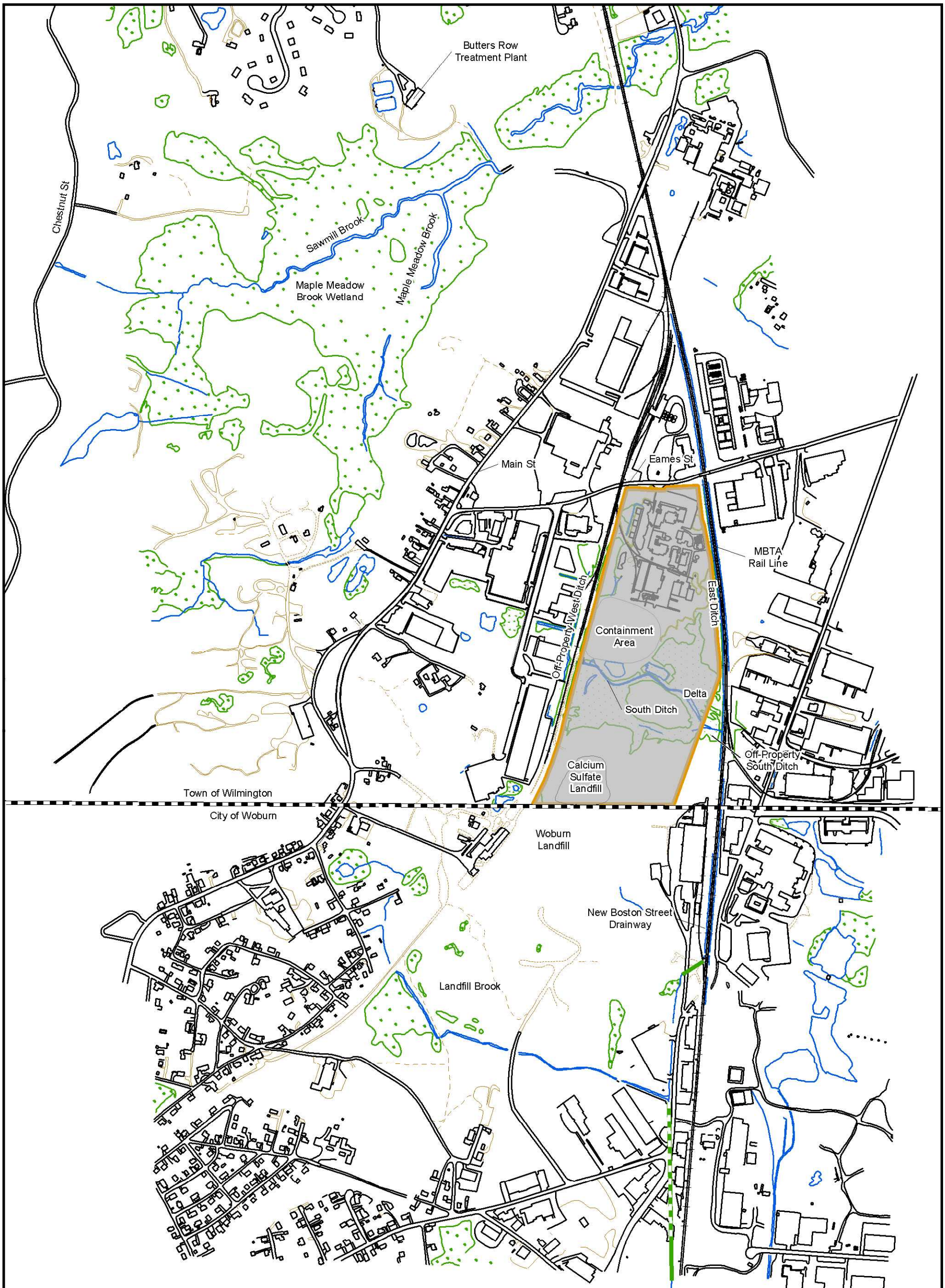

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SS-400
AREA-4
SS-402
EA2
SB-406
SB-413
SS-406
SB-435
AREA-3
SS-411
SB-509
LPB-40
SB-453
WDW-C34
EA2-01
SS-415
SB-519
SB-518
SB-521
SWMU-27
BD-C22
SB-522
OSFILL-1220
EA1
EA3
SS-414
Containment Area
SS-418
SS-510
SB-473
DB-C1
AREA-9
A8CW-1-W
A8CW-1-N
SS-427
OSFILL-600
A8CW-1-E
A8CW-1-S
SS-511
A8CW-3
A8CW-4
OSFILL-550
OSFILL-530
A9CW-1
A8CW-2
SS-432
OSFILL-460
SD-C1
CPDA-8
SS-512
SD-C43B
OSFILL-400
SS-513
SD-C2
CPDA-5
SD-C1B
A9CW-2
SD-C42B
BS018
CP-C78
CP-TP15
SS-514
AREA-1-6
SD-C40B
CP-TP19
A9CW-(COMP)
SS-515
SD-C54S
SS-517
SD-C53N
AREA-8-3
BS045
SD-C51N
SD-C52N
SD-C21B
CP-TP8
AREA-8-2
BS020
SD-C50N
SD-C20B
SS-519
SD-C48N
SD-C29B
SD-C19B
A9CW-3
SS-520
EA4
SD-C18B
SD-C6
BS019
BS044
BS015
SD-C30B
SD-C17B
SS-518
SDF-6
SD-C48S
SD-C49N
SD-C16B
SD-C13
SD-C9
SD-C15
A9CW-4
SWMU-33-102
SWMU-33-103
SS-434
SD-C7
SD-C14
SS-516
SD-C10
SS-522
SWMU-33
SS-521
BS043
SWMU-33-101
SDF-5
BS016
SS-435
BS042
SS-523
SS-449
SS-436
SDF-4
EA5
SDF-3
SOLSD04
SOLSD09
SS-437
SOLSD01
SOLSD10
BS041
SS-524
SOLSD03
SS-433
SOLSD05
SOLSD08
SOLSD12
SS-450
SOLSD02
SOLSD16
SOLSD07
SS-439
SS-440
BS040
SOLSD15
SOLSD06
SB-527
SS-441
SS-451
SDF-1
SOLSD14
SS-443
SS-442
SB-528
SS-445
SOLSD11
SOLSD13
SOLSD19
SS-453
SS-444
SOLSD18
SDF-2
SS-446
SOLSD17
SS-447
SOLSD21
SOLSD20
SOLSD22
SOLSD23
SS-454
SS-456
SS-457
Background
SS-455
SS-458
Calcium Sulfate Landfill
SS-459
SS-460
SS-461

Legend

- Surface Soil Sample
- Exposure Area
- Culvert
- 51 Eames St. Property Boundary
- Water
- Railroad
- Paved Road
- Unpaved Road
- Wetland Boundary

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Westford, MA 01886

N

0 80 160
Feet

Figure 3.5-1 - Surface Soil Samples and Terrestrial Exposure Areas
Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: JDP 03/29/13 | Checked/Date: SFR 03/29/13

Document: P:\old_Wakefield_Data\projects\OLIN\Wilmington\GIS\MapDocuments\BERA OU1 OU2\BERA_22X34_P_rotated.mxd PDF: P:\old_Wakefield_Data\projects\OLIN\Wilmington\2013 Remedial Investigation Report\Internal Drafts\Appendices\Appendix FX - BERA\Figures\Figure 3.5-1 - Surface Soil Samples and Terrestrial Exposure Areas.pdf 3/29/2013 1:18 AM jonathan.penney

On Property West Ditch/ West Ditch Wetland
RSD-01
WDW-26
RSD-02
WDW-24
WDW-25
WDW-22
WDW-23
WDW-21A
WDW-21B
WDW-20
WDW-19
WDW-17
WDW-16
SD-SD1
On Property West Ditch/ West Ditch Wetland
WDW-14
WDW-13
WDW-12
WDW-11
OPWD-2
Off Property West Ditch
OPWD-1
OPWD-SD-S
ISCO1
PZ-18R
SD-SD2
SD-504
SD-17
Detention Basin
PZ-17RR
SD-503
SD-SD4
SD-502
Central Pond
PZ-16RR
SD-501
SD-SD3
Upper South Ditch
SDSW-E
SD-SD5
Lower South Ditch
SD-1
BS032
BS031
BS030
ISCO2

Legend

- Off Property West Ditch Sediment Sample
- Central Pond Sediment Sample
- Detention Basin Sediment Sample
- Lower South Ditch Sediment Sample
- West Ditch Wetland Sediment Sample
- Upper South Ditch Sediment Sample
- Surface Water Sample Location
- Culvert
- 51 Eames St. Property Boundary
- Water
- Railroad
- Paved Road
- Unpaved Road
- Wetland Boundary

AMEC Environment & Infrastructure
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Westford, MA 01886

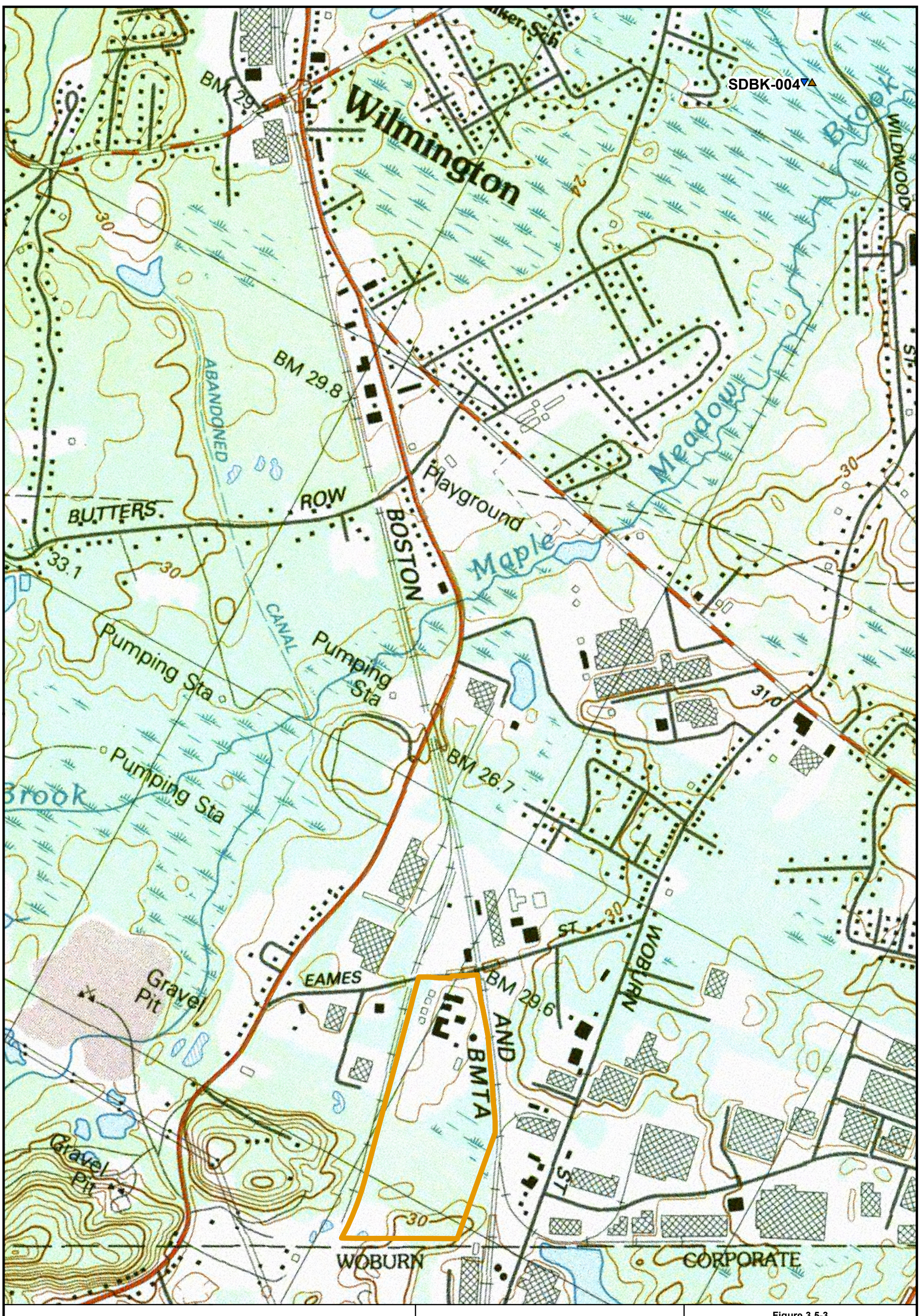
N

0 80 160
Feet

Figure 3.5-2
Surface Water and Sediment Samples and Aquatic Exposure Areas
Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 07/23/15 | Checked/Date: CTM 07/23/15

Document: P:\old_Wakefield_Data\projects\OLIN\Wilmington\GIS\MapDocuments\BERA OU1 OU2\BERA_22X34_P_rotated.mxd PDF: P:\old_Wakefield_Data\projects\OLIN\Wilmington\2013 Remedial Investigation Report\Revised_OU1_OU2_RI\Figures\Figure ES-5 - BERA Exposure Areas.pdf 4/2/2014 3:58 PM brian.roden



Legend

- Background Surface Water Sample Location
- Background Sediment Sample Location
- 51 Eames St. Property Boundary

AMEC Environment & Infrastructure
2 Robbins Rd
Westford, MA 01886

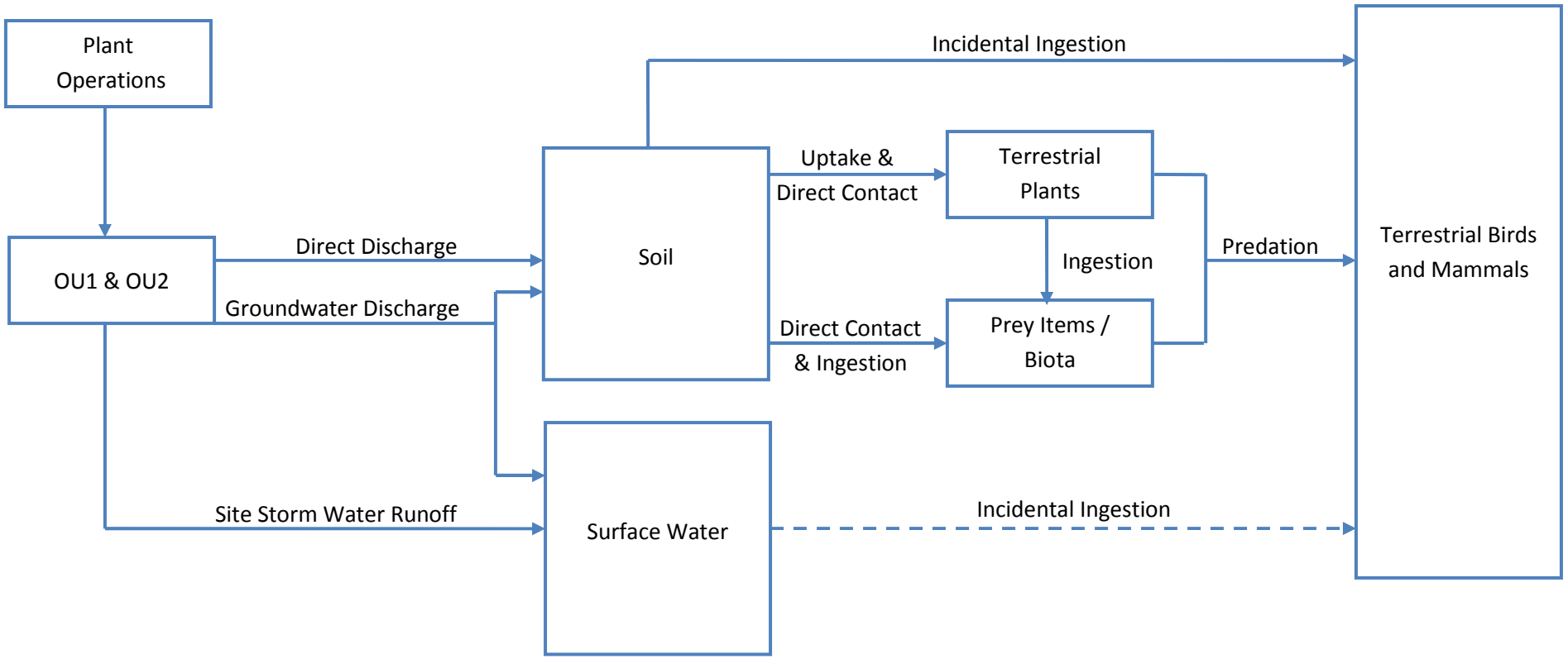
N

0 400 800 1,600 Feet

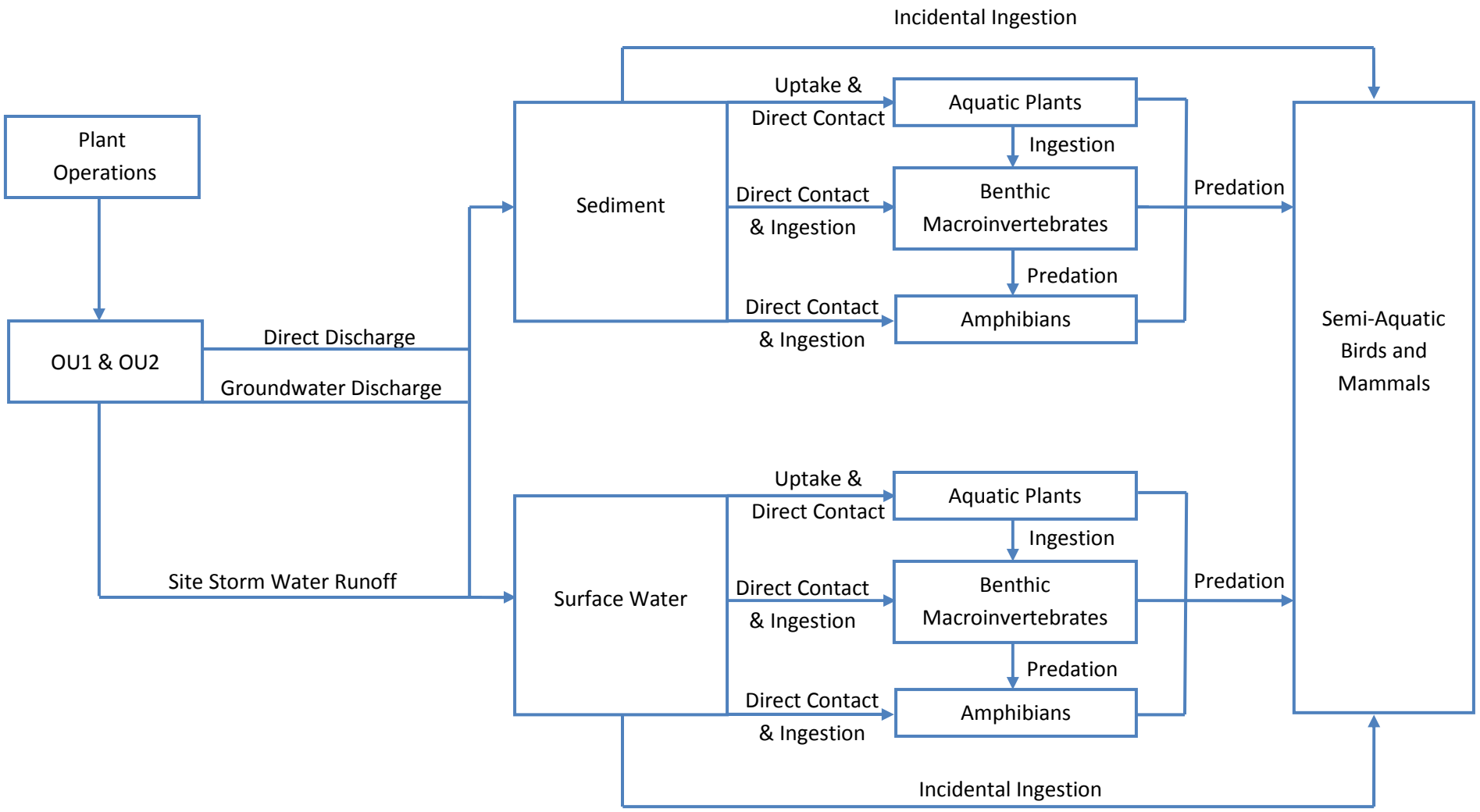
Figure 3.5-3
Background Surface Water and Sediment Samples
Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 07/18/13 | Checked/Date: SFR 07/18/13

Document: P:Wilmington\GIS\MapDocuments\BERA OU1 OU2\BERA_11X17_P_rotated.mxd PDF: P:\old_Wakefield_Data\projects\OLIN\Wilmington\2013 Remedial Investigation Report\Internal Drafts\Appendices\Appendix FX - BERA\Figures\Figure 3.5-3 Background Surface Water and Sediment Samples.pdf



Legend		
Complete Pathway Negligible Pathway	amec	**Figure 3.10-1** **Terrestrial Ecological Conceptual Site Model** **Baseline Ecological Risk Assessment** **Olin Chemical Superfund Site** **Wilmington, Massachusetts**
		Prepared by: SFR 3/19/2013 — Checked by: TR 3/29/2013



Legend

Complete Pathway

Figure 3.10-2
Aquatic Ecological Conceptual Site Model
Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 3/19/2013	Checked by: TR 3/29/2013

TABLES

Table 3.5-1
Wildlife in OU1 and OU2 Exposure Areas
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Species Present [a]		Exposure Areas								
		Terrestrial			Aquatic [c]					
Common Name	Scientific Name	EA2	EA4	EA5	Upper South Ditch	Lower South Ditch	Storm Water Detention Basin	Central Pond	On-PWD / WDW	Off-PWD
Mammals										
coyote	*Canis latrans*	X	X	X						
eastern cottontail	*Sylvilagus floridanus*	X	X	X						
meadow voles	*Microtus pensylvanicus*	X	X	X						
mice	*Peromyscus leucopus*	X	X	X						
muskrat	*Ondatra zibethicus*				X	X	X	X	X	X
raccoon	*Procyon lotor*	X	X	X	X	X	X	X	X	X
red fox	*Vulpes vulpes*	X	X	X						
shrews	*Blarina brevicauda*	X	X	X						
squirrel	*Sciurus carolinensis*	X	X	X						
white-tailed deer	*Odocoileus virginianus*	X	X	X						
wild turkey	*Meleagris gallopavo*	X	X	X						
woodchuck	*Marmota monax*	X	X	X						
Birds										
American kestrel	*Falco sparverius.*	X	X	X						
American robin	*Turdus migratorius*	X	X	X						
American woodcock	*Scolopax minor*	X	X	X						
blue jay	*Cyanocitta cristata*	X	X	X						
Canada goose	*Branta canadensis*				X	X	X	X	X	X
cardinal	*Cardinalis cardinalis*	X	X	X						
cat bird	*Dumetella carolinensis*	X	X	X						
chickadee	*Poecile atricapillus*	X	X	X						
crow	*Corvus brachyrhynchos*	X	X	X						
downy woodpecker	*Picoides pubescens*	X	X	X						
goldfinch	*Carduelis tristis*	X	X	X						
great blue heron	*Ardea herodias*				X	X	X	X	X	X
house finch	*Carpodacus mexicanus*	X	X	X						
junco	*Junco hyemalis*	X	X	X						
killdeer	*Charadrius vociferus*				X	X	X	X	X	X
mallard duck	*Anas platyrhynchos*				X	X	X	X	X	X
mocking bird	*Mimus polyglottos*	X	X	X						
mourning dove	*Zenaida maroura*	X	X	X						
osprey	*Pandion haliaetus*				X	X	X	X	X	X
red-tailed hawk	*Buteo jamaicensis*	X	X	X						
red-wing black bird	*Agelaius phoeniceus*				X	X	X	X	X	X
sharp-shinned hawk	*Accipiter striatus*	X	X	X						
sparrow	*Spizella sp.*	X	X	X						

Table 3.5-1
Wildlife in OU1 and OU2 Exposure Areas
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Species Present [a]		Exposure Areas								
		Terrestrial			Aquatic [c]					
Common Name	Scientific Name	EA2	EA4	EA5	Upper South Ditch	Lower South Ditch	Storm Water Detention Basin	Central Pond	On-PWD / WDW	Off-PWD
white egret	*Ardea alba*				X	X	X	X	X	X
Frogs [b]					X	X	X	X	X	X
Invertebrates [b]					X	X	X	X	X	X

Prepared by: SFR 3/28/2013
Checked by: EYM 3/28/2013

Notes:
[a] Species listed are those observed on the Property during weekly weir inspections conducted from January 2008 to January 2013.
[b] Frogs and invertebrates observed were not indentified to the species level.
[c] Aquatic exposure areas MMB Wetland, Landfill Brook and North Pond are not included on the table as observations of these areas were not included in the weekly weir inspections.
[d] No fish have ever been observed in the upper south ditch, lower south ditch, storm water detention basin, central pond, on-PWD/WDW, or Off-PWD.

Table 3.8-1
Exposure Pathways and Receptors Evaluated by Exposure Area
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Exposure Areas [a]	Exposure Pathways / Media / Receptors	Root Uptake	Ingestion				
		Soil	Surface Water	Sediment	Soil	Plants	Prey
Terrestrial Exposure Areas: EA-2, EA-4, & EA-5	Terrestrial Plant Communities	X					
	Soil Invertebrate Communities				X		
	Terrestrial Bird Populations						
	American Robin				X	X	X
	Red-tailed Hawk				X		X
	Terrestrial Mammal Populations						
	Short-tailed Shrew				X	X	X
	Red Fox				X		X
Aquatic Exposure Areas: Central Pond, Storm Water Detention Basin, On-PWD/WDW, Off-PWD, MMB Wetland, Landfill Brook, North Pond	Benthic Macroinvertebrate Communities		X	X			
	Amphibian Populations		X	X			
	Semi-aquatic Bird Populations						
	Marsh Wren		X	X			X
	Green Heron		X	X			X
	Semi-aquatic Mammal Populations						
	Muskrat		X	X		X	
	Raccoon		X	X			X

Prepared by: SFR 7/7/2013
Checked by: EYM 7/8/2013

Notes:
[a] All terrestial and aquatic exposure areas are evaluated for the same sets of receptors.
X - Indicates a complete exposure pathway for a receptor.

Table 3.9-1
Decision Rules for Attribute Scores
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Decision Rules for Attribute Scores Used to Weight LOEs				
		Low		Medium		High
		1	2	3	4	5
Strength of Association	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	Biological processes link the LOE to the assessment endpoint only indirectly, yielding a weak association between the assessment endpoint and LOE.	Biological processes directly link the LOE to the assessment endpoint and LOE, but the specific effect, target organ, and mechanism of action evaluated are not the same.	LOE and assessment endpoint are directly linked and the adverse effect, target organ, and mechanism of action are the same for LOE and assessment endpoint, but the levels of ecological organization differ.	LOE and assessment endpoint are directly linked and the adverse effect, target organ, and mechanism of action are the same for LOE and assessment endpoint, and the levels of ecological organization are the same.	Assessment endpoint is directly measured and is equivalent to the LOE.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	LOE can detect only extreme responses, and certainty in observed responses is low; Only one or two of the following factors is derived from or reflects the site: data, media, species, environmental conditions, benchmark, habitat type.	LOE can detect large changes, but with a low degree of confidence; Three of the six factors listed to left are derived from or reflect the site.	LOE can detect large changes with a high degree of confidence, and moderate changes with a low degree of confidence; Four of the six factors listed to left are derived from or reflect the site .	LOE can detect moderate changes with a high degree of confidence, and small changes with a low degree of confidence; Five of the six factors listed to left are derived from or reflect the site.	LOE can detect small changes with a high degree of confidence; All six factors listed to left are derived from or reflect the site (i.e., both data and benchmark reflect site conditions).

Table 3.9-1
Decision Rules for Attribute Scores
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Decision Rules for Attribute Scores Used to Weight LOEs				
		Low		Medium		High
		1	2	3	4	5
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	Three or more DQOs are not met OR DQOs barely meet the needs of the risk assessment OR There is no documentation of the reason for not meeting DQO and the impact on the assessment; Method has never been published AND methodology is not an impact assessment, field survey, toxicity test, benchmark approach, toxicity quotient, or tissue residue analysis.	Two or more DQOs are not met AND DQOs satisfy the needs of the risk assessment AND Reason for not meeting DQOs and the impact on the assessment are documented satisfactorily; Method is one of six listed methodologies, but the particular application is neither published nor standardized.	One DQO is not met AND DQOs satisfy the needs of the risk assessment AND Reason for not meeting DQOs and the impact on the assessment are clearly stated; A standard method exists, but its suitability for this purpose is questionable, and it must be modified to be applicable to site-specific conditions .	One DQO is not met AND DQOs are rigorous and comprehensive AND Reason for not meeting DQOs and the impact on the assessment are clearly stated; A standard method exists and it is directly applicable to the LOE, but it was not developed precisely for this purpose and requires slight modification OR the methodology is used in two peer-reviewed studies.	All DQOs are met AND DQOs are rigorous and comprehensive; A standard method exists and is directly applicable to the LOE and it was developed precisely for this purpose and requires no modification OR the methodology is used in three or more peer reviewed studies.

Table 3.9-1
Decision Rules for Attribute Scores
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Decision Rules for Attribute Scores Used to Weight LOEs				
		Low		Medium		High
		1	2	3	4	5
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	The locations of two of the following factors overlap spatially only to a limited extent: (1) study area, (2) sampling / measurement site, (3) stressors, (4) receptors, and (5) points of potential exposure; Measurements are collected during a season different from when effects would be expected to be most clearly manifested, AND a single sampling or measurement event is conducted, AND high variability in that parameter is expected over time.	The locations of two of the following factors overlap spatially: (1) study area, (2) sampling / measurement site, (3) stressors, (4) receptors, and (5) points of potential exposure; Measurements are collected during a season different from when effects would be expected to be most clearly manifested, OR a single sampling or measurement event is conducted, AND high variability in that parameter is expected over time.	The locations of three of the following factors overlap spatially: (1) study area, (2) sampling / measurement site, (3) stressors, (4) receptors, and (5) points of potential exposure; Measurements are collected during the same period that effects would be expected to be most clearly manifested, AND a single sampling or measurement event is conducted, AND moderate variability in that parameter is expected over time.	The locations of four of the following factors overlap spatially: (1) study area, (2) sampling / measurement site, (3) stressors, (4) receptors, and (5) points of potential exposure; Measurements are collected during the same period that effects would be expected to be most clearly manifested, AND two sampling or measurement events are conducted, AND moderate variability in that parameter is expected over time.	The locations of five of the following factors overlap spatially: (1) study area, (2) sampling / measurement site, (3) stressors, (4) receptors, and (5) points of potential exposure; Measurements are collected during the same period that effects would be expected to be most clearly manifested, AND EITHER two sampling events are conducted and variability is low OR multiple sampling events are conducted and variability is low OR multiple sampling events are conducted and variability is moderate to high over time.

Table 3.9-1
Decision Rules for Attribute Scores
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Decision Rules for Attribute Scores Used to Weight LOEs				
		Low		Medium		High
		1	2	3	4	5
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	LOE response to stressor has not been demonstrated in previous studies, but is expected to be based on demonstrated response to similar stressors; mechanistic linkage absent.	LOE response to stressor has been suggested in previous studies, but has not been definitely proven; mechanistic linkage absent.	LOE response to stressor has been demonstrated in previous studies, but response is not correlated with magnitude of exposure; mechanistic linkage equivocal.	LOE response is quantitatively correlated with magnitude of exposure, but correlation is not statistically significant (or data are insufficient to test for statistical relationships); mechanistic linkage inferred, but not definitive.	Statistically significant correlation is demonstrated; clear mechanistic linkage from exposure to response.

Prepared by: SFR 7/7/2013
Checked: EYM 7/8/2013

Notes:
Attributes and their descriptions and the decision rules used to score them are derived from Menzie *et. al.* (1997) as presented in SABCS (2010).

LOE - Line of Evidence

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoints	
		1A and 2A	
		Compare site bulk soil concentrations to soil effects benchmarks and to reference area conditions.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	2	There is a high level of uncertainty associated with the use of benchmarks. Benchmarks do not account for site-specific conditions which may affect the toxicity of chemical constituents in environmental media. Benchmarks tend to overestimate risk.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	1	There is a high level of uncertainty associated with the use of benchmarks. Benchmarks are generic and not specific to site receptors. Benchmarks are susceptible to confounding factors specific to the site.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	1	There is a high level of uncertainty associated with the use of benchmarks. Benchmarks are generally single data points and not derived from concentration response curves.
Average LOE Rank		2.5	
Inference Weight [b]		Low	

Notes:
[a] Score for 'Strength of Association' is double-weighted to account for its importance.
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Medium; 4 - <4.5 Medium/High; ≥ 4.5 = High.

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		3A	
		Compare estimated daily dose for omnivorous song bird species (American robin) based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published avian TRVs and compare to reference area conditions.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		4A	
		Compare estimated daily doses for omnivorous small mammal species (short-tailed shrew) based on ingestion of prey and incidental ingestion of soil in terrestrial Site exposure areas to published mammalian TRVs and to reference area conditions.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		5A	
		Compare estimated daily doses for carnivorous bird species (Red-tailed Hawk) based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published avian TRVs and compare to reference area conditions.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		6A	
		Compare estimated daily doses for carnivorous mammal species (Red Fox) based on ingestion of prey and incidental ingestion of soil in Site exposure areas to published mammal TRVs and compare to reference area conditions.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		7A and 8A	
		Compare site bulk sediment and surface water concentrations to sediment and surface water effects benchmarks.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	2	There is a high level of uncertainty associated with the use of benchmarks. Benchmarks do not account for site-specific conditions which may affect the toxicity of chemical constituents in environmental media. Benchmarks tend to overestimate risk.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	1	There is a high level of uncertainty associated with the use of benchmarks. Benchmarks are generic and not specific to site receptors. Benchmarks are susceptible to confounding factors specific to the site.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	1	There is a high level of uncertainty associated with the use of benchmarks. Benchmarks are generally single data points and not derived from concentration response curves.
Average LOE Rank		2.5	
Inference Weight [b]		Low	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		7B	
		Compare sediment toxicity test results for the South Ditch sample to corresponding sediment toxicity test results for reference samples.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Toxicity tests provide a direct measurement of sediment toxicity to aquatic invertebrates.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	Toxicity tests demonstrate risk under laboratory conditions but may not be extrapolated to field conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Sufficient samples collected to characterize South Ditch; toxicity tests conducted pursuant to USEPA guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Toxicity tests demonstrate risk under laboratory conditions but may not be extrapolated to field conditions.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		9A	
		Compare estimated daily doses for invertivorous bird species (Marsh Wren) based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		9B	
		Compare estimated daily doses for omnivorous bird species (Green Heron) based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published avian TRVs.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		10A	
		Compare estimated daily doses for semi-aquatic herbivorous mammal species (muskrat) based on ingestion of plants and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.9-2
Attribute Scoring of Measurement Endpoints
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Line Of Evidence (LOE) Attribute	Description of Attribute	Measurement Endpoint	
		10B	
		Compare estimated daily doses for semi-aquatic omnivorous mammal species (raccoon) based on ingestion of prey and incidental ingestion of sediment and surface water in Site aquatic exposure areas to published mammalian TRVs.	
		Score	Rationale
Strength of Association [a]	Site-specificity and relevance of LOE to assessment endpoint; linkage based on known biological processes; similarity of effect, mechanism of action, target organ, and level of ecological organization.	4	Food chain modeling incorporates site-specific exposure profiles.
Sensitivity	The degree to which the LOE can detect change above baseline or reference conditions; the degree to which the LOE is specific to certain stressors; the potential for confounding factors to affect interpretation.	3	There is a moderate level of uncertainty associated with the use of TRVs. TRVs are usually based on related test species. However, TRVs are often single data points and not derived from dose response curves and may not be representative of site specific conditions.
Data Quality and Study Design	Extent to which data quality objectives (DQOs) are met; quality of data; use of standard methods.	5	Numerous samples collected over years of field efforts following EPA Superfund guidance.
Representativeness	Spatial and temporal overlap among measurements or samples, stressors, and ecological receptors.	4	Sufficient geographical and temporal coverage to reasonably represent conditions at OU1 and OU2.
Correlation / Causation / Consistency	Ability of LOE to demonstrate effects from exposure to stressor and to correlate effects with degree of exposure.	4	Use of TRVs based on specific classes of receptors allows for ability to correlate effects with receptor specific exposures.
Average LOE Rank		4	
Inference Weight [b]		Medium / High	

Prepared by: SFR 7/7/2013
Checked by: EYM 7/8/2013

Notes:
[a] Score for 'Strength of Association' is double-weighted to acc
[b] Key to Inference Weight: LOE Rank <3 = Low; 3 - <4 = Me

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU1	Soil	EA2	AREA-3	AREA 03	7/9/1991	0 - 1 ft
			AREA-4	AREA 04	7/9/1991	0 - 1 ft
			BD-C22	1120-BD-C22	10/27/2000	0.6 - 0.6 ft
			LPB-40	LPB-40-OVR	12/10/2003	0 - 2.9 ft
			OSFILL-1220	1130-OSFILL-1220-RISK	11/15/2000	0.5 - 0.5 ft
			SB-406	OC-SB-406-0.0/1.0-XXX	9/17/2009	0 - 1 ft
			SB-413	OC-SB-413-0.0/1.0-XXX	9/17/2009	0 - 1 ft
			SB-435	OC-SB-435-0.0/1.0-XXX	9/17/2009	0 - 1 ft
			SB-453	OC-SB-453-0.0/1.0-XXX	9/17/2009	0 - 1 ft
			SS-400	OC-SS-400-0.0/1.0-XXX	9/14/2009	0 - 1 ft
			SS-402	OC-SS-402-0.0/1.0-XXX	9/14/2009	0 - 1 ft
			SS-406	OC-SS-406-0.0/1.0.-XXX	9/15/2009	0 - 1 ft
			SS-411	OC-SS-411-0.0/1.0-XXX	9/15/2009	0 - 1 ft
			SS-415	OC-SS-415-0.0/1.0-XXX	9/15/2009	0 - 1 ft
			SS101XX27-RISK	SS101XX27X	11/23/1998	0 - 2 ft
			SWMU-27-101	SS101XX27X	11/30/1998	0 - 2 ft
			WDW-C34	1140-WDW-C34	5/16/2001	0.6 - 0.6 ft
			SB-509	OC-SB-509-0.0/1.0-XXX	12/14/2012	0 - 1 ft
			SB-518	OC-SB-518-0.0/1.0-XXX	12/14/2012	0 - 1 ft
			SB-519	OC-SB-519-0.0/1.0-XXX	12/14/2012	0 - 1 ft
			SB-521	OC-SB-521-0.0/1.0-XXX	12/14/2012	0 - 1 ft
			SB-522	OC-SB-522-0.0/1.0-XXX	12/13/2012	0 - 1 ft
OU1	Soil	EA4	A8CW-1-E	1160-A8CW-1-E	11/9/2000	0 - 2 ft
			A8CW-1-N	1160-A8CW-1-N	11/9/2000	0 - 2 ft
			A8CW-1-S	1160-A8CW-1-S	11/9/2000	0 - 2 ft
			A8CW-1-W	1160-A8CW-1-W	11/9/2000	0 - 2 ft
			A8CW-2	A8CW-2	12/16/1996	0 - 1 ft
			A8CW-3	A8CW-3	12/16/1996	0 - 1 ft
			A8CW-4	A8CW-4	12/16/1996	0 - 1 ft
			A9CW-(COMP)	A9CW-(COMP)	12/16/1996	0 - 1 ft
			A9CW-1	A9CW-1	12/16/1996	0 - 1 ft
			A9CW-2	A9CW-2	12/16/1996	0 - 1 ft
			A9CW-3	A9CW-3	12/16/1996	0 - 1 ft
			A9CW-4	A9CW-4	12/16/1996	0 - 1 ft
			AREA-1-6	AREA 1-6	12/15/1996	0 - 1 ft
			AREA-8-2	AREA8-2	12/16/1996	0 - 1 ft
			AREA-8-3	AREA8-3	12/16/1996	0 - 1 ft
			AREA-9	AREA 09	7/9/1991	0 - 1 ft
			BS015	BS015SDX	1/21/1997	0 - 0 ft
			BS016	BS016SMD	1/21/1997	0 - 0 ft
			BS018	BS018PND	1/21/1997	0 - 0 ft
			BS019	BS019WMD	1/21/1997	0 - 0 ft
			BS020	BS020WMD	1/21/1997	0 - 0 ft
			BS041	BS041LSD	8/22/2005	0 - 0.5 ft
			BS042	BS042LSD	8/22/2005	0 - 0.5 ft
			BS043	BS043LSD	8/22/2005	0 - 0.5 ft
			BS044	BS044LSD	8/23/2005	0 - 0.5 ft
			BS045	BS045LSD	8/23/2005	0 - 0.5 ft
			CP-C78	1140-CP-C78	5/9/2001	0.9 - 0.9 ft
			CPDA-5	CPDA-5	12/16/1996	0 - 1 ft
			CPDA-8	CPDA-8	12/16/1996	0 - 1 ft
			CP-TP15	1010-CP-TP15	9/18/2001	0 - 2.25 ft
			CP-TP19	1010-CP-TP19	9/18/2001	0 - 2.25 ft
			CP-TP8	1010-CP-TP8	9/18/2001	0 - 2.25 ft
			DB-C1	97598-DB-C1	8/10/2000	0.7 - 0.7 ft
			RSD-09	RSD-09	1/19/2000	0 - 0 ft
			RSD-10	RSD-10	1/18/2000	0 - 0 ft
			OSFILL-400	1130-OSFILL-400	11/15/2000	0.5 - 0.5 ft
			OSFILL-460	1130-OSFILL-460	11/15/2000	0.5 - 0.5 ft
			OSFILL-530	1130-OSFILL-530	11/15/2000	0.5 - 0.5 ft
			OSFILL-550	1130-OSFILL-550	10/13/2000	0.5 - 0.5 ft
			OSFILL-600	1130-OSFILL-600	11/15/2000	0.5 - 0.5 ft
			SB-473	OC-SB-473-0.0/1.0-XXX	9/18/2009	0 - 1 ft
			SD-C1	1140-SD-C1	10/3/2000	0.5 - 0.5 ft

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU1	Soil	EA4	SD-C10	1140-SD-C10	10/11/2000	0.46 - 0.46 ft
		(continued)	SD-C13	1140-SD-C13	10/11/2000	0.46 - 0.46 ft
			SD-C14	1140-SD-C14	10/11/2000	0.54 - 0.54 ft
			SD-C15	1140-SD-C15	10/11/2000	0.49 - 0.49 ft
			SD-C16B	1140-SD-C16B	10/12/2000	0.21 - 0.21 ft
			SD-C17B	1140-SD-C17B	10/12/2000	0.47 - 0.47 ft
			SD-C18B	1140-SD-C18B	10/12/2000	0.03 - 0.03 ft
			SD-C19B	1140-SD-C19B	10/12/2000	0.11 - 0.11 ft
			SD-C1B	1140-SD-C1B	10/3/2000	0.5 - 0.5 ft
			SD-C2	1140-SD-C2	10/3/2000	0.5 - 0.5 ft
			SD-C20B	1140-SD-C20B	10/12/2000	0.51 - 0.51 ft
			SD-C21B	1140-SD-C21B	10/12/2000	0.27 - 0.27 ft
			SD-C29B	1140-SD-C29B	11/2/2000	0.48 - 0.48 ft
			SD-C30B	1140-SD-C30B	11/2/2000	0.48 - 0.48 ft
			SD-C40B	1140-SD-C40B	11/3/2000	0.48 - 0.48 ft
			SD-C42B	1140-SD-C42B	11/3/2000	0.38 - 0.38 ft
			SD-C43B	1140-SD-C43B	11/3/2000	0.65 - 0.65 ft
			SD-C48N	1140-SD-C48N	5/14/2001	0.26 - 0.76 ft
			SD-C48S	1140-SD-C48S	5/14/2001	0.66 - 1.16 ft
			SD-C49N	1140-SD-C49N	5/14/2001	0.04 - 0.46 ft
			SD-C50N	1140-SD-C50N	5/14/2001	0.06 - 0.56 ft
			SD-C51N	1140-SD-C51N	5/14/2001	0.56 - 1.06 ft
			SD-C52N	1140-SD-C52N	5/14/2001	0.56 - 1.06 ft
			SD-C53N	1140-SD-C53N	5/15/2001	0.63 - 1.13 ft
			SD-C54S	1140-SD-C54S	5/15/2001	0.53 - 1.03 ft
			SD-C6	1140-SD-C6	10/11/2000	0.48 - 0.48 ft
			SD-C7	1140-SD-C7	10/11/2000	0.49 - 0.49 ft
			SD-C9	1140-SD-C9	10/11/2000	0.5 - 0.5 ft
			SDF-3	1010-SED-SDF-3S	9/17/2001	0 - 0.5 ft
			SDF-4	1010-SED-SDF-4S	9/17/2001	0 - 0.5 ft
			SDF-5	1010-SED-SDF-5S	9/17/2001	0 - 0.5 ft
			SDF-6	1010-SED-SDF-6S	9/17/2001	0 - 0.5 ft
			SS-414	OC-SS-414-0.0/1.0-XXX	9/15/2009	0 - 1 ft
			SS-418	OC-SS-418-0.0/1.0-XXX	9/15/2009	0 - 1 ft
			SS-427	OC-SS-427-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-432	OC-SS-432-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-436	OC-SS-436-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-437	OC-SS-437-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-440	OC-SS-440-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-442	OC-SS-442-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-456	OC-SS-456-0.0/1.0-XXX	9/18/2009	0 - 1 ft
			SS-457	OC-SS-457-0.0/1.0-XXX	9/17/2009	0 - 1 ft
			SS-458	OC-SS-458-0.0/1.0-XXX	9/18/2009	0 - 1 ft
			SS-459	OC-SS-459-0.0/1.0-XXX	9/18/2009	0 - 1 ft
			SS-461	OC-SS-461-0.0/1.0-XXX	9/18/2009	0 - 1 ft
			SWMU-33	SWMU-33	7/30/1991	0 - 1 ft
			SWMU-33-101	SS101XX33X	11/23/1998	0 - 2 ft
			SWMU-33-101	SS101XX33X	11/30/1998	0 - 2 ft
			SWMU-33-102	SS102XX33X	11/23/1998	0 - 2 ft
			SWMU-33-102	SS102XX33X	11/30/1998	0 - 2 ft
			SWMU-33-103	SS103XX33X	11/23/1998	0 - 2 ft
			SWMU-33-103	SS103XX33X	11/30/1998	0 - 2 ft
			SS-510	OC-SS-510-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-511	OC-SS-511-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-512	OC-SS-512-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-513	OC-SS-513-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-514	OC-SS-514-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-515	OC-SS-515-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-516	OC-SS-516-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-517	OC-SS-517-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-518	OC-SS-518-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-519	OC-SS-519-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-520	OC-SS-520-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-521	OC-SS-521-0.0/1.0-XXX	12/4/2012	0 - 1 ft

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU1	Soil	EA4 (continued)	SS-522	OC-SS-522-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-523	OC-SS-523-0.0/1.0-XXX	12/4/2012	0 - 1 ft
			SS-524	OC-SS-524-0.0/1.0-XXX	12/5/2012	0 - 1 ft
			SS-525	OC-SS-525-0.0/1.0-XXX	12/5/2012	0 - 1 ft
OU1 & OU2 [a]	Surface Water	South Ditch	ISCO1	OC-ISCO-1	2/24/2009	
			PZ-16RR	OC-PZ-16RRSW	2/24/2009	
			PZ-17RR	OC-PZ-17RRSW	2/24/2009	
			PZ-18R	OC-PZ-18RSW	2/24/2009	
			SD-17	OC-SD-17	2/24/2009	
			ISCO1	OC-ISCO-1	5/12/2009	
			PZ-16RR	OC-PZ16RRSW	5/12/2009	
			PZ-17RR	OC-PZ17RRSW	5/12/2009	
			PZ-18R	OC-PZ18RSW	5/12/2009	
			SD-17	OC-SD17	5/12/2009	
			ISCO1	OC-ISCO-1	8/12/2009	
			PZ-16RR	OC-PZ-16RR	8/12/2009	
			PZ-17RR	OC-PZ-17RR	8/12/2009	
			PZ-18R	OC-PZ-18R	8/12/2009	
			SD-17	OC-SD-17	8/12/2009	
			PZ-18R	OC-SW-18R	11/12/2009	
			ISCO1	OC-SW-ISCO1	11/12/2009	
			PZ-16RR	OC-SW-PZ16RR	11/12/2009	
			PZ-17RR	OC-SW-PZ17RR	11/12/2009	
			SD-17	OC-SW-SD17	11/12/2009	
			ISCO1	OC-SW-ISCO-1-0.2	2/18/2010	
			PZ-16RR	OC-SW-PZ-16RR-0.2	2/18/2010	
			PZ-17RR	OC-SW-PZ-17RR-0.2	2/18/2010	
			PZ-18R	OC-SW-PZ-18R-0.2	2/18/2010	
			SD-17	OC-SW-SD-17-0.2	2/18/2010	
			ISCO1	OC-SW-ISCO1	6/9/2010	
			PZ-16RR	OC-SW-PZ-16RR	6/9/2010	
			PZ-17RR	OC-SW-PZ-17RR	6/9/2010	
			PZ-18R	OC-SW-PZ-18R	6/9/2010	
			SD-17	OC-SW-SD-17	6/9/2010	
			ISCO1	OC-ISCO 1	9/1/2010	
			PZ-16RR	OC-PZ 16 RR SW	9/1/2010	
			PZ-17RR	OC-PZ 17 RR SW	9/1/2010	
			PZ-18R	OC-PZ 18 R SW	9/1/2010	
			SD-17	OC-SD17SW	9/9/2010	
			ISCO1	OC-SW-ISCO1	11/15/2010	
			PZ-16RR	OC-SW-PZ-16RR	11/15/2010	
			PZ-17RR	OC-SW-PZ-17RR	11/15/2010	
			PZ-18R	OC-SW-PZ-18R	11/15/2010	
			SD-17	OC-SW-SD-17	11/15/2010	
			PZ-16RR	OC-SW-PZ-16RR-XXX	12/9/2010	
			SD-1	OC-SW-SD-1-XXX	12/9/2010	
			ISCO1	OC-SW-ISCO-1-XXX	12/10/2010	
			PZ-17RR	OC-SW-PZ-17RR-XXX	12/10/2010	
			ISCO1	OC-SW-ISCO1	3/22/2011	
			PZ-16RR	OC-SW-PZ-16RRSW	3/22/2011	
			PZ-17RR	OC-SW-PZ-17RRSW	3/22/2011	
			PZ-18R	OC-SW-PZ-18RSW	3/22/2011	
			SD-17	OC-SW-SD-17	3/22/2011	
			ISCO1	OC-SW-ISCO1	5/16/2011	
			PZ-16RR	OC-SW-PZ-16RRSW	5/16/2011	
			PZ-17RR	OC-SW-PZ-17RRSW	5/16/2011	
			PZ-18R	OC-SW-PZ-18RSW	5/16/2011	
			SD-17	OC-SW-SD-17	5/16/2011	
			ISCO1	OC-SW-ISCO-1-XXX	6/6/2011	
			ISCO2	OC-SW-ISCO-2-XXX	6/6/2011	
			PZ-16RR	OC-SW-PZ-16RR-XXX	6/6/2011	
			PZ-17RR	OC-SW-PZ-17RR-XXX	6/6/2011	
			SD-1	OC-SW-SD-1-XXX	6/6/2011	
			ISCO1	OC-SW-ISCO1	8/23/2011	

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU1 & OU2 [a]	Surface Water	South Ditch (continued)	PZ-16RR	OC-SW-PZ-16RRSW	8/23/2011	
			PZ-17RR	OC-SW-PZ-17RRSW	8/23/2011	
			PZ-18R	OC-SW-PZ-18RSW	8/23/2011	
			SD-17	OC-SW-SD-17	8/23/2011	
			ISCO1	OC-SW-ISCO1	11/8/2011	
			PZ-16RR	OC-SW-PZ16RR	11/8/2011	
			PZ-17RR	OC-SW-PZ17RR	11/8/2011	
			PZ-18R	OC-SW-PZ18R	11/8/2011	
			SD-17	OC-SW-SD17	11/8/2011	
			ISCO1	OC-ISCO1-SW	2/23/2012	
			PZ-16RR	OC-SW-PZ16RR-SW	2/23/2012	
			PZ-17RR	OC-SW-PZ-17RR-SW	2/23/2012	
			PZ-18R	OC-PZ18R-SW	2/23/2012	
			SD-17	OC-SD-17-SW	2/23/2012	
			ISCO1	OC-SW-ISCO1	6/7/2012	
			PZ-16RR	OC-SW-PZ-16RRSW	6/7/2012	
			PZ-17RR	OC-SW-PZ-17RRSW	6/7/2012	
			PZ-18R	OC-SW-PZ-18RSW	6/7/2012	
			SD-17	OC-SW-SD-17	6/7/2012	
			ISCO1	OC-SW-ISCO1	8/23/2012	
			PZ-16RR	OC-SW-PZ-16RRSW	8/23/2012	
			PZ-17RR	OC-SW-PZ-17RRSW	8/23/2012	
			PZ-18R	OC-SW-PZ-18RSW	8/23/2012	
			SD-17	OC-SW-SD-17	8/23/2012	
			ISCO1	OC-SW-ISCO1	11/16/2012	
			PZ-16RR	OC-SW-PZ-16RRSW	11/16/2012	
			PZ-17RR	OC-SW-PZ-17RRSW	11/16/2012	
			PZ-18R	OC-SW-PZ-18RSW	11/16/2012	
			SD-17	OC-SW-SD-17	11/16/2012	
			PZ-17RR	OC-SW-PZ-17RR-XXX	12/17/2012	
			SD-1	OC-SW-SD-1-XXX	12/17/2012	
			ISCO1	OC-ISCO1	3/21/2013	
			PZ-16RR	OC-PZ-16RRSW	3/21/2013	
			PZ-17RR	OC-PZ-17RRSW	3/21/2013	
			PZ-18R	OC-PZ-18RSW	3/21/2013	
			SD-17	OC-SD-17 SW	3/21/2013	
			ISCO2	OC-ISCO-2	2/24/2009	
			ISCO2	OC-ISCO-2	5/12/2009	
			ISCO2	OC-ISCO-2	8/12/2009	
			ISCO2	OC-SW-ISCO2	11/12/2009	
			ISCO2	OC-SW-ISCO-2-0.2	2/18/2010	
			ISCO2	OC-SW-ISCO2	6/9/2010	
			ISCO2	OC-ISCO 2	9/1/2010	
			ISCO2	OC-SW-ISCO2	11/15/2010	
			ISCO2	OC-SW-ISCO-2-XXX	12/9/2010	
			ISCO2	OC-SW-ISCO2	3/22/2011	
			ISCO2	OC-SW-ISCO2	5/16/2011	
			ISCO2	OC-SW-ISCO2	8/23/2011	
			ISCO2	OC-SW-ISCO2	11/8/2011	
			ISCO2	OC-ISCO2-SW	2/23/2012	
			ISCO2	OC-SW-ISCO2	6/7/2012	
			ISCO2	OC-SW-ISCO2	8/23/2012	
			ISCO2	OC-SW-ISCO2	11/16/2012	
			ISCO2	OC-ISCO2	3/21/2013	
			ISCO1	OC-ISCO1	5/13/2013	
			ISCO1	OC-ISCO1	8/22/2013	
			ISCO1	OC-ISCO1	11/21/2013	
			PZ-16RR	OC-PZ-16RRSW	5/13/2013	
			PZ-16RR	OC-PZ-16RRSW	8/22/2013	
			PZ-16RR	OC-PZ-16RRSW	11/21/2013	
			PZ-17RR	OC-PZ-17RRSW	5/13/2013	
			PZ-17RR	OC-PZ-17RRSW	11/21/2013	
			PZ-17RRR	OC-PZ-17RRRSW	8/22/2013	
			PZ-18R	OC-PZ-18RSW-RISK	5/13/2013	

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU1 & OU2 [a]	Surface Water	South Ditch (continued)	PZ-18R	OC-PZ-18RSW	8/22/2013	
			PZ-18R	OC-PZ-18RSW-RISK	11/21/2013	
			SD-17	OC-SD-17	5/13/2013	
			SD-17	OC-SD-17	8/22/2013	
			SD-17	OC-SD-17	11/21/2013	
			ISCO2	OC-ISCO2	5/13/2013	
			ISCO2	OC-ISCO2	8/22/2013	
			ISCO2	OC-ISCO2	11/21/2013	
OU1	Surface Water	Central Pond	SD-501	OC-SW-SD-501-XXX	12/17/2012	
		Storm Water Detention Basin	SD-503	OC-SW-SD-503-XXX	12/17/2012	
OU1	Sediment	On Property West Ditch and West Ditch Wetland	WDW-12	1120-WDW-12S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-13	1120-WDW-13S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-14	1120-WDW-14S (0-6)	8/31/2000	0 - 0.5 ft
			WDW-16	1120-WDW-16S (0-6)	8/31/2000	0 - 0.5 ft
			WDW-17	1120-WDW-17S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-19	1120-WDW-19S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-20	1120-WDW-20S (0-6)	8/31/2000	0 - 0.5 ft
			WDW-21A	1120-WDW-21AS (0-6)	8/30/2000	0 - 0.5 ft
			SD-SD1	OC-SD-SD1-RISK	11/21/2013	1 - 1.5 ft
			WDW-21B	1120-WDW-21BS (0-6)	8/30/2000	0 - 0.5 ft
OU1	Sediment	On Property West Ditch and West Ditch Wetland (continued)	WDW-22	1120-WDW-22S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-23	1120-WDW-23S (0-6)	8/31/2000	0 - 0.5 ft
			WDW-24	1120-WDW-24S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-25	1120-WDW-25S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-26	1120-WDW-26S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-27	1120-WDW-27S (0-6)	8/31/2000	0 - 0.5 ft
			WDW-28	1120-WDW-28S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-29	1120-WDW-29S (0-6)	8/30/2000	0 - 0.5 ft
			WDW-30	1120-WDW-30S	8/30/2000	0 - 0.5 ft
			WDW-31	1120-WDW-31S	8/30/2000	0 - 0.5 ft
			WDW-32	1120-WDW-32S (0-6)	8/31/2000	0 - 0.5 ft
			WDW-11	1140-WDW-11S	8/25/2000	0 - 0.5 ft
			RSD-01	RSD-01	1/18/2000	
			RSD-02	RSD-02	1/18/2000	
			SD-SD1	SD-SD1-03-01	6/17/2003	0 - 0.25 ft
			SD-SD1	SD-SD1-03-02	8/10/2004	0 - 0.25 ft
			SD-SD1	SD-SD1-03-03	5/19/2005	0 - 0.25 ft
			SD-SD1	OC-SD-SD1-RISK	11/16/2007	0 - 0.25 ft
			SD-SD1	OC-SD-SD1	11/19/2008	0 - 0.3 ft
			SD-SD1	OC-SD-SD-SD1-0.0/0.5-RISK	11/11/2009	0 - 0.5 ft
			SD-SD1	OC-SD-SD1-0.0/0.5	11/15/2010	0 - 0.5 ft
			SD-SD1	OC-SD-SD1-0.0/0.5	11/11/2011	0 - 0.5 ft
			SD-SD1	OC-SD-SD1	11/16/2012	0 - 0.5 ft
OU1	Sediment	Upper South Ditch	SD-SD2	SD-SD2-03-03	5/19/2005	0 - 0.25 ft
			SD-SD2	OC-SD-SD2	11/16/2007	
			SD-SD2	OC-SD-SD2	11/19/2008	0 - 0.4 ft
			SD-SD2	OC-SD-SD-SD2-0.0/0.5	11/11/2009	0 - 0.5 ft
			SD-SD2	OC-SD-SD2-0.0/0.5-RISK	11/15/2010	0 - 0.5 ft
			SD-SD2	OC-SD-SD-SD2-RISK	12/10/2010	0 - 0.5 ft
			SD-SD2	OC-SD-SD2-0.0/0.5	11/11/2011	0 - 0.5 ft
			SD-SD2	OC-SD-SD2	11/16/2012	0 - 0.5 ft
			SD-SD3	SD-SD3-03-03	5/19/2005	0 - 0.25 ft
			SD-SD3	OC-SD-SD3	11/16/2007	
			SD-SD3	OC-SD-SD3	11/19/2008	0 - 0.4 ft
			SD-SD3	OC-SD-SD-SD3-0.0/0.5	11/11/2009	0 - 0.5 ft
			SD-SD3	OC-SD-SD3-0.0/0.5	11/15/2010	0 - 0.5 ft
			SD-SD3	OC-SD-SD-SD3-XXX	12/9/2010	0 - 0.5 ft
			SD-SD3	OC-SD-SD3-0.0/0.5-RISK	11/11/2011	0 - 0.5 ft
			SD-SD3	OC-SD-SD3	11/16/2012	0 - 0.5 ft
			SD-SD5	SD-SD5-03-03	5/19/2005	0 - 0.25 ft
			SD-SD5	OC-SD-SD5	11/16/2007	
			SD-SD5	OC-SD-SD5	11/19/2008	0 - 0.4 ft
			SD-SD5	OC-SD-SD-SD5-0.0/0.5	11/11/2009	0 - 0.5 ft
			SD-SD5	OC-SD-SD5-0.0/0.5	11/15/2010	0 - 0.5 ft

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU1	Sediment	Upper South Ditch (continued)	SD-SD5	OC-SD-SD5-0.0/0.5	11/11/2011	0 - 0.5 ft
			SD-SD5	OC-SD-SD5-RISK	11/16/2012	0 - 0.5 ft
			SD-SD2	OC-SD-SD2	11/21/2013	
			SD-SD3	OC-SD-SD3	11/21/2013	
			SD-SD5	OC-SD-SD5	11/21/2013	
			SDSW-E	OC-SD-SDSW-E-XXX	12/9/2010	0 - 0.5 ft
OU1 & OU2 [b]	Sediment	Lower South Ditch	BS031	BS031LSD-02	8/22/2005	0 - 0.5 ft
			BS032	BS032LSD-02	8/22/2005	0 - 0.5 ft
			SD-1	OC-SD-SD-1-XXX	12/9/2010	0 - 0.5 ft
			BS030	BS030LSD-02	8/22/2005	0 - 0.5 ft
			ISCO2	OC-SD-ISCO-2-XXX	12/9/2010	0 - 0.5 ft
			ISCO2	OC-SD-ISCO-2-XXX	2/17/2011	
OU1	Sediment	Central Pond	SD-SD4	SD-SD4-03-03	5/19/2005	0 - 0.25 ft
			SD-SD4	OC-SD-SD4	11/16/2007	
			SD-SD4	OC-SD-SD4	11/19/2008	0 - 0.5 ft
			SD-SD4	OC-SD-SD-SD4-0.0/0.5	11/11/2009	0 - 0.5 ft
			SD-SD4	OC-SD-SD4-0.0/0.5	11/15/2010	0 - 0.5 ft
			SD-SD4	OC-SD-SD4-0.0/0.5	11/11/2011	0 - 0.5 ft
			SD-SD4	OC-SD-SD4	11/16/2012	0 - 0.5 ft
			SD-501	OC-SD-SD-501-XXX	12/17/2012	0 - 0.5 ft
			SD-SD4	OC-SD-SD4	11/21/2013	
			SD-502	OC-SD-SD-502-XXX	12/17/2012	0 - 0.5 ft
OU1	Sediment	Storm Water Detention Basin	SD-503	OC-SD-SD-503-XXX	12/17/2012	0 - 0.5 ft
			SD-504	OC-SD-SD-504-XXX	12/17/2012	0 - 0.5 ft
OU2	Soil	EA5	BS040	BS040LSD	8/22/2005	0 - 0.5 ft
			SB-526	OC-SB-526-0.0/1.0-XXX	12/5/2012	0 - 1 ft
			SB-527	OC-SB-527-0.0/1.0-XXX	12/5/2012	0 - 1 ft
			SB-528	OC-SB-528-0.0/1.0-XXX	12/5/2012	0 - 1 ft
			SB-529	OC-SB-529-0.0/1.0-XXX	12/5/2012	0 - 1 ft
			SDF-1	1010-SED-SDF-1S	9/17/2001	0 - 0.5 ft
			SDF-2	1010-SED-SDF-2S	9/17/2001	0 - 0.5 ft
			SOLSD01	SOLSD-1-0-6	9/21/2005	0 - 0.5 ft
			SOLSD02	SOLSD-2-0-6	9/21/2005	0 - 0.5 ft
			SOLSD03	SOLSD-3-0-6	9/21/2005	0 - 0.5 ft
			SOLSD04	SOLSD-4-0-6	9/21/2005	0 - 0.5 ft
			SOLSD05	SOLSD-5-0-6	9/21/2005	0 - 0.5 ft
			SOLSD06	SOLSD-6-0-6	9/21/2005	0 - 0.5 ft
			SOLSD06	SOLSD-6-6-12	9/21/2005	0.5 - 1 ft
			SOLSD07	SOLSD-7-0-6	9/21/2005	0 - 0.5 ft
			SOLSD07	SOLSD-7-6-12	9/21/2005	0.5 - 1 ft
			SOLSD08	SOLSD-8-0-6	9/21/2005	0 - 0.5 ft
			SOLSD09	SOLSD-9-0-6	9/21/2005	0 - 0.5 ft
			SOLSD10	SOLSD-10-0-6	9/21/2005	0 - 0.5 ft
			SOLSD11	SOLSD-11-0-6	9/21/2005	0 - 0.5 ft
			SOLSD11	SOLSD-11-6-12-RISK	9/21/2005	0.5 - 1 ft
			SOLSD12	SOLSD-12-0-6-RISK	9/21/2005	0 - 0.5 ft
			SOLSD13	SOLSD-13-0-6	9/21/2005	0 - 0.5 ft
			SOLSD13	SOLSD-13-6-12	9/21/2005	0.5 - 1 ft
			SOLSD14	SOLSD-14-0-6	9/21/2005	0 - 0.5 ft
			SOLSD14	SOLSD-14-6-12	9/21/2005	0.5 - 1 ft
			SOLSD15	SOLSD-15-0-6	9/21/2005	0 - 0.5 ft
			SOLSD16	SOLSD-16-0-6	9/21/2005	0 - 0.5 ft
			SOLSD17	SOLSD-17-0-6	9/20/2005	0 - 0.5 ft
			SOLSD17	SOLSD-17-6-12	9/20/2005	0.5 - 1 ft
			SOLSD18	SOLSD-18-0-6	9/20/2005	0 - 0.5 ft
			SOLSD18	SOLSD-18-6-12	9/20/2005	0.5 - 1 ft
			SOLSD19	SOLSD-19-0-6	9/20/2005	0 - 0.5 ft
			SOLSD19	SOLSD-19-6-12	9/20/2005	0.5 - 1 ft
			SOLSD20	SOLSD-20-0-6	9/20/2005	0 - 0.5 ft
			SOLSD20	SOLSD-20-6-12	9/20/2005	0.5 - 1 ft
			SOLSD21	SOLSD-21-0-6	9/20/2005	0 - 0.5 ft
			SOLSD22	SOLSD-22-0-6	9/20/2005	0 - 0.5 ft
			SOLSD23	SOLSD-23-0-6	9/20/2005	0 - 0.5 ft
			SS-438	OC-SS-438-0.0/1.0-XXX	6/3/2010	0 - 1 ft

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU2	Soil	EA5	SS-439	OC-SS-439-0.0/1.0-XXX	6/3/2010	0 - 1 ft
		(continued)	SS-441	OC-SS-441-0.0/1.0-XXX	6/3/2010	0 - 1 ft
			SS-443	OC-SS-443-0.0/1.0-XXX	6/3/2010	0 - 1 ft
			SS-444	OC-SS-444-0.0/1.0-XXX	6/3/2010	0 - 1 ft
			SS-445	OC-SS-445-0.0/1.0-XXX	6/3/2010	0 - 1 ft
			SS-446	OC-SS-446-0.0/1.0-XXX	6/3/2010	0 - 1 ft
			SS-447	OC-SS-447-0.0/1.0-XXX	6/3/2010	0 - 1 ft
OU2	Surface Water	Off Property	OPWD-1	OC-SW-OPWD-1-XXX	12/10/2010	
		West Ditch	OPWD-2	OC-SW-OPWD-2-XXX	12/10/2010	
			OPWD-SW-S	OC-SW-OPWD-SD/SO/SW-S-XXX	12/10/2010	
			OPWD-1	OC-SW-OPWD-1-XXX	6/7/2011	
			OPWD-2	OC-SW-OPWD-2-XXX	6/7/2011	
			OPWD-SW-S	OC-SW-OPWD-SD/SO/SW-S-XXX	6/7/2011	
OU2	Surface Water	Landfill Brook	LB-1	OC-SW-LB-1-XXX	12/9/2010	
			LB-1	OC-SW-LB-1-XXX	6/7/2011	
			LB-2	OC-SW-LB-S2-XXX	12/9/2010	
			LB-2	OC-SW-LB-2-XXX	6/7/2011	
			LB-3	OC-SW-LB-3-XXX	12/9/2010	
			LB-3	OC-SW-LB-3-XXX	6/7/2011	
OU2	Surface Water	MMB Wetland	MMB-SW/SD-1	OC-SW-MMB-SW/SD-1-XXX	12/1/2010	
			MMB-SW/SD-1	OC-SW-MMB-SW/SD-1-RISK	6/6/2011	
			MMB-SW/SD-10	OC-SW-MMB-SW/SD-10-XXX	12/2/2010	
			MMB-SW/SD-10	OC-SW-MMB-SW/SD-10-XXX	6/6/2011	
			MMB-SW/SD-11	OC-SW-MMB-SW/SD-11-XXX	12/2/2010	
			MMB-SW/SD-11	OC-SW-MMB-SW/SD-11-XXX	6/7/2011	
			MMB-SW/SD-2	OC-SW-MMB-SW/SD-2-XXX	12/3/2010	
			MMB-SW/SD-2	OC-SW-MMB-SW/SD-2-XXX	6/8/2011	
			MMB-SW/SD-3	OC-SW-MMB-SW/SD-3-XXX	12/3/2010	
			MMB-SW/SD-3	OC-SW-MMB-SW/SD-3-XXX	6/8/2011	
			MMB-SW/SD-4	OC-SW-MMB-SW/SD-4-XXX	12/2/2010	
			MMB-SW/SD-4	OC-SW-MMB-SW/SD-4-XXX	6/6/2011	
			MMB-SW/SD-5	OC-SW-MMB-SW/SD-5-XXX	12/2/2010	
			MMB-SW/SD-5	OC-SW-MMB-SW/SD-5-XXX	6/7/2011	
			MMB-SW/SD-6	OC-SW-MMB-SW/SD-6-XXX	12/3/2010	
			MMB-SW/SD-6	OC-SW-MMB-SW/SD-6-XXX	6/8/2011	
			MMB-SW/SD-8	OC-SW-MMB-SW/SD-8-RISK	12/2/2010	
			MMB-SW/SD-8	OC-SW-MMB-SW/SD-8-XXX	6/7/2011	
			MMB-SW/SD-8A	OC-SW-MMB-SW/SD-8A-XXX	12/2/2010	
			MMB-SW/SD-8A	OC-SW-MMB-SW/SD-8A-XXX	6/7/2011	
			MMB-SW/SD-8A	OC-SW-MMB-SW/SD-8A-XXX	6/8/2011	
			MMB-SW/SD-9	OC-SW-MMB-SW/SD-9-XXX	12/1/2010	
			MMB-SW/SD-9	OC-SW-MMB-SW/SD-9-XXX	6/6/2011	
OU2	Surface Water	North	SW/SD-600	OC-SW-600-RISK	6/20/2013	
		Pond	SW/SD-601	OC-SW-601-XXX	6/20/2013	
			SW/SD-602	OC-SW-602-XXX	6/20/2013	
			SW/SD-603	OC-SW-603-XXX	6/20/2013	
OU2	Sediment	Off Property	OPWD-1	OC-SD-OPWD-1-XXX	12/10/2010	0 - 0.5 ft
		West Ditch	OPWD-2	OC-SD-OPWD-2-XXX	12/10/2010	0 - 0.5 ft
			OPWD-SD-S	OC-SD-OPWD-SD/SO/SW-S-XXX	12/10/2010	0 - 0.5 ft
OU2	Sediment	Landfill Brook	LB-1	OC-SD-LB-1-XXX	12/9/2010	0 - 0.5 ft
			LB-2	OC-SD-LB-2-XXX	12/9/2010	0 - 0.5 ft
			LB-3	OC-SD-LB-3-XXX	12/9/2010	0 - 0.5 ft
OU2	Sediment	MMB Wetland	MMB-SW/SD-1	OC-SD-MMB-SW/SD-1-XXX	12/1/2010	0 - 0.5 ft
			MMB-SW/SD-1	OC-SD-MMB-SW/SD-1-XXX	2/17/2011	
			MMB-SW/SD-10	OC-SD-MMB-SW/SD-10-XXX	12/2/2010	0 - 0.5 ft
			MMB-SW/SD-11	OC-SD-MMB-SW/SD-11-XXX	12/2/2010	0 - 0.5 ft
			MMB-SW/SD-2	OC-SD-MMB-SW/SD-2-XXX	12/3/2010	0 - 0.5 ft
			MMB-SW/SD-3	OC-SD-MMB-SW/SD-3-XXX	12/3/2010	0 - 0.5 ft
			MMB-SW/SD-4	OC-SD-MMB-SW/SD-4-XXX	12/2/2010	0 - 0.5 ft
			MMB-SW/SD-5	OC-SD-MMB-SW/SD-5-XXX	12/2/2010	0 - 0.5 ft
			MMB-SW/SD-6	OC-SD-MMB-SW/SD-6-XXX	12/3/2010	0 - 0.5 ft
			MMB-SW/SD-8	OC-SD-MMB-SW/SD-8-RISK	12/2/2010	0 - 0.5 ft
			MMB-SW/SD-8A	OC-SD-MMB-SW/SD-8A-XXX	12/2/2010	0 - 0.5 ft
			MMB-SW/SD-9	OC-SD-MMB-SW/SD-9-XXX	12/1/2010	0 - 0.5 ft

Table 3.11-1
Samples Used in the Baseline Ecological Risk Assessment
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU2	Sediment	North Pond	SW/SD-600	OC-SD-600-0.0/0.5-RISK	6/20/2013	0 - 0.5 ft
			SW/SD-601	OC-SD-601-0.0/0.5-XXX	6/20/2013	0 - 0.5 ft
			SW/SD-602	OC-SD-602-0.0/0.5-XXX	6/20/2013	0 - 0.5 ft
			SW/SD-603	OC-SD-603-0.0/0.5-XXX	6/20/2013	0 - 0.5 ft
BKG	Soil	Background	SS-434	OC-SS-434-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-435	OC-SS-435-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-449	OC-SS-449-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-450	OC-SS-450-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-451	OC-SS-451-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-453	OC-SS-453-0.0/1.0-XXX	9/17/2009	0 - 1 ft
BKG	Soil	Background (continued)	SS-454	OC-SS-454-0.0/1.0-XXX	9/17/2009	0 - 1 ft
			SS-455	OC-SS-455-0.0/1.0-XXX	9/16/2009	0 - 1 ft
			SS-460	OC-SS-460-0.0/1.0-XXX	9/16/2009	0 - 1 ft
BKG	Surface Water	MMB Wetland Reference	SDBK-004	OC-SW-BK-SW/SD-004-XXX	12/3/2010	
			SDBK-004	OC-SW-SDBK-004-XXX	6/8/2011	
BKG	Sediment	MMB Wetland Reference	SDBK-004	OC-SD-BK-SW/SD-004-XXX	12/3/2010	0 - 0.5 ft

Prepared by: KJC 3/18/2013
Checked by: SFR 3/26/2013
Revised: SFR 6/28/2013
Revised: SFR 2/5/2014

Notes:

[a] All South Ditch surface water is a single data set that is used to evaluate ecological risk from surface water in both the Upper South Ditch and the Lower South Ditch exposure areas.

[b] The Lower South Ditch sediment data set includes samples from OU1 and OU2 evaluated as a single exposure area.

BKG - Background
EA - Exposure Area
ft - feet
OU - Operable Unit
MMB - Maple Meadow Brook

Table 3.12-1
Ecological Soil Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Volatile Organics (mg/kg)		
1,1,1-Trichloroethane	29.8	USEPA Region 5
1,2,4-Trichlorobenzene	20	ORNL - Invertebrates
1,2,4-Trimethylbenzene	1.4	ECOSAR - CSV
1,3,5-Trimethylbenzene	1.4	ECOSAR - CSV
2,4,4-Trimethyl-1-pentene	1.2	ECOSAR - CSV
2,4,4-Trimethyl-2-Pentene	1.2	ECOSAR - CSV
Acetaldehyde	NA	NA
Acetone	2.5	USEPA Region 5
Formaldehyde	83.3	Sample et. al. - Mammal
Methylene chloride	4.05	USEPA Region 5
Tetrachloroethene	0.01	USEPA Region 4
Toluene	200	ORNL - Plants
Trichloroethene	0.001	USEPA Region 4
Xylene, m/p	14.2	ECOSAR - CSV
Xylenes, Total	0.05	USEPA Region 4
Semivolatile Organics (mg/kg)		
1,2-Dichlorobenzene	2.96	USEPA Region 5
1,4-Dichlorobenzene	20	ORNL - Invertebrates
1-Methylnaphthalene	16.4	ECOSAR - CSV
2-Methylnaphthalene	3.24	USEPA Region 5
2-Methylphenol	40.4	USEPA Region 5
3-Nitroaniline	3.16	USEPA Region 5
Acenaphthylene	682	USEPA Region 5
Acetophenone	300	USEPA Region 5
Aniline	NA	NA
Anthracene	0.1	USEPA Region 4
Benzaldehyde	NA	NA
Benzo(a)anthracene	5.21	USEPA Region 5
Benzo(a)pyrene	0.1	USEPA Region 4
Benzo(b)fluoranthene	59.8	USEPA Region 5
Benzo(ghi)perylene	119	USEPA Region 5
Benzo(k)fluoranthene	148	USEPA Region 5
Biphenyl	60	ORNL - Plants
Benzoic Acid	219	ECOSAR - CSV
Bis(2-Ethylhexyl)phthalate	130	REACH
Butylbenzylphthalate	0.239	USEPA Region 5
Carbazole	21	ECOSAR - CSV
Chrysene	4.73	USEPA Region 5
Dibenz(a,h)anthracene	18.4	USEPA Region 5
Dibenzofuran	1.9	ECOSAR - CSV
Diethylphthalate	100	ORNL - Plants
Di-n-butylphthalate	200	ORNL - Plants
Di-n-octylphthalate	709	USEPA Region 5
Diphenyl ether	NA	NA
Fluoranthene	0.1	USEPA Region 4
Fluorene	30	ORNL - Invertebrates
Indeno(1,2,3-cd)pyrene	109	USEPA Region 5
Naphthalene	0.0994	USEPA Region 5
N-Nitrosodi-n-propylamine	NA	NA
N-Nitrosodiphenylamine	20	ORNL - Invertebrates
Phenanthrene	0.1	USEPA Region 4
Phenol	30	ORNL - Invertebrates

Table 3.12-1
Ecological Soil Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Pyrene	0.1	USEPA Region 4
Pesticides (mg/kg)		
4,4`-DDD	0.0025	USEPA Region 4
4,4`-DDE	0.0025	USEPA Region 4
4,4`-DDT	0.021	Eco-SSL - Mammals
Aldrin	0.0025	USEPA Region 4
Alpha-BHC	0.0025	USEPA Region 4
Alpha-Chlordane [b]	2.6	ECOSAR - CSV
Beta-BHC	0.001	USEPA Region 4
Chlordane (technical)	2.6	ECOSAR - CSV
Delta-BHC	9.94	USEPA Region 5
Dieldrin	0.0049	Eco-SSL - Mammals
Endosulfan I	0.119	USEPA Region 5
Endosulfan II	0.119	USEPA Region 5
Endrin ketone	3.2	ECOSAR - CSV
Gamma-BHC/Lindane	0.00005	USEPA Region 4
Heptachlor epoxide	0.152	USEPA Region 5
Hexachlorobenzene	0.0025	USEPA USEPA Region 4
PCB's (mg/kg)		
Aroclor-1016	1.9	ECOSAR - CSV
Metals (mg/kg)		
Aluminum	50	ORNL - Plants
Antimony	0.27	Eco-SSL - Mammals
Arsenic	10	ORNL - Plants
Barium	330	Eco-SSL - Invertebrates
Beryllium	10	ORNL - Plants
Cadmium	0.36	Eco-SSL - Mammals
Calcium [c]	EN	EN
Chromium	0.4	ORNL - Invertebrates
Chromium, Hexavalent	81	Eco-SSL - Mammals
Cobalt	13	Eco-SSL - Plants
Copper	28	Eco-SSL - Birds
Iron	200	USEPA Region 4
Lead	11	Eco-SSL - Birds
Magnesium [c]	EN	EN
Manganese	220	ECO-SSL- Plants
Mercury	0.1	ORNL - Invertebrates
Nickel	30	ORNL - Plants
Potassium [c]	EN	EN
Selenium	0.52	Eco-SSL - Plants
Silver	2	ORNL - Plants
Sodium [c]	EN	EN
Thallium	1	ORNL - Plants
Tin	50	ORNL - Plants
Vanadium	2	ORNL - Plants
Zinc	46	Eco-SSL - Birds
Inorganics (mg/kg)		
Chloride	8.7	ECOSAR - CSV
Cyanide, Total	0.9	USEPA Region 4
Nitrogen, as Ammonia	NA	NA
Sulfate	46	ECOSAR - CSV

Table 3.12-1
Ecological Soil Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
EPH (mg/kg)		
C11-C22 Aromatics	NA	NA
C19-C36 Aliphatics	NA	NA
C9-C18 Aliphatics	NA	NA

Prepared by: SFR 3/26/2013
Checked by: EYM 3/26/2013
Revised: SFR 6/28/2013

Notes:

[a] Screening benchmark sources are in order of preference:

[1] The lowest values presented in these sources were used:

- Eco-SSLs - Ecological (Eco) Soil Screening Levels (SSLs) (USEPA, 2013).
- ORNL - Invertebrates - Oak Ridge National Laboratory (ORNL) (Efroymson, Will, & Suter, 1997).
- ORNL - Plants - (Efroymson, *et al.* 1997).

[2] Lacking a value from the sources listed in [a][1] above the lowest values presented in these sources were used:

- USEPA Region 4 - (Friday, 1998).
- USEPA Region 5 - (USEPA, 2003).

[3] Lacking a value from sources listed in [a][1] and [a][2] above, benchmarks were estimated using the USEPA, 2012. Ecological Structure Activity Relationships (ECOSAR) Database v.1.11. 14-day LC50s for earthworms were used and factors of: 10 for non-persistent chemicals, 20 for persistent but non-bioaccumulating chemicals, and 100 for persistent and bioaccumulating chemicals were applied to convert to NOAELs for use as screening benchmarks. Persistent chemicals are defined as those that are either listed as Persistent Organic Pollutants under the Stockholm Convention or have half lives in soil or surface water longer than 2 months, as calculated by the USEPA, 2010. Persistent, Bio-accumulating, and Toxic (PBT) Profiler v.1.301. Calculations of persistence exclude net advection and sediment burial. Bio-accumulating organic chemicals are those with LogKow > 3.0. Methodology is derived from the Texas Surface Water Quality Standards TSWQS (30 TAC §307.6(c).(7), as amended TNRCC, 2000).

[4] Lacking a value from sources listed in [a][1], [a][2], and [a][3] above, a benchmark for formaldehyde was selected from the following source:

- Sample *et. al.* - Mammals - value for shrew - (Sample *et al.*, 1996).

[5] REACH database. Values selected are NOECs for invertebrates.

[b] Chlordane (technical) is used as a surrogate for Alpha-Chlordane.

[c] Calcium, magnesium, potassium, and sodium are considered essential nutrients; therefore benchmarks are not applicable.

CSV - Calculated Screening Value
EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbons
LC50 - Lethal Concentration affecting 50% of test population
mg/kg - milligrams per kilogram
NA- Not Available
NOAEL - No Observed Adverse Effects Level
PCBs - Polychlorinated Biphenyls

Table 3.12-1
Ecological Soil Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

USEPA, 2013. Ecological Soil Screening Levels (Eco-SSL) Guidance and Documents Webpage: http://www.epa.gov/oswer/riskassessment/ecorisk/ecossl.htm

Efroymson, R.A., M.E., Will, and G.W. Suter II. 1997. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision.* Oak Ridge National Laboratory, Oak Ridge, TN.

Efroymson, R.A., M.E., Will, and G.W. Suter II and A.C. Wooten. 1997. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.*

Friday, G. P. 1998. *Ecological Screening Values for Surface Water, Sediment, and Soil.* Westinghouse Savannah River Company, Savannah River Technology Center, (WSRC-TR-98-00110), Aiken, SC 29808. Cited in: USEPA. 2001. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment*. November 30, 2001 update.

USEPA. 2003. *USEPA, Region 5, RCRA Ecological Screening Levels*. August 22, 2003.

USEPA, 2012. Ecological Sturcture Activity Relationships Database v.1.11.

Table 3.12-2
Ecological Surface Water Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Volatile Organics (mg/L)		
1,1,1-Trichloroethane	0.011	ORNL - SCV
1,1,2-Trichloro-1,2,2-Trifluoroethane	NA	NA
1,1-Dichloroethane	0.047	ORNL - SCV
1,1-Dichloroethene	0.025	ORNL - SCV
1,3-Dichlorobenzene	0.071	ORNL - SCV
2,4,4-Trimethyl-1-pentene	0.015	ECOSAR - CSV
2,4,4-Trimethyl-2-pentene	0.018	ECOSAR - CSV
2-Butanone	14	ORNL - SCV
4-iso-Propyltoluene	0.085	USEPA Region 3
Acetone	1.5	ORNL - SCV
Bromodichloromethane	14.1	ECOSAR - CSV
Bromoform	0.32	ORNL - SCV
Carbon disulfide	0.00092	ORNL - SCV
Chlorodibromomethane	15.1	ECOSAR - CSV
Chloroethane	NA	NA
Chloroform	0.028	ORNL - SCV
Cis-1,2-Dichloroethene	0.59	ORNL - SCV
Dibromomethane	0.15	ECOSAR - CSV
Formaldehyde	3.9	ECOSAR - CSV
Methyl Tertbutyl Ether	11.07	USEPA Region 3
Tetrachloroethene	0.098	ORNL - SCV
Toluene	0.0098	ORNL - SCV
Trichloroethene	0.047	ORNL - SCV
Vinyl chloride	0.93	USEPA Region 3
Xylene, o	1.012	ECOSAR - CSV
Xylenes (m&p)	NA	NA
Semivolatile Organics (mg/L)		
2-Nitrophenol	3.5	USEPA Region 4 - Chronic
3 & 4 Methylphenol	NA	NA
4-Nitrophenol	0.3	ORNL - SCV
Acenaphthene	0.017	USEPA Region 4 - Chronic
Anthracene	0.00073	ORNL - SCV
Azobenzene	NA	NA
Benzo(a)anthracene	0.000027	ORNL - SCV
Benzo(a)pyrene	0.000014	ORNL - SCV
Benzo(b)fluoranthene	0.0006	ECOSAR - CSV
Benzo(ghi)perylene	0.0002	ECOSAR - CSV
Benzo(k)fluoranthene	0.0006	ECOSAR - CSV
Benzoic Acid	0.042	ORNL - SCV
Benzyl alcohol	0.0086	ORNL - SCV
Bis(2-Ethylhexyl)phthalate	0.003	ORNL - SCV
Butylbenzylphthalate	0.019	ORNL - SCV
Caprolactam	NA	NA
Chrysene	0.0019	ECOSAR - CSV
Dibenz(a,h)anthracene	0.0002	ECOSAR - CSV
Diethylphthalate	0.21	ORNL - SCV
Di-n-butylphthalate	0.035	ORNL - SCV
Di-n-octylphthalate	0.022	USEPA Region 3
Diphenyl ether	0.25	ECOSAR - CSV
Diphenylmethanone	1.5	ECOSAR - CSV
Fluoranthene	0.0398	USEPA Region 4 - Chronic
Fluorene	0.0039	ORNL - SCV
Indeno(1,2,3-cd)pyrene	0.0002	ECOSAR - CSV
N-Nitrosodimethylamine	0.117	USEPA Region 3
N-Nitrosodi-n-propylamine	NA	NA
N-Nitrosodiphenylamine	0.21	ORNL - SCV
Phenanthrene	0.0004	USEPA Region 3
Phenol	0.256	USEPA Region 4 - Chronic
Pyrene	0.000025	USEPA Region 3
Metals (mg/L)		
Aluminum [b]	0.087	AWQC - CCC
Antimony	0.16	USEPA Region 4 - Chronic
Arsenic [c]	0.15	AWQC - CCC
Barium	0.004	ORNL - SCV

Table 3.12-2
Ecological Surface Water Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Beryllium	0.00066	ORNL - SCV
Cadmium [d]	Equation	AWQC - CCC
Calcium [e]	EN	EN
Chromium [d]	Equation	AWQC - CCC
Chromium, Hexavalent	0.011	AWQC - CCC
Cobalt	0.023	ORNL - SCV
Copper [d]	Equation	AWQC - CCC
Iron	1	AWQC - CCC
Lead [d]	Equation	AWQC - CCC
Magnesium [e]	EN	EN
Manganese	0.12	ORNL - SCV
Mercury [f]	0.00077	AWQC - CCC
Nickel [d]	Equation	AWQC - CCC
Potassium [e]	EN	EN
Silver	0.000012	USEPA Region 4 - Chronic
Sodium [e]	EN	EN
Thallium	0.004	USEPA Region 4 - Chronic
Tin	0.073	USEPA Region 3
Vanadium	0.02	USEPA Region 3
Zinc [d]	Equation	AWQC - CCC
Bromide	NA	NA
Chloride	230	AWQC - CCC
Nitrate as N	166	ECOSAR - CSV
Nitrite as N	NA	NA
Nitrogen, as Ammonia [g]	3.0	AWQC - CCC
Sulfate	29,479	ECOSAR - CSV
Specialty Compounds (mg/L)		
Hydrazine	0.01	REACH
4,4'-Isopropylidenediphenol	3.16	REACH
4-Nonylphenol (Tech.)	0.024	REACH
Kempore (Azodicarbonamide)	2.89	REACH

Prepared by: SFR 3/13/2013
Checked by: EYM 3/14/2013

Notes:

[a] Screening benchmark sources are in order of preference:

[1] AWQC - CCC - USEPA, Freshwater Ambient Water Quality Criteria (AWQC) Chronic Continuous Concentration (CCC) (USEPA, 2013).

[2] ORNL - SCV - Oak Ridge National Laboratory (ORNL) Tier II Secondary Chronic Values (SCVs) from Suter and Tsao, 1996 as cited in Buchman, 2008, Screening Quick Reference Tables (SQuiRTs from NOAA).

[3] USEPA Region 4 - Chronic - (USEPA, 2001)

[4] USEPA Region 3 - (USEPA, 2006)

[5] Lacking a value from sources listed in [a][1],[a][2],[a][3],and [a][4] above, benchmarks were estimated using the USEPA, 2009, Ecological Structure Activity Relationships (ECOSAR) Database v.1.11. ChVs (Chronic Toxicity Values; equal to a LC50÷10) were restored to LC50s and factors of 10 for non-persistent chemicals, 20 for persistent but non-bioaccumulating chemicals, and 100 for persistent and bioaccumulating chemicals were applied to convert the LC50s to NOAELs for use as screening benchmarks. Persistent chemicals are defined as those that are either listed as Persistent Organic Pollutants under the Stockholm Convention or have half lives in soil or surface water longer than 2 months as calculated by the USEPA, 2010, Persistent, Bio-accumulating, and Toxic (PBT) Profiler v.1.301. Calculations of persistence exclude net advection and sediment burial. Bio-accumulating organic chemicals are those with LogKow > 3.0. Methodology is derived from the Texas Surface Water Quality Standards TSWQS (30 TAC §307.6(c).(7), as amended TNRCC, 2000b).

[6] Screening benchmarks were seleted for specialty compounds from the REACH database. Values selected are NOECs for aquatic invertebrates.

[b] AWQC-CCC for aluminum is for waters with pH between 6.5 and 9.0.

[c] AWQC-CCC is for the dissolved fraction of the metal.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] Calcium, magnesium, potassium, and sodium are considered essential nutrients; therefore benchmarks are not applicable.

Table 3.12-2
Ecological Surface Water Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Notes (continued):

[f] AWQC-CCC for inorganic methylmercuy

[g] The AWQC-CCC for ammonia is calculated using the equations presented in USEPA (2013), using a default pH of 7.0 and a default temperature of 25°C and assuming and that sensitive early life stages of fish are absent.

CSV - Calculated Screening Value

EN - Essential Nutrient

Equation - Value is calculated for site-specific conditions using AWQC equations

LC50 - Lethal Concentration affecting 50% of test population

mg/L - milligrams per liter

NA - Not Available

NOAEL - No Observed Adverse Effects Level

References:

Suter, G.W, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects of Aquatic Biota: 1996 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-96/R2. June 1996.

REACH Database. Available at: http://echa.europa.eu/web/guest/information-onchemicals/registered-substances

USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

USEPA, 2012. Ecological Sturcture Activity Relationships Database v.1.11.

USEPA. 2006. EPA Region III BTAG Screening Benchmarks for Freshwater Screening Benchmarks. July, 2006.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. November 30, 2001 update.

Table 3.12-3
Ecological Surface Water Screening Benchmarks - AWQC Equations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Metals	Exposure Area	Hardness [a]	Equation Factors [b]				Freshwater Conversion		Calculated Values (mg/L) [b]			
									Total Metals		Dissolved Metals [c]	
			mA	bA	mC	bC	CMC	CCC	CCC	CMC	CCC	CMC
Cadmium	Off-PWD	61	1.0166	-3.924	0.7409	-4.719			0.00064	0.0012		
	Storm Water Detention Basin	142							0.0012	0.0029		
	Central Pond	528							0.0032	0.011		
	South Ditch	177							0.0014	0.0036		
	Landfill Brook	117							0.0010	0.0023		
	MMB Wetland	72							0.00072	0.0014		
	North Pond	108							0.00097	0.0022		
Chromium	Off-PWD	61	0.819	3.7256	0.819	0.6848	0.316	0.86	0.051	0.61		
	Storm Water Detention Basin	142							0.10	1.2		
	Central Pond	528							0.30	3.6		
	South Ditch	177							0.12	1.5	0.10	0.46
	Landfill Brook	117							0.087	1.0		
	MMB Wetland	72							0.058	0.70		
	North Pond	108							0.081	0.98		
Copper	Off-PWD	61	0.9422	-1.7	0.8545	-1.702			0.0078	0.010		
	Storm Water Detention Basin	142							0.016	0.021		
	Central Pond	528							0.050	0.074		
	South Ditch	177							0.019	0.026		
	Landfill Brook	117							0.014	0.018		
	MMB Wetland	72							0.0090	0.011		
	North Pond	108							0.0128	0.017		
Lead	Off-PWD	61	1.273	-1.46	1.273	-4.705			0.00047	0.029		
	Storm Water Detention Basin	142							0.0014	0.086		
	Central Pond	528							0.0073	0.46		
	South Ditch	177							0.0018	0.11		
	Landfill Brook	117							0.0011	0.067		
	MMB Wetland	72							0.00058	0.036		
	North Pond	108							0.00097	0.060		
Nickel	Off-PWD	61	0.846	2.255	0.846	0.0584			0.034	0.22		
	Storm Water Detention Basin	142							0.070	0.45		
	Central Pond	528							0.21	1.4		
	South Ditch	177							0.084	0.54		
	Landfill Brook	117							0.059	0.38		
	MMB Wetland	72							0.039	0.25		
	North Pond	108							0.055	0.35		
Zinc	Off-PWD	61	0.8473	0.884	0.8473	0.884			0.069	0.069		
	Storm Water Detention Basin	142							0.14	0.14		
	Central Pond	528							0.43	0.43		
	South Ditch	177							0.17	0.17		
	Landfill Brook	117							0.12	0.12		
	MMB Wetland	72							0.079	0.079		
	North Pond	108							0.112	0.112		

Notes:

Prepared by: SFR 7/10/2013
Checked: EYM 7/15/2013

[a] Hardness values are the average (arithmetic mean) for a given exposure area expressed at mg/L CaCO3.
[b] Equations used to calculate CCC and CMC values are from USEPA (2013) and are as follows:

$$CMC = \exp\{mA\,[ln(\text{hardness})] + bA\}$$
$$CCC = \exp\{mC\,[ln(\text{hardness})] + bC\}$$

Conversion factors for calculating CCC and CMC values for dissolved metals are not applied as all metals concentrations in the data are reported as total metals, with the exception of chromium in South Ditch surface water, for which the conversion is shown.

CCC - Chronic Continuous Concentration
CMC - Chronic Maximum Concentration
mg/L - Milligrams per Liter

References:

USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

Table 3.12-4
Ecological Sediment Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Volatile Organics (mg/kg)		
1,2,4-Trichlorobenzene	2.1	USEPA Region 3
2,4,4-Trimethyl-1-pentene	NA	NA
2,4,4-Trimethyl-2-pentene	NA	NA
2-Butanone	5.4	ORNL - LCV
4-iso-Propyltoluene	NA	NA
4-Nitrophenol	NA	NA
Acetone	0.0091	ORNL - LCV
Carbon disulfide	0.001	USEPA Region 3
Cis-1,2-Dichloroethene [b]	6.4	ORNL - LCV
Methyl Tertbutyl Ether	NA	NA
sec-Butylbenzene	NA	NA
Toluene	6.4	ORNL - LCV
trans-1,2-Dichloroethene	1.05	USEPA Region 3
Trichloroethene	0.0969	USEPA Region 3
Semivolatile Organics (mg/kg)		
1,2,4-Trichlorobenzene	2.1	USEPA Region 3
2-Methylnaphthalene	0.33	USEPA Region 4
3 & 4 Methylphenol	NA	NA
4-Chlorophenyl phenyl ether	NA	NA
4-Nitrophenol	NA	NA
Acetophenone	NA	NA
Aniline	NA	NA
Benzaldehyde	NA	NA
Benzoic Acid	0.65	USEPA Region 3
Benzyl alcohol	0.073	ORNL - LCV
Bis(2-Ethylhexyl)phthalate	433	REACH
Caprolactam	NA	NA
Carbazole	NA	NA
Dibenzofuran	0.415	USEPA Region 3
Di-n-octylphthalate	NA	NA
Diphenyl ether	NA	NA
Diphenylamine	NA	NA
Diphenylmethanone	NA	NA
N-Nitrosodiphenylamine	2.68	USEPA Region 3
Phenol	0.42	USEPA Region 3
Nonionic Organics (ug/goc)		
Benzene	16	USEPA NIO ESBs
Biphenyl	110	USEPA NIO ESBs
Chlorobenzene	41	USEPA NIO ESBs
1,2-Dichlorobenzene	33	USEPA NIO ESBs
1,3-Dichlorobenzene	170	USEPA NIO ESBs
Polyaromatic Hydrocarbons (ug/goc)		
Anthracene	594	USEPA PAH ESBs
Acenaphthene	491	USEPA PAH ESBs
Benzo(a)anthracene	841	USEPA PAH ESBs
Benzo(a)pyrene	965	USEPA PAH ESBs
Benzo(b)fluoranthene	979	USEPA PAH ESBs
Benzo(ghi)perylene	1,095	USEPA PAH ESBs
Benzo(k)fluoranthene	981	USEPA PAH ESBs
Chrysene	844	USEPA PAH ESBs
Dibenz(a,h)anthracene	1,123	USEPA PAH ESBs
Fluoranthene	707	USEPA PAH ESBs
Fluorene	538	USEPA PAH ESBs
Indeno(1,2,3-cd)pyrene	1,115	USEPA PAH ESBs
Naphthalene	385	USEPA PAH ESBs
Phenanthrene	596	USEPA PAH ESBs
Pyrene	697	USEPA PAH ESBs
Pesticides (mg/kg)		
4,4`-DDT	0.00416	TEC
Hexachlorobenzene	0.02	OMEE - LEL

Table 3.12-4
Ecological Sediment Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Metals (mg/kg)		
Aluminum	25,500	ARCs - TEC
Antimony	12	USEPA Region 4
Arsenic	9.79	TEC
Barium	NA	NA
Beryllium	NA	NA
Cadmium	0.99	TEC
Calcium [c]	EN	EN
Chromium	43.4	TEC
Chromium, Hexavalent	NA	NA
Cobalt	50	OMEE - SEL
Copper	31.6	TEC
Iron	20,000	OMEE - LEL
Lead	35.8	TEC
Magnesium [c]	EN	EN
Manganese	460	OMEE - LEL
Mercury	0.18	TEC
Nickel	22.7	TEC
Potassium [c]	EN	EN
Selenium	2	USEPA Region 3
Silver	2	USEPA Region 4
Sodium [c]	EN	EN
Thallium	NA	NA
Tin	NA	NA
Vanadium	NA	NA
Zinc	121	TEC
Inorganics (mg/kg)		
Chloride	NA	NA
Nitrogen, as Ammonia	NA	NA
Sulfate	NA	NA
EPH (mg/kg)		
C11-C22 Aromatics	0.09	MassDEP
C19-C36 Aliphatics	9.88	MassDEP
C9-C18 Aliphatics	3.17	MassDEP
Hydrazines (mg/kg)		
Hydrazine	NA	NA
Formaldehydes (mg/kg)		
Acetaldehyde	NA	NA
Formaldehyde	NA	NA
Dimethylformamides (mg/kg)		
Dimethylformamide	NA	NA

Prepared by: EYM 3/13/2013
Checked by: SFR 3/14/2013

Notes:

[a] Sources are in order of preference:

[1] USEPA PAH ESBs - Equilibrium Sediment Partitioning Benchmarks for PAHs ($C_{OC,PAHi,FCVi}$) (USEPA, 2003)

[2] USEPA NIO ESBs - Equilibrium Sediment Partitioning Benchmarks for Nonionic Organics Freshwater Conventional ESBs (USEPA, 2008)

[3] TECs - Threshold Effects Concentrations (TECs) (MacDonald, *et al.*, 2000).

[4] USEPA Region 4 (USEPA, 2001).

[5] OMEE LELs - Ontario Ministry of Energy and Environment (OMEE) Low-Effect Levels (LELs) (Persaud *et al*.,1993).

[6] ARCs TECs - Assessment and Remediation of Contaminated Sediments (ARCS) Program Threshold Effects Concentrations (USEPA, 1996).

[7] USEPA Region 3 (USEPA, 2006).

[8] ORNL - LCVs - Oak Ridge National Laboratory (ORNL) Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).

[9] MassDEP - Sediment Benchmarks for Current MassDEP Petroleum Hydrocarbon Fractions (MassDEP, 2007).

[10] REACH database. Values selected are NOECs for aquatic invertebrates.

[b] Value is for 1,2-Dichloroethene.

[c] Calcium, magnesium, potassium, and sodium are considered essential nutrients; therefore benchmarks are not applicable.

Table 3.12-4
Ecological Sediment Screening Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Notes (continued):

EN - Essential Nutrient
EPH - Extractable Petroleum HydrocarbonS
mg/kg - milligrams per kilogram
NA - Not available
ug/goc - micrograms per gram organic carbon

References:

Jones, D.S., G.W. Suter II, and R.N. Hull, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision; Oak Ridge National Laboratories (ES/ER/TM-95/R4); November 1997.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39:20-31.

MassDEP, 2007. Sediment Toxicity of Petroleum Hydrocarbon Fractions. Office of Research and Standards. September, 2007.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto. Cited in Jones, Suter and Hull, 1997.

USEPA. 1996. Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella Azteca and the Midge Chironomus Riparius. Great Lakes National Program Office. EPA-905-R96-08. September, 1996.

USEPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA/600/R-02/013. November 2003.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. 2001.

USEPA. 2006. EPA Region III BTAG Screening Benchmarks for Freshwater and Sediment. August, 2006.

USEPA. 2008. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics. EPA/600/R-02/016. March 2008.

Table 3.13-1
Selection of COPECs - Soil - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/kg)								
1,2,4-Trimethylbenzene	1 / 13	0.0037 : 0.66	0.025 - 0.025	SWMU-27-101	0.054	1.4	No	BSL
2,4,4-Trimethyl-1-pentene	1 / 15	0.0075 : 0.49	0.019 - 0.019	SB-518	0.028	1.2	No	BSL
2,4,4-Trimethyl-2-pentene	1 / 15	0.0075 : 0.49	0.017 - 0.017	SB-518	0.028	1.2	No	BSL
Acetaldehyde	2 / 3	1.1 : 1.1	0.044 - 0.2	SB-435	0.26	NA	Yes	NSL
Acetone	2 / 15	0.016 : 13	0.039 - 0.068	SB-406	1.1	2.5	No	BSL
Formaldehyde	3 / 3		0.26 - 0.86	SB-435	0.59	83.3	No	BSL
Tetrachloroethene	2 / 15	0.0037 : 0.66	0.001 - 0.0093	SWMU-27-101	0.046	0.01	No	BSL
Toluene	1 / 15	0.0037 : 0.66	0.002 - 0.002	AREA-4	0.046	200	No	BSL
Semivolatile Organics (mg/kg)								
2-Methylnaphthalene	1 / 17	0.04 : 23	0.075 - 0.075	AREA-4	1.7	3.24	No	BSL
Acenaphthylene	1 / 17	0.04 : 23	0.057 - 0.057	AREA-4	1.7	682	No	BSL
Acetophenone	3 / 12	0.046 : 23	0.013 - 0.038	SB-406	2.0	300	No	BSL
Anthracene	3 / 17	0.046 : 23	0.069 - 0.094	SB-519	1.7	0.1	No	BSL
Benzaldehyde	7 / 12	0.43 : 23	0.086 - 1.9	SB-435	2.2	NA	Yes	NSL
Benzo(a)anthracene	6 / 16	0.077 : 17	0.015 - 0.36	AREA-4	1.0	5.21	No	BSL
Benzo(a)pyrene	6 / 13	0.077 : 1.9	0.021 - 0.24	AREA-4	0.25	0.1	Yes	ASL
Benzo(b)fluoranthene	6 / 16	0.05 : 17	0.028 - 0.56	AREA-4	1.1	59.8	No	BSL
Benzo(ghi)perylene	4 / 17	0.077 : 23	0.015 - 0.17	SS-400	1.7	119	No	BSL
Benzo(k)fluoranthene	4 / 17	0.046 : 23	0.039 - 0.19	SS-400	1.6	148	No	BSL
Benzoic Acid	4 / 17	0.2 : 110	2 - 34	SB-453	7.5	219	No	BSL
Biphenyl	1 / 12	0.04 : 23	0.032 - 0.032	SB-519	2.0	60	No	BSL
Bis(2-Ethylhexyl)phthalate	12 / 17	0.36 : 4	0.022 - 340	SB-518	22	0.925	Yes	ASL
Butylbenzylphthalate	1 / 17	0.04 : 23	0.061 - 0.061	AREA-4	1.7	0.239	No	BSL
Chrysene	9 / 17	0.36 : 23	0.024 - 0.64	AREA-4	1.7	4.73	No	BSL
Dibenz(a,h)anthracene	3 / 13	0.04 : 1.9	0.074 - 0.31	SS-400	0.28	18.4	No	BSL
Di-n-butylphthalate	1 / 17	0.046 : 110	0.034 - 0.034	AREA-4	4.2	200	No	BSL
Diphenyl ether	1 / 12	0.04 : 23	0.12 - 0.12	SB-519	2.1	NA	Yes	NSL
Fluoranthene	9 / 17	0.36 : 23	0.037 - 0.94	AREA-4	1.7	0.1	Yes	ASL
Indeno(1,2,3-cd)pyrene	6 / 16	0.05 : 17	0.032 - 0.2	AREA-4	1.0	109	No	BSL
Naphthalene	1 / 17	0.04 : 41	0.066 - 0.066	AREA-4	2.7	0.0994	No	BSL
N-Nitrosodiphenylamine	2 / 17	0.046 : 23	0.02 - 0.11	SB-519	1.7	20	No	BSL
Phenanthrene	9 / 17	0.36 : 23	0.026 - 0.68	AREA-4	1.8	0.1	Yes	ASL
Pyrene	9 / 17	0.36 : 23	0.042 - 0.66	AREA-4	1.7	0.1	Yes	ASL
Pesticides (mg/kg)								
4,4'-DDD	1 / 3	0.045 : 0.21	0.039 - 0.039	AREA-4	0.056	0.0025	Yes	ASL
4,4'-DDE	1 / 3	0.045 : 0.21	0.049 - 0.049	AREA-4	0.059	0.0025	Yes	ASL
4,4'-DDT	1 / 3	0.045 : 0.21	0.68 - 0.68	AREA-4	0.27	0.021	Yes	ASL

Table 3.13-1
Selection of COPECs - Soil - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Metals (mg/kg)								
Aluminum	13 / 13		1,200 - 24,000	SB-406	8,715	50	Yes	ASL
Arsenic	13 / 14	5 : 5	1.7 - 15	SB-406	6.7	10	Yes	ASL
Barium	13 / 13		6.9 - 87	SB-435	35	330	No	BSL
Beryllium	9 / 12	0.3 : 1.5	0.1 - 0.9	SS-411	0.43	10	No	BSL
Cadmium	9 / 14	0.2 : 1	0.14 - 1.1	SS-415	0.51	0.36	Yes	ASL
Calcium	12 / 12		330 - 13,000	SS-415	2,786	EN	No	EN
Chromium	14 / 15	5 : 5	10 - 275	SWMU-27-101	39	0.4	Yes	ASL
Cobalt	12 / 12		1.1 - 5.9	SS-415	3.0	13	No	BSL
Copper	12 / 12		5.2 - 35	SS-400	17.9	28	Yes	ASL
Iron	13 / 13		710 - 36,000	SS-400	10,908	200	Yes	ASL
Lead	13 / 14	5 : 5	3.85 - 80	SS-415	40	11	Yes	ASL
Magnesium	12 / 12		110 - 1,500	SB-406	735	EN	No	EN
Manganese	12 / 12		13 - 100	SS-400	51	220	No	BSL
Mercury	8 / 14	0.05 : 0.76	0.01 - 0.35	SB-435	0.15	0.1	Yes	ASL
Nickel	12 / 12		3.2 - 13	SB-406	8.9	30	No	BSL
Potassium	11 / 12	620 : 620	230 - 1,100	SB-406	442	EN	No	EN
Selenium	4 / 14	0.5 : 5	0.93 - 3.6	SB-435	1.1	0.52	Yes	ASL
Silver	3 / 13	0.7 : 3.3	0.089 - 1	SS-415	0.73	2	No	BSL
Sodium	7 / 12	160 : 310	34 - 590	SB-453	137	EN	No	EN
Tin	9 / 9		4.1 - 34	SS-415	10.4	50	No	BSL
Vanadium	12 / 12		14 - 44	SS-402	24	2	Yes	ASL
Zinc	12 / 12		6.7 - 140	SB-435	49	46	Yes	ASL
Inorganics (mg/kg)								
Chloride	4 / 12	26 : 48	25.85 - 550	SB-453	79	8.7	Yes	ASL
Nitrogen, as Ammonia	12 / 12		23 - 1,200	SB-435	439	NA	Yes	NSL
Sulfate	3 / 12	52 : 210	4.2 - 37	AREA-3	41	46	No	BSL

Prepared by: KJC 03/24/13
Checked by: SFR 3/26/2013
Revised: SFR 6/28/2013
Checked by: EYM 7/24/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Screening benchmarks were selected in Table 3.12-1.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level

Table 3.13-2
Selection of COPECs - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/kg)								
1,1,1-Trichloroethane	3 / 56	0.0026 : 1	0.012 - 0.071	A9CW-3	0.068	29.8	No	BSL
1,2,4-Trichlorobenzene	1 / 40	0.0026 : 1	0.098 - 0.098	DB-C1	0.093	20	No	BSL
1,2,4-Trimethylbenzene	1 / 40	0.0026 : 1	0.21 - 0.21	DB-C1	0.096	1.4	No	BSL
1,3,5-Trimethylbenzene	1 / 40	0.0026 : 1	0.13 - 0.13	DB-C1	0.094	1.4	No	BSL
2,4,4-Trimethyl-1-pentene	2 / 52	0.0052 : 0.79	0.002 - 0.088	A8CW-4	0.048	1.2	No	BSL
2,4,4-Trimethyl-2-pentene	1 / 52	0.0052 : 0.79	0.022 0.022	A8CW-5	0.047	1.2	No	BSL
Acetaldehyde	1 / 6	0.23 : 0.36	0.046 - 0.046	SS-457	0.12	NA	Yes	NSL
Acetone	2 / 56	0.006 : 20	0.021 - 0.081	SS-461	1.3	2.5	No	BSL
Formaldehyde	6 / 6		0.18 - 0.57	SS-440	0.28	83.3	No	BSL
Methylene chloride	3 / 56	0.004 : 1.6	0.002 - 0.44	DB-C1 SD-C42B	0.11	4.05	No	BSL
Tetrachloroethene	2 / 56	0.0026 : 1	0.001 - 0.015	SWMU-33-102	0.066	0.01	No	FOD
Toluene	3 / 56	0.0026 : 1	0.001 - 0.038	SWMU-33-102	0.067	200	No	BSL
Trichloroethene	1 / 56	0.0026 : 1	0.007 - 0.007	A9CW-3	0.066	0.001	No	FOD
Xylenes (m&p)	1 / 40	0.0052 : 1	0.011 - 0.011	SWMU-33-102	0.092	NA	No	FOD
Xylenes, Total	1 / 56	0.0052 : 1	0.011 - 0.011	SWMU-33-102	0.067	0.05	No	BSL
Semivolatile Organics (mg/kg)								
2-Methylnaphthalene	2 / 79	0.036 : 32	0.007 - 0.038	AREA-9	0.80	3.24	No	BSL
2-Methylphenol	1 / 76	0.036 : 32	0.02 - 0.02	BS018	0.95	40.4	No	BSL
Acenaphthylene	5 / 79	0.036 : 32	0.008 - 3.9	BS042	0.88	682	No	BSL
Acetophenone	2 / 19	0.036 : 1.5	0.013 - 0.021	SS-442	0.22	300	No	BSL
Anthracene	10 / 79	0.036 : 32	0.005 - 0.073	BS045	0.75	0.1	No	BSL
Benzaldehyde	12 / 14	0.35 : 0.41	0.012 - 1.2	SS-456	0.24	NA	Yes	NSL
Benzo(a)anthracene	14 / 77	0.036 : 8.8	0.012 - 1.1	BS045	0.48	5.21	No	BSL
Benzo(a)pyrene	18 / 69	0.036 : 0.89	0.011 - 3.4	SDF-4	0.33	0.1	Yes	ASL
Benzo(b)fluoranthene	16 / 77	0.036 : 8.8	0.013 - 1.065	BS041	0.49	59.8	No	BSL
Benzo(ghi)perylene	14 / 79	0.036 : 32	0.015 - 8.4	SDF-6	0.96	119	No	BSL
Benzo(k)fluoranthene	12 / 79	0.036 : 32	0.012 - 0.355	BS041	0.80	148	No	BSL
Benzoic Acid	8 / 75	0.18 : 160	0.07 - 1.2	BS043	4.6	219	No	BSL
Bis(2-Ethylhexyl)phthalate	56 / 76	0.043 : 0.98	0.014 - 200	BS015	9.0	0.925	Yes	ASL
Carbazole	1 / 18	0.036 : 0.89	0.02 - 0.02	SS-432	0.12	21	No	BSL
Chrysene	18 / 79	0.043 : 32	0.013 - 0.87	BS041	0.83	4.73	No	BSL
Dibenz(a,h)anthracene	5 / 69	0.036 : 1.3	0.021 - 0.25	SS-459	0.22	18.4	No	BSL
Diethylphthalate	5 / 76	0.021 : 32	0.013 - 0.085	BS016	0.91	100	No	BSL
Di-n-butylphthalate	10 / 76	0.036 : 23	0.013 - 3	SD-C42B	0.69	200	No	BSL
Di-n-octylphthalate	1 / 75	0.036 : 32	0.012 - 0.012	A8CW-3	0.96	709	No	BSL
Fluoranthene	24 / 79	0.061 : 32	0.011 - 1.9	BS045	0.85	0.1	Yes	ASL
Fluorene	2 / 79	0.036 : 32	0.008 - 0.028	SS-432	0.79	30	No	BSL
Indeno(1,2,3-cd)pyrene	14 / 77	0.036 : 8.8	0.022 - 0.725	BS041	0.48	109	No	BSL
Naphthalene	4 / 79	0.088 : 32	0.008 - 0.21	SS-458	0.82	0.0994	Yes	ASL
N-Nitrosodiphenylamine	2 / 76	0.036 : 23	0.55 - 2.8	BS015	0.75	20	No	BSL

Table 3.13-2
Selection of COPECs - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Phenanthrene	17 / 79	0.044 : 32	0.012 - 0.69	BS045	0.78	0.1	Yes	ASL
Pyrene	24 / 78	0.061 : 32	0.013 - 1.3	BS041 BS045	0.82	0.1	Yes	ASL
Pesticides (mg/kg)								
4,4'-DDD	6 / 34	0.0042 : 0.13	0.00012 - 0.16	BS045	0.021	0.0025	Yes	ASL
4,4'-DDE	11 / 34	0.0042 : 0.13	0.00053 - 0.011	BS018	0.017	0.0025	Yes	ASL
4,4'-DDT	18 / 34	0.012 : 0.13	0.0014 - 0.15	BS045	0.025	0.021	Yes	ASL
Aldrin	2 / 34	0.0022 : 0.13	0.000098 - 0.0019	A9CW-(COMP)	0.015	0.0025	No	BSL
Alpha-BHC	3 / 34	0.0022 : 0.13	0.0002 - 0.0058	BS015	0.015	0.0025	Yes	ASL
Alpha-Chlordane	2 / 16	0.0022 : 0.19	0.00034 - 0.00079	BS018	0.010	2.6	No	BSL
Beta-BHC	1 / 34	0.0022 : 0.33	0.00013 - 0.00013	AREA-8-2	0.025	0.001	No	BSL
Chlordane (technical)	3 / 16	0.0022 : 0.19	0.00028 - 0.036	DB-C1	0.012	2.6	No	BSL
Delta-BHC	2 / 34	0.0022 : 0.13	0.0015 - 0.031	DB-C1	0.016	9.94	No	BSL
Dieldrin	8 / 34	0.0042 : 0.13	0.00055 - 0.0025	BS018	0.017	0.0049	No	BSL
Endosulfan I	3 / 34	0.0022 : 0.13	0.0021 - 0.034	BS042	0.016	0.119	No	BSL
Endrin ketone	1 / 21	0.0042 : 0.065	0.0014 - 0.0014	BS019	0.010	3.2	No	BSL
Gamma-BHC/Lindane	5 / 34	0.0022 : 0.13	0.00011 - 0.13	DB-C1	0.019	0.00005	Yes	ASL
Heptachlor epoxide	2 / 34	0.0022 : 0.13	0.000078 - 0.00041	BS020	0.015	0.152	No	BSL
PCBs (mg/kg)								
Aroclor-1016	1 / 10	0.1 : 0.19	0.98 - 0.98	SWMU-33	0.15	1.9	No	BSL
Metals (mg/kg)								
Aluminum	43 / 43	0 : 0	640 - 59,000	SWMU-33	7,016	50	Yes	ASL
Antimony	1 / 34	0.61 : 20	79 - 79	SWMU-33	3.8	0.27	No	FOD
Arsenic	40 / 53	0.9 : 21	2 - 32	SD-C42B	7.6	10	Yes	ASL
Barium	46 / 46	0 : 0	3.4 - 120	BS045	20	330	No	BSL
Beryllium	17 / 34	0.18 : 1.5	0.06 - 4	SWMU-33	0.47	10	No	BSL
Cadmium	18 / 60	0.1 : 4	0.026 - 5.8	SWMU-33	0.42	0.36	Yes	ASL
Calcium	34 / 34	0 : 0	68 - 21,000	CPDA-8	1,982	EN	No	EN
Chromium	86 / 86	0 : 0	1.1 - 5,000	SWMU-33	272	0.4	Yes	ASL
Chromium, Hexavalent	2 / 29	1.1 : 95	8.9 - 95	SS-437	11	81	Yes	BSL
Cobalt	31 / 34	0.24 : 5.4	0.16 - 45.5	BS041	5.0	13	Yes	ASL
Copper	33 / 34	1 : 1	0.94 - 79.5	BS041	14	28	Yes	ASL
Iron	43 / 43	0 : 0	81 - 100,000	SWMU-33	8,973	200	Yes	ASL
Lead	59 / 60	7.6 : 7.6	1.5 - 210	AREA-9	24	11	Yes	ASL
Magnesium	34 / 34	0 : 0	24 - 3,500	SS-457	644	EN	No	EN
Manganese	34 / 34	0 : 0	2.8 - 1035	BS041	84	220	Yes	ASL
Mercury	23 / 55	0.04 : 0.32	0.034 - 0.49	BS043	0.12	0.1	Yes	ASL
Nickel	33 / 34	5 : 5	0.66 - 67	SWMU-33	10	30	Yes	ASL
Potassium	29 / 34	220 : 2100	46.3 - 2,000	SS-457	457	EN	No	EN
Selenium	1 / 55	0.5 : 20	1.5 - 1.5	BS015	1.4	0.52	No	FOD
Silver	4 / 43	0.6 : 21	0.18 - 0.99	SS-440	1.4	2	No	BSL
Sodium	23 / 34	66 : 1100	23 - 2,250	BS041	226	EN	No	EN

Table 3.13-2
Selection of COPECs - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Thallium	1 / 34	0.6 : 5.4	0.8 - 0.8	AREA-9	1.0	1	No	BSL
Tin	13 / 14	6.4 : 6.4	1 - 35	SS-440	8.7	50	No	BSL
Vanadium	34 / 34	0 : 0	4.1 - 54	SWMU-33-102	17	2	Yes	ASL
Zinc	29 / 34	11 : 27	1.2 - 180	SWMU-33	23	46	Yes	ASL
Inorganics (mg/kg)								
Chloride	5 / 19	16 : 33	26.3 - 560	SWMU-33	54	8.7	Yes	ASL
Cyanide, Total	6 / 7	2 : 2	3.7 - 9.05	BS041	5.8	0.9	Yes	ASL
Nitrogen, as Ammonia	32 / 32	0 : 0	27 - 1,800	BS044	262	NA	Yes	NSL
Sulfate	15 / 27	31 : 66	13.4 - 23,900	CPDA-8	1,095	46	Yes	ASL
EPH (mg/kg)								
C11-C22 Aromatics	8 / 12	3.6 : 3.7	6.8 - 130	SDF-5	32	NA	Yes	NSL
C19-C36 Aliphatics	7 / 12	3.6 : 3.8	5.9 - 190	SDF-5	42	NA	Yes	NSL
C9-C18 Aliphatics	5 / 12	3.4 : 3.8	6.7 - 17	SDF-5 SDF-6	6.5	NA	Yes	NSL

Prepared by: KJC 03/24/13
Checked by: SFR 3/26/2013
Revised: SFR 6/28/2013
Checked by: EYM 7/11/2013
Revised: SFR 2/5/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Screening benchmarks were selected in Table 3.12-1.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbons
FOD - Frequency of Detection
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PCBs - Polychlorinated Biphenyls

Table 3.13-3
Selection of COPECs - Soil - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-2-pentene	1 / 9	0.008 : 0.56	0.0056 - 0.0056	SS-445	0.061	1.2	No	BSL
Acetaldehyde	3 / 3		0.048 - 0.13	SS-447	0.082	NA	Yes	NSL
Formaldehyde	3 / 3		0.47 - 1.1	SS-447	0.69	83.3	No	BSL
Semivolatile Organics (mg/kg)								
1,2-Dichlorobenzene	1 / 11	0.046 : 33	0.21 - 0.21	SS-439	2.8	2.96	No	BSL
1,4-Dichlorobenzene	1 / 11	0.046 : 33	0.053 - 0.053	SS-439	2.7	20	No	BSL
1-Methylnaphthalene	4 / 10	0.046 : 0.063	0.023 - 0.062	SS-447	0.034	16.4	No	BSL
2-Methylnaphthalene	4 / 13	0.046 : 2.6	0.026 - 0.075	SS-447	0.23	3.24	No	BSL
3-Nitroaniline	1 / 10	0.28 : 170	0.073 - 0.073	SS-446	15.3	3.16	No	BSL
Acenaphthylene	2 / 13	0.046 : 2.6	0.058 - 0.063	SS-445	0.23	682	No	BSL
Acetophenone	2 / 10	0.046 : 0.99	0.018 - 0.17	SS-445	0.089	300	No	BSL
Aniline	1 / 12	0.046 : 170	0.12 - 0.12	SS-445	12.7	NA	Yes	NSL
Anthracene	1 / 12	0.046 : 2.6	0.044 - 0.044	SS-445	0.23	0.1	No	BSL
Benzaldehyde	10 / 10		0.029 - 0.33	SS-445	0.12	NA	Yes	NSL
Benzo(a)anthracene	2 / 12	0.046 : 2.6	0.069 - 2.3	BS040	0.42	5.21	No	BSL
Benzo(a)pyrene	4 / 10	0.056 : 0.07	0.014 - 0.44	BS040	0.072	0.1	Yes	ASL
Benzo(b)fluoranthene	3 / 12	0.046 : 2.6	0.025 - 0.6	BS040	0.27	59.8	No	BSL
Benzo(ghi)perylene	4 / 12	0.046 : 2.6	0.023 - 2.3	SDF-2	0.36	119	No	BSL
Benzo(k)fluoranthene	4 / 12	0.046 : 2.6	0.022 - 0.24	BS040	0.25	148	No	BSL
Biphenyl	2 / 10	0.046 : 0.07	0.86 - 0.93	SB-528	0.20	60	No	BSL
Bis(2-Ethylhexyl)phthalate	11 / 14	0.057 : 0.28	0.026 - 216	SDF-1	31	0.925	Yes	ASL
Carbazole	2 / 10	0.046 : 0.07	0.039 - 0.086	SS-445	0.036	21	No	BSL
Chrysene	3 / 12	0.046 : 2.6	0.029 - 0.56	BS040	0.28	4.73	No	BSL
Dibenzofuran	6 / 12	0.056 : 33	0.022 - 1.2	SS-447	2.6	1.9	No	BSL
Di-n-butylphthalate	1 / 12	0.046 : 33	0.98 - 0.98	SS-445	2.6	200	No	BSL
Diphenyl ether	2 / 10	0.046 : 0.07	1.6 - 1.9	SB-528	0.37	NA	Yes	NSL
Fluoranthene	10 / 13	0.056 : 2.2	0.018 - 2.6	SDF-1	0.44	0.1	Yes	ASL
Indeno(1,2,3-cd)pyrene	2 / 11	0.046 : 2.2	0.027 - 13	SDF-1	1.3	109	No	BSL
Naphthalene	5 / 13	0.056 : 2.6	0.021 - 0.082	SS-447	0.24	0.0994	No	BSL
N-Nitrosodi-n-propylamine	1 / 12	0.046 : 33	0.26 - 0.26	SS-445	2.5	NA	Yes	NSL
N-Nitrosodiphenylamine	3 / 13	0.046 : 33	0.63 - 1.3	SB-528	2.5	20	No	BSL
Phenanthrene	9 / 13	0.056 : 2.6	0.023 - 0.41	BS040	0.26	0.1	Yes	ASL
Phenol	2 / 12	0.046 : 33	0.024 - 0.24	SS-445	2.5	30	No	BSL
Pyrene	7 / 13	0.056 : 2.6	0.024 - 0.79	BS040	0.28	0.1	Yes	ASL
Pesticides (mg/kg)								
4,4'-DDT	1 / 1		0.045 - 0.045	BS040	0.045	0.021	Yes	ASL
Hexachlorobenzene	1 / 1		0.029 - 0.029	BS040	0.029	0.0025	Yes	ASL
Metals (mg/kg)								
Aluminum	9 / 9		2,500 - 43,000	BS040	10,789	50	Yes	ASL
Antimony	2 / 7	0.92 : 6.9	0.29 - 0.34	SS-441	0.88	0.27	Yes	ASL
Arsenic	10 / 11	37 : 37	4.5 - 42	SS-445	19.4	10	Yes	ASL

Table 3.13-3
Selection of COPECs - Soil - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Barium	11 / 11		5.5 - 130	SS-445	31	330	No	BSL
Beryllium	8 / 8		0.061 - 2.8	BS040	0.59	10	No	BSL
Cadmium	6 / 10	0.36 : 4	0.093 - 0.52	SS-444	0.65	0.36	Yes	ASL
Calcium	9 / 9		190 - 1,100	SS-445	496	EN	No	EN
Chromium	42 / 43	10 : 10	7.2 - 62,000	SOLSD06	6,648	0.4	Yes	ASL
Chromium, Hexavalent	4 / 16	2.8 : 110	19 - 1,100	SS-445	79	81	Yes	ASL
Cobalt	9 / 9		0.91 - 10	BS040	3.2	13	No	BSL
Copper	9 / 9		3.8 - 190	SS-445	38	28	Yes	ASL
Iron	9 / 9		3,700 - 31,000	BS040	14,067	200	Yes	ASL
Lead	11 / 11		27 - 150	SS-445	71	11	Yes	ASL
Magnesium	9 / 9		82 - 1,000	BS040	538	EN	No	EN
Manganese	9 / 9		9 - 170	BS040	49	220	No	BSL
Mercury	10 / 11	0.16 : 0.16	0.047 - 3.1	SS-445	0.64	0.1	Yes	ASL
Nickel	9 / 9		2.1 - 16	BS040	8.4	30	No	BSL
Potassium	8 / 9	1400 : 1,400	240 - 2,200	SS-445	669	EN	No	EN
Silver	2 / 11	0.75 : 19	10 - 1,100	SS-445	103	2	Yes	ASL
Thallium	1 / 8	1.5 : 3.5	7.4 - 7.4	SS-445	1.9	1	Yes	ASL
Tin	8 / 9	7.5 : 7.5	4.5 - 26,000	SS-445	2924	50	Yes	ASL
Vanadium	9 / 9		12 - 150	SS-445	39	2	Yes	ASL
Zinc	9 / 9		3.4 - 47	BS040	17.0	46	Yes	ASL
Inorganics (mg/kg)								
Cyanide, Total	1 / 1		6.5 - 6.5	BS040	6.5	0.9	Yes	ASL
Nitrogen, as Ammonia	9 / 9		150 - 1,100	SS-445	406	NA	Yes	NSL
Sulfate	2 / 8	56 : 150	120 - 230	SS-445	74	46	Yes	ASL
EPH (mg/kg)								
C11-C22 Aromatics	2 / 2		1,400 - 7,500	SDF-1	4450	NA	Yes	NSL
C19-C36 Aliphatics	2 / 2		1,800 - 4,900	SDF-1	3350	NA	Yes	NSL
C9-C18 Aliphatics	2 / 2		200 - 780	SDF-1	490	NA	Yes	NSL

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Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Screening benchmarks were selected in Table 3.12-1.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbons
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level

Table 3.13-4
Selection of COPECs - Surface Water - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/L)								
1,3-Dichlorobenzene	2 / 12	0.001 : 0.001	0.0003 - 0.00057	PZ-17RR	0.00049	0.071	No	BSL
2,4,4-Trimethyl-1-pentene	9 / 12	0.001 : 0.001	0.0014 - 0.01	PZ-17RR	0.0033	0.015	No	BSL
2,4,4-Trimethyl-2-pentene	5 / 12	0.001 : 0.001	0.00044 - 0.002	PZ-17RR	0.00069	0.018	No	BSL
2-Butanone	2 / 12	0.01 : 0.01	0.0071 - 0.025	SD-1	0.0068	14	No	BSL
Acetone	2 / 12	0.05 : 0.05	0.0084 - 0.012	SD-1	0.023	1.5	No	BSL
Bromodichloromethane	3 / 12	0.0005 : 0.001	0.00021 - 0.00051	PZ-17RR	0.00036	14.1	No	BSL
Bromoform	8 / 12	0.001 : 0.001	0.00067 - 0.0034	PZ-17RR	0.0013	0.32	No	BSL
Carbon disulfide	3 / 12	0.01 : 0.01	0.00021 - 0.000605	ISCO1	0.0039	0.00092	No	BSL
Chlorodibromomethane	6 / 12	0.0005 : 0.0005	0.00048 - 0.0038	PZ-17RR	0.0014	15.1	No	BSL
Chloroform	6 / 12	0.001 : 0.001	0.00027 - 0.0012	PZ-17RR	0.00057	0.028	No	BSL
Dibromomethane	6 / 12	0.001 : 0.001	0.00032 - 0.0011	PZ-17RR	0.00058	0.15	No	BSL
Formaldehyde	5 / 10	0.03 : 0.03	0.0145 - 0.021	PZ-16RR	0.016	3.9	No	BSL
Toluene	2 / 12	0.001 : 0.001	0.00046 - 0.00048	PZ-17RR	0.00050	0.0098	No	BSL
Semivolatile Organics (mg/L)								
2-Nitrophenol	7 / 12	0.00096 : 0.0045	0.00057 - 0.0018	PZ-17RR	0.0012	3.5	No	BSL
4-Nitrophenol	4 / 12	0.0045 : 0.005	0.00072 - 0.0021	PZ-17RR	0.0021	0.3	No	BSL
Azobenzene	2 / 12	0.00096 : 0.005	0.00046 - 0.00053	PZ-17RR	0.0017	NA	Yes	NSL
Benzo(a)pyrene	1 / 12	0.00018 : 0.00099	0.00015 - 0.00015	ISCO2	0.00016	0.000014	Yes	ASL
Benzoic Acid	7 / 10	0.0045 : 0.0045	0.0018 - 0.0021	SD-1 PZ-17RR	0.0020	0.042	No	BSL
Bis(2-Ethylhexyl)phthalate	2 / 11	0.0018 : 0.0089	0.0018 - 0.0061	ISCO2	0.0024	0.003	Yes	ASL
Di-n-octylphthalate	1 / 12	0.00096 : 0.005	0.00083 - 0.00083	ISCO1	0.0019	0.022	No	BSL
Diphenyl ether	4 / 12	0.00096 : 0.005	0.00056 - 0.0011	PZ-17RR	0.0015	0.25	No	BSL
Diphenylmethanone	4 / 12	0.00096 : 0.005	0.00052 - 0.0012	PZ-17RR	0.0015	1.5	No	BSL
N-Nitrosodimethylamine	12 / 12		0.0000215 - 0.0003	PZ-17RR	0.00012	0.117	No	BSL
N-Nitrosodi-n-propylamine	2 / 12	0.0000019 : 0.000021	0.0000049 - 0.0000093	PZ-17RR	0.0000035	NA	Yes	NSL
N-Nitrosodiphenylamine	2 / 12	0.00096 : 0.005	0.00047 - 0.00064	PZ-17RR	0.0017	0.21	No	BSL
Metals, Total (mg/L)								
Aluminum	131 / 132	0.2 : 0.2	0.076 - 280	SD-17	4.9	0.087	Yes	ASL
Antimony	1 / 12	0.006 : 0.006	0.0037 - 0.0037	ISCO1	0.0031	0.16	No	BSL
Arsenic	2 / 12	0.01 : 0.01	0.0031 - 0.0035	PZ-16RR	0.0047	0.15	No	BSL
Barium	12 / 12		0.013 - 0.032	ISCO1	0.024	0.004	Yes	ASL
Beryllium	5 / 12	0.001 : 0.001	0.0003 - 0.0011	PZ-17RR	0.00061	0.00066	Yes	ASL
Calcium	12 / 12		23 - 81	SD-1	53	EN	No	EN
Chromium [d]	132 / 132		0.0085 - 64	SD-17	1.1	0.12	Yes	ASL
Cobalt	12 / 12		0.0053 - 0.05	PZ-17RR	0.028	0.023	Yes	ASL
Copper [d]	12 / 12		0.00021 - 0.026	PZ-17RR	0.0090	0.019	Yes	ASL
Iron	12 / 12		1.5 - 13	ISCO2	5.9	1	Yes	ASL
Lead [d]	10 / 12	0.0001 : 0.001	0.00028 - 0.0021	ISCO2	0.00063	0.0018	Yes	ASL

Table 3.13-4
Selection of COPECs - Surface Water - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Magnesium	12 / 12		3.3 - 17	SD-1 PZ-17RR	10.9	EN	No	EN
Manganese	12 / 12		0.5 - 2.2	PZ-17RR	1.5	0.12	Yes	ASL
Mercury	1 / 13	0.0002 : 0.0002	0.00029 - 0.00029	PZ-16RR	0.00011	0.00077	No	BSL
Nickel [d]	12 / 12		0.00415 - 0.057	PZ-17RR	0.031	0.084	No	BSL
Potassium	12 / 12		1.3 - 3.4	PZ-17RR	2.3	EN	No	EN
Silver	1 / 12	0.0001 : 0.001	0.000017 - 0.000017	SD-1	0.00027	0.000012	Yes	ASL
Sodium	132 / 132		47 - 320	ISCO2 PZ-17RR	125	EN	No	EN
Thallium	1 / 12	0.01 : 0.01	0.0031 - 0.0031	ISCO1	0.0048	0.004	No	BSL
Vanadium	1 / 12	0.01 : 0.01	0.0022 - 0.0022	PZ-17RR	0.0048	0.02	No	BSL
Zinc [d]	12 / 12		0.017 - 0.097	PZ-17RR	0.056	0.17	No	BSL
Metals, Filtered (mg/L)								
Aluminum	120 / 120	0.017 : 0.2	0.02 - 22	PZ-17RR	0.69	0.087	Yes	ASL
Chromium	120 / 120		0.004 - 5	PZ-17RR	0.20	0.10	Yes	ASL
Sodium	120 / 120		55 - 330	ISCO2	132	EN	No	EN
Inorganics (mg/L)								
Bromide	10 / 12	0.2 : 0.2	0.14 - 0.48	PZ-17RR	0.32	NA	Yes	NSL
Chloride	132 / 132		60 - 300	SD-1	164	230	Yes	ASL
Nitrate as N	127 / 132	0.05 : 0.05	0.078 - 6	SD-1 SD-17	1.2	166	No	BSL
Nitrite as N	12 / 126	0.01 : 0.1	0.01 - 0.043	SD-1	0.031	NA	Yes	NSL
Nitrogen, as Ammonia [e]	132 / 132		14 - 250	ISCO2	56	3.0	Yes	ASL
Sulfate	132 / 132		63 - 1,300	ISCO2	341	29,479	No	BSL
Specialty Compounds (mg/L)								
Hydrazine	2 / 10	0.0001 : 0.0001	0.000076 - 0.00008	ISCO2	0.000056	0.01	No	BSL
4,4'-Isopropylidenediphenol	3 / 9	0.00094 : 0.00098	0.00065 - 0.00096	PZ-16RR	0.00059	3.16	No	BSL
4-Nonylphenol (Tech.)	7 / 9	0.0047 : 0.0048	0.0056 - 0.018	PZ-17RR	0.0098	0.024	No	BSL
Kempore (Azodicarbonamide)	3 / 10	1 : 1.1	1.1 - 1.4	SD-1	0.73	2.89	No	BSL

Prepared by: KJC 03/25/13
Checked by: SFR 3/27/2013
Revised by: SFR 7/8/2013
Checked by: EYM 7/11/2013
Revised by: SFR 2/5/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 3.13-5
Selection of COPECs - Surface Water - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Metals, Total (mg/L)								
Aluminum	1 / 1		0.21 - 0.21	SD-501	0.21	0.087	Yes	ASL
Barium	1 / 1		0.049 - 0.049	SD-501	0.049	0.004	Yes	ASL
Calcium	1 / 1		190 - 190	SD-501	190	EN	No	EN
Chromium [d]	1 / 1		0.0085 - 0.0085	SD-501	0.0085	0.30	No	BSL
Cobalt	1 / 1		0.0012 - 0.0012	SD-501	0.0012	0.023	No	BSL
Copper [d]	1 / 1		0.0018 - 0.0018	SD-501	0.0018	0.05	No	BSL
Iron	1 / 1		0.43 - 0.43	SD-501	0.43	1	No	BSL
Lead [d]	1 / 1		0.0009 - 0.0009	SD-501	0.00090	0.0073	No	BSL
Magnesium	1 / 1		13 - 13	SD-501	13	EN	No	EN
Manganese	1 / 1		0.7 - 0.7	SD-501	0.70	0.12	Yes	ASL
Nickel [d]	1 / 1		0.0053 - 0.0053	SD-501	0.0053	0.21	No	BSL
Potassium	1 / 1		7.6 - 7.6	SD-501	7.6	EN	No	EN
Silver	1 / 1		0.000015 - 0.000015	SD-501	0.000015	0.000012	Yes	ASL
Sodium	1 / 1		68 - 68	SD-501	68	EN	No	EN
Zinc [d]	1 / 1		0.04 - 0.04	SD-501	0.040	0.43	No	BSL
Inorganics (mg/L)								
Bromide	1 / 1		0.13 - 0.13	SD-501	0.13	NA	Yes	NSL
Chloride	1 / 1		52 - 52	SD-501	52	230	No	BSL
Nitrate as N	1 / 1		3.6 - 3.6	SD-501	3.6	166	No	BSL
Nitrite as N	1 / 1		0.075 - 0.075	SD-501	0.075	NA	Yes	NSL
Nitrogen, as Ammonia [e]	1 / 1		28 - 28	SD-501	28	3.0	Yes	ASL
Sulfate	1 / 1		460 - 460	SD-501	460	29,479	No	BSL

Prepared by: KJC 03/25/13
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Checked by: EYM 7/11/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 3.13-6
Selection of COPECs - Surface Water - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Semivolatile Organics (mg/L)								
N-Nitrosodimethylamine	1 / 1		0.0000032 - 0.0000032	SD-503	0.0000032	0.117	No	BSL
N-Nitrosodiphenylamine	1 / 1		0.0000074 - 0.0000074	SD-503	0.0000074	NA	Yes	NSL
Metals, Total (mg/L)								
Aluminum	1 / 1		0.9 - 0.9	SD-503	0.90	0.087	Yes	ASL
Barium	1 / 1		0.026 - 0.026	SD-503	0.026	0.004	Yes	ASL
Calcium	1 / 1		53 - 53	SD-503	53	EN	No	EN
Chromium [d]	1 / 1		0.0068 - 0.0068	SD-503	0.0068	0.10	No	BSL
Chromium, Hexavalent	1 / 1		0.01 - 0.01	SD-503	0.010	0.011	No	BSL
Copper [d]	1 / 1		0.0027 - 0.0027	SD-503	0.0027	0.016	No	BSL
Iron	1 / 1		1.5 - 1.5	SD-503	1.5	1	Yes	ASL
Lead [d]	1 / 1		0.003 - 0.003	SD-503	0.0030	0.0014	Yes	ASL
Magnesium	1 / 1		2.4 - 2.4	SD-503	2.4	EN	No	EN
Manganese	1 / 1		0.12 - 0.12	SD-503	0.12	0.12	No	BSL
Nickel [d]	1 / 1		0.0014 - 0.0014	SD-503	0.0014	0.070	No	BSL
Potassium	1 / 1		4 - 4	SD-503	4.0	EN	No	EN
Silver	1 / 1		0.000056 - 0.000056	SD-503	0.000056	0.000012	Yes	ASL
Sodium	1 / 1		18 - 18	SD-503	18.0	EN	No	EN
Vanadium	1 / 1		0.002 - 0.002	SD-503	0.0020	0.02	No	BSL
Zinc [d]	1 / 1		0.01 - 0.01	SD-503	0.010	0.14	No	BSL
Inorganics (mg/L)								
Chloride	1 / 1		9 - 9	SD-503	9.0	230	No	BSL
Nitrate as N	1 / 1		0.084 - 0.084	SD-503	0.084	166	No	BSL
Nitrite as N	1 / 1		0.026 - 0.026	SD-503	0.026	NA	Yes	NSL
Nitrogen, as Ammonia [e]	1 / 1		7.5 - 7.5	SD-503	7.5	3.0	Yes	ASL
Sulfate	1 / 1		96 - 96	SD-503	96	29,479	No	BSL

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Checked by: EYM 7/11/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 3.13-7
Selection of COPECs - Surface Water - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/L)								
2,4,4-Trimethyl-1-pentene	3 / 6	0.001 : 0.001	0.00071 - 0.0071	OPWD-2	0.0020	0.015	No	BSL
2,4,4-Trimethyl-2-pentene	1 / 6	0.001 : 0.001	0.0019 - 0.0019	OPWD-2	0.00073	0.018	No	BSL
Carbon disulfide	3 / 6	0.01 : 0.01	0.001 - 0.0025	OPWD-2	0.0033	0.00092	Yes	ASL
Formaldehyde	3 / 4	0.03 0.03	0.0064 - 0.02	OPWD-1	0.013	3.9	No	BSL
Toluene	1 / 6	0.001 : 0.001	0.0005 - 0.0005	OPWD-2	0.00050	0.0098	No	BSL
Semivolatile Organics (mg/L)			-					
3 & 4 Methylphenol	2 / 6	0.0045 : 0.005	0.00073 - 0.00076	OPWD-2	0.0018	NA	Yes	NSL
4-Nitrophenol	1 / 6	0.0045 : 0.005	0.00075 - 0.00075	OPWD-SW-S	0.0020	0.3	No	BSL
Acenaphthene	1 / 6	0.00091 : 0.001	0.000047 - 0.000047	OPWD-2	0.00039	0.017	No	BSL
Benzo(a)anthracene	2 / 6	0.00027 : 0.0003	0.00024 - 0.002	OPWD-2	0.00047	0.000027	Yes	ASL
Benzo(a)pyrene	4 / 6	0.00018 : 0.0002	0.00012 - 0.0042	OPWD-2	0.00089	0.000014	Yes	ASL
Benzo(b)fluoranthene	4 / 6	0.00027 : 0.0003	0.00019 - 0.0077	OPWD-2	0.0016	0.0006	Yes	ASL
Benzo(ghi)perylene	3 / 6	0.00045 : 0.0005	0.00011 - 0.0046	OPWD-2	0.00099	0.0002	Yes	ASL
Benzo(k)fluoranthene	2 / 6	0.00027 : 0.0003	0.0005 - 0.0026	OPWD-2	0.00061	0.0006	Yes	ASL
Benzoic Acid	5 / 6	0.0045 : 0.0045	0.0019 - 0.0042	OPWD-2	0.0024	0.042	No	BSL
Chrysene	4 / 6	0.00091 : 0.001	0.00018 - 0.0053	OPWD-2	0.0012	0.0019	Yes	ASL
Dibenz(a,h)anthracene	1 / 6	0.00045 : 0.0005	0.0012 - 0.0012	OPWD-2	0.00039	0.0002	Yes	ASL
Di-n-octylphthalate	2 / 6	0.0045 : 0.005	0.00081 - 0.00087	OPWD-1	0.0018	0.022	No	BSL
Fluoranthene	4 / 6	0.00091 : 0.001	0.00023 - 0.0051	OPWD-2	0.0012	0.0398	No	BSL
Fluorene	1 / 6	0.00091 : 0.001	0.000056 - 0.000056	OPWD-2	0.00040	0.0039	No	BSL
Indeno(1,2,3-cd)pyrene	3 / 6	0.00045 : 0.0005	0.000098 - 0.004	OPWD-2	0.00088	0.0002	Yes	ASL
N-Nitrosodimethylamine	5 / 6	0.000038 : 0.000038	0.0000056 - 0.00011	OPWD-1	0.000049	0.117	No	BSL
Phenanthrene	4 / 6	0.00018 : 0.0002	0.000081 - 0.0025	OPWD-2	0.00053	0.0004	Yes	ASL
Phenol	1 / 6	0.0045 0.005	0.00051 - 0.00051	OPWD-2	0.0020	0.256	No	BSL
Pyrene	4 / 6	0.0045 : 0.005	0.00022 - 0.012	OPWD-2	0.0031	0.000025	Yes	ASL
Metals, Total (mg/L)								
Aluminum	6 / 6		0.1 - 1.6	OPWD-2	0.82	0.087	Yes	ASL
Arsenic	2 / 6	0.01 : 0.01	0.0038 - 0.012	OPWD-2	0.0060	0.15	No	BSL
Barium	6 / 6		0.026 - 0.046	OPWD-2	0.035	0.004	Yes	ASL
Beryllium	3 / 6	0.001 : 0.001	0.00017 - 0.00026	OPWD-1	0.00035	0.00066	No	BSL
Calcium	6 / 6		6.1 - 28	OPWD-SW-S	18.7	EN	No	EN
Chromium [d]	6 / 6		0.0061 - 0.13	OPWD-1	0.050	0.051	Yes	ASL
Cobalt	6 / 6		0.0033 - 0.018	OPWD-1	0.0097	0.023	No	BSL
Copper [d]	6 / 6		0.00079 - 0.0061	OPWD-2	0.0040	0.0078	No	BSL
Iron	6 / 6		5 - 30	OPWD-2	16.4	1	Yes	ASL
Lead [d]	6 / 6		0.00082 - 0.0058	OPWD-2	0.0027	0.00047	Yes	ASL
Magnesium	6 / 6		1.2 - 5.4	OPWD-1	3.5	EN	No	EN
Manganese	6 / 6		0.27 - 1.5	OPWD-1	0.85	0.12	Yes	ASL
Nickel [d]	6 / 6		0.0041 - 0.018	OPWD-1	0.0090	0.034	No	BSL

Table 3.13-7
Selection of COPECs - Surface Water - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Potassium	4 / 6	4 : 4	1.6 - 2.3	OPWD-1	2.0	EN	No	EN
Sodium	6 / 6		41 - 120	OPWD-1	81	EN	No	EN
Vanadium	4 / 6	0.01 : 0.01	0.0026 - 0.012	OPWD-2	0.0057	0.02	No	BSL
Zinc [d]	6 / 6		0.009 - 0.12	OPWD-2	0.038	0.069	Yes	ASL
Inorganics (mg/L)								
Bromide	5 / 6	0.1 : 0.1	0.1 - 0.21	OPWD-1	0.15	NA	Yes	NSL
Chloride	6 / 6		82 - 180	OPWD-1 OPWD-SW-S	139	230	No	BSL
Nitrate as N	1 / 6	0.05 : 0.05	0.069 - 0.069	OPWD-SW-S	0.032	166	No	BSL
Nitrite as N	1 / 6	0.01 : 0.1	0.02 - 0.02	OPWD-2	0.023	NA	Yes	NSL
Nitrogen, as Ammonia [e]	6 / 6		17 - 66	OPWD-1	45	3.0	Yes	ASL
Sulfate	6 / 6		66 - 360	OPWD-1	211	29,479	No	BSL

Prepared by: KJC 03/25/13
Checked by: SFR 3/27/2013
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Checked by: EYM 7/11/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 3.13-8
Selection of COPECs - Surface Water - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/L)								
Carbon disulfide	3 / 22	0.01 : 0.01	0.00027 - 0.00029	MMB-SW/SD-6	0.0044	0.00092	No	BSL
Cis-1,2-Dichloroethene	2 / 22	0.001 : 0.001	0.0002 - 0.00062	MMB-SW/SD-2	0.00049	0.59	No	BSL
Formaldehyde	10 / 22	0.03 : 0.03	0.005 - 0.01	MMB-SW/SD-4	0.012	3.9	No	BSL
Methyl Tertbutyl Ether	4 / 22	0.001 : 0.001	0.0002 - 0.00033	MMB-SW/SD-2	0.00046	11.07	No	BSL
Toluene	3 / 22	0.001 : 0.001	0.00034 - 0.00075	MMB-SW/SD-3	0.00050	0.0098	No	BSL
Trichloroethene	1 / 22	0.001 : 0.001	0.0004 - 0.0004	MMB-SW/SD-2	0.00050	0.047	No	FOD
Semivolatile Organics (mg/L)								
3 & 4 Methylphenol	1 / 22	0.0045 : 0.005	0.00074 - 0.00074	MMB-SW/SD-6	0.0022	NA	No	FOD
Benzo(a)pyrene	2 / 22	0.00018 : 0.0002	0.000096 - 0.00013	MMB-SW/SD-9	0.000094	0.000014	Yes	ASL
Benzo(b)fluoranthene	1 / 22	0.00027 : 0.0003	0.00013 - 0.00013	MMB-SW/SD-6	0.00014	0.0006	No	FOD
Benzo(ghi)perylene	1 / 22	0.00045 : 0.0005	0.000089 - 0.000089	MMB-SW/SD-6	0.00022	0.0002	No	FOD
Benzoic Acid	10 / 20	0.0045 : 0.0045	0.0019 - 0.0024	MMB-SW/SD-6	0.0021	0.042	No	BSL
Caprolactam	2 / 22	0.0045 : 0.005	0.00066 - 0.00066	MMB-SW/SD-3	0.0021	NA	Yes	NSL
Di-n-butylphthalate	5 / 22	0.0045 : 0.005	0.00056 - 0.00098	MMB-SW/SD-1	0.0019	0.035	No	BSL
Indeno(1,2,3-cd)pyrene	1 / 22	0.00045 : 0.0005	0.0002 - 0.0002	MMB-SW/SD-1	0.00023	0.0002	No	FOD
N-Nitrosodimethylamine	1 / 22	0.0000019 : 0.000038	4.7E-07 - 4.7E-07	MMB-SW/SD-1	0.0000041	0.117	No	FOD
N-Nitrosodi-n-propylamine	3 / 22	0.0000019 : 0.000038	4.4E-07 - 7.8E-07	MMB-SW/SD-1	0.0000041	NA	Yes	NSL
Phenol	1 / 22	0.0045 : 0.005	0.00083 - 0.00083	MMB-SW/SD-6	0.0022	0.256	No	FOD
Metals, Total (mg/L)								
Aluminum	18 / 22	0.1 : 0.1	0.012 - 1.8	MMB-SW/SD-6	0.17	0.087	Yes	ASL
Arsenic	2 / 22	0.01 : 0.01	0.0045 - 0.0048	MMB-SW/SD-6	0.0050	0.15	No	BSL
Barium	22 / 22		0.015 - 0.15	MMB-SW/SD-6	0.037	0.004	Yes	ASL
Cadmium [d]	1 / 22	0.001 : 0.001	0.00025 - 0.00025	MMB-SW/SD-6	0.00049	0.00072	No	FOD
Calcium	22 / 22		9.7 - 40	MMB-SW/SD-6	22	EN	No	EN
Chromium [d]	1 / 22	0.005 : 0.005	0.00098 - 0.00098	MMB-SW/SD-6	0.0024	0.058	No	FOD
Cobalt	5 / 22	0.01 : 0.01	0.0016 - 0.0077	MMB-SW/SD-6	0.0046	0.023	No	BSL
Copper [d]	18 / 22	0.0005 : 0.01	0.00077 - 0.054	MMB-SW/SD-6	0.0048	0.009	Yes	ASL
Iron	22 / 22		0.39 - 29	MMB-SW/SD-6	3.4	1	Yes	ASL
Lead [d]	18 / 22	0.0001 : 0.001	0.00016 - 0.11	MMB-SW/SD-6	0.0065	0.00058	Yes	ASL
Magnesium	22 / 22		2 - 5.9	MMB-SW/SD-6	3.9	EN	No	EN
Manganese	22 / 22		0.03 - 9.3	MMB-SW/SD-6	0.91	0.12	Yes	ASL
Nickel [d]	5 / 22	0.01 : 0.01	0.0012 - 0.0072	MMB-SW/SD-3	0.0046	0.039	No	BSL
Potassium	22 / 22		1.2 - 3.6	MMB-SW/SD-6	2.4	EN	No	EN
Sodium	22 / 22		29 - 110	MMB-SW/SD-11	65	EN	No	EN
Thallium	1 / 22	0.01 : 0.01	0.0066 - 0.0066	MMB-SW/SD-6	0.0051	0.004	No	FOD
Vanadium	2 / 22	0.01 : 0.01	0.0015 - 0.0037	MMB-SW/SD-6	0.0048	0.02	No	BSL
Zinc [d]	10 / 22	0.05 : 0.05	0.0071 - 0.069	MMB-SW/SD-6	0.022	0.079	No	BSL

Table 3.13-8
Selection of COPECs - Surface Water - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Inorganics (mg/L)								
Bromide	2 / 22	0.1 : 0.1	0.1 - 0.12	MMB-SW/SD-8	0.055	NA	Yes	NSL
Chloride	22 / 22		48 - 220	MMB-SW/SD-11	121	230	No	BSL
Nitrate as N	15 / 22	0.05 : 0.05	0.097 - 0.6	MMB-SW/SD-2	0.19	166	No	BSL
Nitrogen, as Ammonia [e]	14 / 22	0.1 : 0.1	0.1 - 2.5	MMB-SW/SD-6	0.30	3.0	No	BSL
Sulfate	22 / 22		3.2 - 39	MMB-SW/SD-6	15.1	29479	No	BSL
Specialty Compounds (mg/L)								
Hydrazine	1 / 22	0.0001 : 0.0001	0.00006 - 0.00006	MMB-SW/SD-8	0.000050	0.01	No	BSL
Kempore (Azodicarbonamide)	1 / 4	1 : 1	0.71 - 0.71	MMB-SW/SD-2	0.55	2.89	No	BSL

Prepared by: KJC 07/9/2013
Checked by: SFR 07/9/2013
Checked by: EYM 7/11/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
FOD - Frequency of Detection
mg/L - milligrams per liter
MMB - Maple Meadow Brook
NA - Not Available
NSL - No Screening Level

Table 3.13-9
Selection of COPECs - Surface Water - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/L)								
1,1-Dichloroethane	1 / 6	0.001 : 0.001	0.00028 - 0.00028	LB-3	0.00046	0.047	No	BSL
2-Butanone	1 / 6	0.01 : 0.01	0.0014 - 0.0014	LB-3	0.0044	14	No	BSL
4-iso-Propyltoluene	1 / 6	0.001 : 0.001	0.00025 - 0.00025	LB-3	0.00046	0.085	No	BSL
Carbon disulfide	1 / 6	0.01 : 0.01	0.00043 - 0.00043	LB-1	0.0042	0.00092	No	BSL
Methyl Tertbutyl Ether	6 / 6	:	0.0002 - 0.00056	LB-1	0.00039	11.07	No	BSL
Toluene	3 / 6	0.001 : 0.001	0.00036 - 0.0046	LB-3	0.0012	0.0098	No	BSL
Semivolatile Organics (mg/L)								
3 & 4 Methylphenol	1 / 6	0.0045 : 0.0045	0.0018 - 0.0018	LB-1	0.0022	NA	Yes	NSL
Benzo(a)anthracene	1 / 6	0.00027 : 0.00027	0.00052 - 0.00052	LB-1	0.00020	0.000027	Yes	ASL
Benzo(a)pyrene	2 / 6	0.00018 : 0.00018	0.00017 - 0.001	LB-1	0.00026	0.000014	Yes	ASL
Benzo(b)fluoranthene	2 / 6	0.00027 : 0.00027	0.00013 - 0.0015	LB-1	0.00036	0.0006	Yes	ASL
Benzo(ghi)perylene	1 / 6	0.00045 : 0.00045	0.0016 - 0.0016	LB-1	0.00045	0.0002	Yes	ASL
Benzo(k)fluoranthene	2 / 6	0.00027 : 0.00027	0.00015 - 0.00061	LB-1	0.00022	0.0006	Yes	ASL
Benzoic Acid	4 / 6	0.0045 : 0.0045	0.0019 - 0.0043	LB-1	0.0024	0.042	No	BSL
Benzyl alcohol	1 / 6	0.0091 : 0.0091	0.00076 - 0.00076	LB-1	0.0039	0.0086	No	BSL
Bis(2-Ethylhexyl)phthalate	1 / 6	0.0018 : 0.027	0.00074 - 0.00074	LB-1	0.0033	0.003	No	BSL
Chrysene	1 / 6	0.00091 : 0.00091	0.001 - 0.001	LB-1	0.00055	0.0019	No	BSL
Fluoranthene	1 / 6	0.00091 : 0.00091	0.001 - 0.001	LB-1	0.00055	0.0398	No	BSL
Indeno(1,2,3-cd)pyrene	2 / 6	0.00045 : 0.00045	0.0002 - 0.0012	LB-1	0.00038	0.0002	Yes	ASL
Phenanthrene	1 / 6	0.00018 : 0.00018	0.00041 - 0.00041	LB-1	0.00014	0.0004	Yes	ASL
Pyrene	1 / 6	0.0045 : 0.0045	0.0014 - 0.0014	LB-1	0.0021	0.000025	Yes	ASL
Metals, Total (mg/L)								
Aluminum	6 / 6	0.1 : 0.1	0.035 - 12	LB-1	2.4	0.087	Yes	ASL
Arsenic	6 / 6		0.0048 - 0.047	LB-3	0.022	0.15	No	BSL
Barium	6 / 6		0.039 - 0.26	LB-1	0.091	0.004	Yes	ASL
Cadmium [d]	1 / 6	0.001 : 0.001	0.0028 - 0.0028	LB-1	0.00088	0.001	Yes	ASL
Calcium	6 / 6		24 - 53	LB-1	38	EN	No	EN
Chromium [d]	6 / 6		0.0015 - 0.047	LB-1	0.013	0.087	No	BSL
Cobalt	3 / 6	0.01 : 0.01	0.0014 - 0.01	LB-1	0.0048	0.023	No	BSL
Copper [d]	6 / 6		0.0036 - 0.051	LB-1	0.016	0.014	Yes	ASL
Iron	6 / 6		1.6 - 33	LB-1	13.7	1	Yes	ASL
Lead [d]	5 / 6	0.001 : 0.001	0.00042 - 0.24	LB-1	0.049	0.0011	Yes	ASL
Magnesium	6 / 6		3.3 - 8.1	LB-1	5.28	EN	No	EN
Manganese	6 / 6		0.54 - 2.2	LB-3	1.2	0.12	Yes	ASL
Mercury	2 / 6	0.0002 : 0.0002	0.00027 - 0.00055	LB-1	0.00020	0.00091	No	BSL
Nickel [d]	3 / 6	0.01 : 0.01	0.0023 - 0.019	LB-1	0.0068	0.059	No	BSL
Potassium	6 / 6		1.4 - 8	LB-3	5.2	EN	No	EN
Sodium	6 / 6		81 - 190	LB-1	119	EN	No	EN
Tin	1 / 6	0.05 : 0.05	0.007 - 0.007	LB-1	0.022	0.073	No	BSL

Table 3.13-9
Selection of COPECs - Surface Water - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Vanadium	3 / 6	0.01 : 0.01	0.0047 - 0.038	LB-1	0.011	0.02	Yes	ASL
Zinc [d]	5 / 6	0.05 : 0.05	0.0073 - 0.5	LB-1	0.12	0.12	Yes	ASL
Inorganics (mg/L)								
Chloride	6 / 6		140 - 410	LB-1	232	230	Yes	ASL
Nitrate as N	4 / 6	0.05 : 0.05	0.13 - 0.94	LB-2	0.48	166	No	BSL
Nitrogen, as Ammonia [e]	6 / 6		0.52 - 8.7	LB-3	4.3	3.0	Yes	ASL
Sulfate	6 / 6		4.4 - 88	LB-1	33	29479	No	BSL

Prepared by: KJC 07/9/2013
Checked by: SFR 07/9/2013
Checked by: EYM 7/11/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 3.13-10
Selection of COPECs - Surface Water - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/L)								
Acetone	2 / 4	0.05 : 0.05	0.0035 - 0.004	SW/SD-603	0.014	1.5	No	BSL
Semivolatile Organics (mg/L)								
Acenaphthene	3 / 4	0.00095 : 0.00095	0.000038 - 0.00005	SW/SD-601	0.00015	0.017	No	BSL
Anthracene	1 / 4	0.00095 : 0.00095	0.000036 - 0.000036	SW/SD-603	0.00037	0.00073	No	BSL
Benzo(a)anthracene	2 / 4	0.00028 : 0.00028	0.000076 - 0.00012	SW/SD-603	0.00012	0.000027	Yes	ASL
Benzo(a)pyrene	2 / 4	0.00019 : 0.00019	0.00013 - 0.00017	SW/SD-603	0.00012	0.000014	Yes	ASL
Benzo(b)fluoranthene	2 / 4	0.00028 : 0.00028	0.00021 - 0.00027	SW/SD-603	0.00019	0.0006	No	BSL
Benzo(k)fluoranthene	2 / 4	0.00028 : 0.00028	0.000076 - 0.00015	SW/SD-603	0.00013	0.0006	No	BSL
Bis(2-Ethylhexyl)phthalate	4 / 4		0.00041 - 0.0026	SW/SD-602	0.0010	0.003	No	BSL
Butylbenzylphthalate	1 / 4	0.0047 : 0.0052	0.00072 - 0.00072	SW/SD-602	0.0020	0.019	No	BSL
Caprolactam	1 / 4	0.0047 : 0.0052	0.00033 - 0.00033	SW/SD-602	0.0019	NA	Yes	NSL
Chrysene	2 / 4	0.00095 : 0.00095	0.0002 - 0.00029	SW/SD-603	0.00036	0.0019	No	BSL
Diethylphthalate	2 / 4	0.0047 : 0.0052	0.000097 - 0.00013	SW/SD-601	0.0013	0.21	No	BSL
Di-n-butylphthalate	2 / 4	0.00046 : 0.0047	0.00036 - 0.00043	SW/SD-603	0.00084	0.035	No	BSL
Di-n-octylphthalate	1 / 4	0.0047 : 0.0052	0.0023 - 0.0023	SW/SD-602	0.0024	0.022	No	BSL
Fluoranthene	2 / 4	0.00095 : 0.00095	0.00051 - 0.00063	SW/SD-603	0.00052	0.0398	No	BSL
Fluorene	1 / 4	0.00095 : 0.00095	0.000079 - 0.000079	SW/SD-603	0.00038	0.0039	No	BSL
Pyrene	3 / 4	0.0047 : 0.0047	0.000094 - 0.00039	SW/SD-602	0.00080	0.000025	Yes	ASL
Metals, Total (mg/L)								
Aluminum	3 / 4	0.2 : 0.2	0.11 - 0.22	SW/SD-602	0.15	0.087	Yes	ASL
Barium	4 / 4		0.026 - 0.041	SW/SD-600	0.034	0.004	Yes	ASL
Calcium	4 / 4		23 - 56.5	SW/SD-600	36	EN	No	EN
Chromium [d]	4 / 4		0.001 - 0.0043	SW/SD-603	0.0025	0.081	No	BSL
Copper [d]	4 / 4		0.0019 - 0.0039	SW/SD-602	0.0029	0.0128	No	BSL
Iron	4 / 4		0.57 - 2.9	SW/SD-603	1.9	1	Yes	ASL
Lead [d]	4 / 4		0.00022 - 0.0013	SW/SD-602	0.00093	0.00097	Yes	ASL
Magnesium	4 / 4		3 - 7.9	SW/SD-600	4.8	EN	No	EN
Manganese	4 / 4		0.32 - 0.49	SW/SD-603	0.39	0.12	Yes	ASL
Nickel [d]	3 / 4	0.01 : 0.01	0.0014 - 0.0025	SW/SD-602	0.0026	0.055	No	BSL
Potassium	4 / 4		2 - 5	SW/SD-600	3.2	EN	No	EN
Silver	1 / 4	0.001 : 0.001	0.000022 - 0.000022	SW/SD-601	0.00038	0.000012	Yes	ASL
Sodium	4 / 4		74 - 180	SW/SD-600	111	EN	No	EN
Zinc [d]	4 / 4		0.0105 - 0.021	SW/SD-601 / SW-SD-602	0.017	0.112	No	BSL

Table 3.13-10
Selection of COPECs - Surface Water - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Inorganics (mg/L)								
Bromide	2 / 4	0.2 : 0.2	0.27 - 0.65	SW/SD-600	0.28	NA	Yes	NSL
Chloride	4 / 4		120 - 320	SW/SD-600	190	230	Yes	ASL
Nitrate as N	3 / 4	0.05 : 0.05	0.082 - 0.235	SW/SD-600	0.11	166.306	No	BSL
Nitrogen, as Ammonia	3 / 4	0.02 : 0.02	0.097 - 0.1015	SW/SD-600	0.077	3	No	BSL
Sulfate	4 / 4		4.2 - 15	SW/SD-600	8.4	29479	No	BSL

Prepared by: SFR 2/5/2014
Checked by: LG 2/5/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] Surface water screening benchmark values are presented in Table 3.12-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] AWQC-CCC for ammonia in freshwater are pH, temperature, and receptor and receptor life-stage dependent and are calculated using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 3.13-11
Selection of COPECs - Sediment - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
2,4,4-Trimethyl-1-pentene	1 / 4	0.0046 : 0.0075	0.03 - 0.03	SD-SD2	0.010		NA	Yes	NSL
2,4,4-Trimethyl-2-pentene	1 / 4	0.0046 : 0.0075	0.003 - 0.003	SD-SD2	0.0031		NA	Yes	NSL
2-Butanone	1 / 4	0.023 : 0.037	0.021 - 0.021	SD-SD2	0.017		5.4	No	BSL
4-iso-Propyltoluene	1 / 4	0.0023 : 0.0037	0.0026 - 0.0026	SD-SD3	0.0018		NA	Yes	NSL
Acetaldehyde	2 / 4	0.26 : 0.33	0.052 - 0.083	SD-SD2	0.11		NA	Yes	NSL
Formaldehyde	4 / 4		0.27 - 1.09	SD-SD2	0.57		NA	Yes	NSL
Semivolatile Organics (mg/kg)									
3 & 4 Methylphenol	3 / 6	0.29 : 2.2	0.61 - 3	SD-SD3	1.3		NA	Yes	NSL
Acetophenone	1 / 6	0.21 : 2.2	0.09 - 0.09	SD-SD2	0.43		NA	Yes	NSL
Benzaldehyde	3 / 4	0.29 : 0.29	0.2 - 0.62	SD-SD3	0.35		NA	Yes	NSL
Benzoic Acid	2 / 6	1.1 : 11	0.047 - 0.22	SD-SD3	2.0		0.65	No	BSL
Benzyl alcohol	1 / 6	0.43 : 4.3	0.071 - 0.071	SD-SD2	0.82		0.073	No	BSL
Bis(2-Ethylhexyl)phthalate	6 / 6		0.27 - 210	SDSW-E	42		433	No	BSL
Caprolactam	1 / 4	0.21 : 0.29	0.053 - 0.053	SD-SD2	0.10		NA	Yes	NSL
Diphenyl ether	2 / 4	0.21 : 0.22	0.17 - 0.22	SD-SD2	0.15		NA	Yes	NSL
Di-n-octylphthalate	1 / 6	0.055 : 2.2	0.15 - 0.15	SD-1	0.42		NA	Yes	NSL
Diphenylmethanone	1 / 4	0.21 : 0.29	0.0305 - 0.0305	SD-SD2	0.098		NA	Yes	NSL
N-Nitrosodiphenylamine	3 / 6	0.21 : 2.2	0.065 - 0.285	SD-SD2	0.30		2.68	No	BSL
Phenol	3 / 6	0.29 : 2.2	0.22 - 0.96	SD-SD2	0.72		0.42	Yes	ASL
Nonionic Organics (mg/kg)									
Biphenyl	1 / 4	0.21 : 0.29	0.016 - 0.016	SD-SD2	0.094	0.55	110	No	BSL
1,3-Dichlorobenzene	1 / 6	0.21 : 2.2	0.0315 - 0.0315	SD-SD2	0.42	1.1	170	No	BSL
Polyaromatic Hydrocarbons (mg/kg)									
Anthracene	1 / 6	0.01 : 0.29	0.0195 - 0.0195	SD-SD2	0.065	0.7	594	No	BSL
Benzo(a)anthracene	4 / 6	0.21 : 0.29	0.0665 - 0.51	SD-SD3	0.21	17.7	841	No	BSL
Benzo(a)pyrene	5 / 6	0.29 : 0.29	0.032 - 0.13	SD-SD3	0.095	4.5	965	No	BSL
Benzo(b)fluoranthene	5 / 6	0.29 : 0.29	0.046 - 0.16	SD-SD3	0.099	5.5	979	No	BSL
Benzo(ghi)perylene	5 / 6	0.29 : 0.29	0.0545 - 0.13	SD-SD3	0.10	4.5	1,095	No	BSL
Benzo(k)fluoranthene	4 / 6	0.21 : 0.29	0.014 - 0.087	SD-SD3	0.077	3.0	981	No	BSL
Chrysene	5 / 6	0.29 : 0.29	0.061 - 0.14	SD-SD3	0.091	4.8	844	No	BSL
Dibenz(a,h)anthracene	3 / 6	0.21 : 0.29	0.028 - 0.048	SD-SD2	0.078	1.7	1,123	No	BSL
Fluoranthene	5 / 6	0.29 : 0.29	0.12 - 0.3	SD-SD3	0.17	10.4	707	No	BSL
Indeno(1,2,3-cd)pyrene	3 / 6	0.026 : 0.29	0.0615 - 0.087	SD-SD3	0.066	3.0	1,115	No	BSL
Naphthalene	1 / 6	0.13 : 0.7	0.3 - 0.3	BS031	0.23	10.4	385	No	BSL
Phenanthrene	4 / 6	0.25 : 0.35	0.038 - 0.16	SD-SD3	0.11	5.5	596	No	BSL
Pyrene	5 / 6	0.29 : 0.29	0.052 - 0.25	SD-SD3	0.13	8.7	697	No	BSL

Table 3.13-11
Selection of COPECs - Sediment - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Metals (mg/kg)									
Aluminum	30 / 30		3,500 - 17,000	SD-SD5	9,307		25,500	No	BSL
Arsenic	6 / 6		2.1 - 13	SD-SD2	5.3		9.79	Yes	ASL
Barium	6 / 6		7 - 86	SD-SD2	27		NA	Yes	NSL
Beryllium	5 / 6	0.3 : 0.3	0.21 - 1	SD-SD2	0.44		NA	Yes	NSL
Cadmium	4 / 6	0.28 : 0.3	0.16 - 0.32	SD-SD2	0.22		0.99	No	BSL
Calcium	6 / 6		820 - 4,750	SD-SD2	1,772		EN	No	EN
Chromium	30 / 30		20 - 1,800	SD-SD5	405		43.4	Yes	ASL
Chromium, Hexavalent	3 / 6	2.6 : 6.9	2.6 - 25	SDSW-E	7.0		NA	Yes	NSL
Cobalt	6 / 6		3.3 - 5.5	SD-SD2	4.5		50	No	BSL
Copper	6 / 6		5.9 - 24	SD-SD2	16		31.6	No	BSL
Iron	30 / 30		4,200 - 23,000	SD-SD2	12,445		20,000	Yes	ASL
Lead	6 / 6		5.1 - 32.5	SD-SD2	17		35.8	No	BSL
Magnesium	6 / 6		470 - 2,350	SD-SD2	1,200		EN	No	EN
Manganese	6 / 6		38 - 270	SD-SD2	121		460	No	BSL
Mercury	2 / 6	0.1 : 0.12	0.045 - 0.11	BSO31	0.063		0.18	No	BSL
Nickel	6 / 6		7.3 - 11	SD-SD2	9.1		22.7	No	BSL
Potassium	4 / 6	560 : 610	680 - 1,400	SD-SD2	750		EN	No	EN
Silver	4 / 6	1.4 : 1.5	1.6 - 35	SD-SD2	7.5		2	Yes	ASL
Sodium	4 / 6	280 : 300	65 - 160	SD-SD2	117		EN	No	EN
Vanadium	6 / 6		5.4 - 18	SD-SD2	10		NA	Yes	NSL
Zinc	6 / 6		20 - 61	SD-SD2	39		121	No	BSL
Inorganics (mg/kg)									
Chloride	4 / 4		41.5 - 140	SD-SD3	74		NA	Yes	NSL
Nitrogen, as Ammonia	6 / 6		54 - 240	SD-SD2	148		NA	Yes	NSL
Sulfate	4 / 4		210 - 640	SD-SD2	454		NA	Yes	NSL
Specialty Compounds (mg/kg)									
Hydrazine	2 / 4	0.0029 : 0.0029	0.00091 - 0.0013	SD-SD2	0.0013		NA	Yes	NSL
Dimethylformamide	1 / 4	0.11 : 0.18	0.3 - 0.3	SD-SD2	0.13		NA	Yes	NSL
EPH (mg/kg)									
C11-C22 Aromatics	4 / 4		11 - 1,100	SD-SD3	288		0.09	Yes	ASL
C19-C36 Aliphatics	4 / 4		14 - 690	SD-SD3	194		9.88	Yes	ASL
C9-C18 Aliphatics	1 / 4	4.2 : 5.4	96 - 96	SD-1	26		3.17	Yes	ASL

Table 3.13-11
Selection of COPECs - Sediment - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	4 / 4		7,500 - 48,000	SD-SD2 SD-SD3	28,875				

Prepared by: KJC 03/25/13
Checked by: SFR 3/26/2013
Revised: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH and nonionic organic compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH and nonionic organic compound screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and nonionic organics and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbons
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-12
Selection of COPECs - Sediment - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
2,4,4-Trimethyl-1-pentene	2 / 3	0.0075 : 0.0075	0.0096 - 0.02	ISCO2	0.011		NA	Yes	NSL
2,4,4-Trimethyl-2-pentene	1 / 3	0.0075 : 0.0078	0.0035 - 0.0035	ISCO2	0.0037		NA	Yes	NSL
2-Butanone	2 / 3	0.037 : 0.037	0.032 - 0.038	ISCO2	0.030		5.4	No	BSL
Acetaldehyde	1 / 2	0.33 : 0.33	0.063 - 0.063	ISCO2	0.11		NA	Yes	NSL
Acetone	1 / 3	0.37 : 0.4	0.12 - 0.12	ISCO2	0.168		0.0091	Yes	ASL
Cis-1,2-Dichloroethene	1 / 3	0.0037 : 0.0039	0.0024 - 0.0024	ISCO2	0.0021		6.4	No	BSL
Formaldehyde	2 / 2		0.27 - 0.6	ISCO2	0.44		NA	Yes	NSL
trans-1,2-Dichloroethene	1 / 3	0.0037 : 0.0039	0.0045 - 0.0045	ISCO2	0.0028		1.05	No	BSL
Semivolatile Organics (mg/kg)									
Aniline	1 / 6	0.29 : 17	0.23 - 0.23	ISCO2	3.7		NA	Yes	NSL
Benzaldehyde	1 / 3	0.29 : 5.4	0.12 - 0.12	ISCO2	0.99		NA	Yes	NSL
Benzoic Acid	1 / 6	1.4 : 27	0.43 - 0.43	ISCO2	5.6		0.65	No	BSL
Bis(2-Ethylhexyl)phthalate	6 / 6		11 - 920	BS030	322		433	Yes	ASL
Di-n-octylphthalate	1 / 6	0.31 : 5.4	0.15 - 0.15	SD-1	1.1		NA	Yes	NSL
Diphenyl ether	2 / 3	5.4 : 5.4	0.22 - 2.6	ISCO2	1.8		NA	Yes	NSL
Diphenylamine	1 / 2	0.058 : 0.058	0.095 - 0.095	ISCO2	0.062		NA	Yes	NSL
N-Nitrosodiphenylamine	4 / 6	2.2 : 5.4	0.065 - 1.6	ISCO2	1.2		2.68	No	BSL
Phenol	1 / 6	0.29 : 5.4	0.13 - 0.13	ISCO2	1.1		0.42	No	BSL
Nonionic Organics (mg/kg)									
Biphenyl	1 / 3	0.29 : 5.4	0.32 - 0.32	ISCO2	1.1	6.7	110	No	BSL
Polyaromatic Hydrocarbons (mg/kg)									
Benzo(a)anthracene	3 / 6	0.29 : 5.4	0.31 - 3.1	BS030	1.2	65	841	No	BSL
Benzo(a)pyrene	3 / 6	0.29 : 5.4	0.032 - 0.099	BS030	0.53	2.1	965	No	BSL
Benzo(b)fluoranthene	2 / 6	0.088 : 5.4	0.046 - 0.067	BS032	0.53	1.4	979	No	BSL
Benzo(ghi)perylene	3 / 6	0.29 : 5.4	0.13 - 0.64	BS030	0.65	13.3	1095	No	BSL
Benzo(k)fluoranthene	2 / 6	0.088 : 5.4	0.014 - 0.025	BS032	0.51	0.52	981	No	BSL
Chrysene	3 / 6	0.29 : 5.4	0.061 - 0.44	BS030	0.59	9.2	844	No	BSL
Dibenz(a,h)anthracene	3 / 6	0.29 : 5.4	0.028 - 0.26	BS030	0.56	5.4	1123	No	BSL
Fluoranthene	3 / 6	0.29 : 5.4	0.13 - 1.8	BS030	0.85	38	707	No	BSL
Indeno(1,2,3-cd)pyrene	1 / 6	0.026 : 5.4	0.19 - 0.19	BS030	0.54	4.0	1115	No	BSL
Naphthalene	1 / 6	0.3 : 13	0.3 - 0.3	BS031	1.4	6.3	385	No	BSL
Phenanthrene	3 / 6	0.35 : 6.4	0.038 - 0.1	BS030	0.63	2.1	596	No	BSL
Pyrene	3 / 6	0.29 : 5.4	0.052 - 0.16	BS030	0.55	3.3	697	No	BSL
Pesticides (mg/kg)									
4,4`-DDT	1 / 3	0.011 : 0.013	0.062 - 0.062	BS030	0.025		0.00416	Yes	ASL
Hexachlorobenzene	1 / 3	0.011 : 0.013	0.037 - 0.037	BS030	0.016		0.02	Yes	ASL

Table 3.13-12
Selection of COPECs - Sediment - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Metals (mg/kg)									
Aluminum	6 / 6		3,900 - 15,000	BS030	8,533		25,500	No	BSL
Arsenic	6 / 6		2.1 - 6.7	ISCO2	5.0		9.79	No	BSL
Barium	6 / 6		7 - 23	BS030	12.8		NA	Yes	NSL
Beryllium	5 / 6	0.3 : 0.3	0.64 - 1.9	BS030	0.96		NA	Yes	NSL
Cadmium	4 / 6	0.28 : 0.3	0.32 - 1.2	ISCO2	0.56		0.99	Yes	ASL
Calcium	6 / 6		820 - 1,900	BS030	1,142		EN	No	EN
Chromium	6 / 6		570 - 3,000	ISCO2	1,922		43.4	Yes	ASL
Chromium, Hexavalent	4 / 5	6.9 : 6.9	7.9 - 28	ISCO2	14.5		NA	Yes	NSL
Cobalt	6 / 6		3.3 - 21	ISCO2	10.0		50	No	BSL
Copper	6 / 6		5.9 - 22	BS030	15.9		31.6	No	BSL
Iron	6 / 6		4,200 - 8,100	BS030	5,283		20,000	No	BSL
Lead	6 / 6		5.1 - 18	BS030	10.1		35.8	No	BSL
Magnesium	6 / 6		410 - 660	BS032	540		EN	No	EN
Manganese	6 / 6		38 - 87	BS030	55		460	No	BSL
Mercury	5 / 6	0.12 : 0.12	0.045 - 0.39	BS030	0.18		0.18	Yes	ASL
Nickel	6 / 6		7.3 - 24	ISCO2	14.1		22.7	Yes	ASL
Potassium	3 / 6	560 : 1,000	1400 - 1,700	ISCO2	948		EN	No	EN
Selenium	1 / 6	0.89 : 2.6	0.72 - 0.72	ISCO2	0.73		2	No	BSL
Silver	3 / 6	1.4 : 2.6	35 - 62	ISCO2	25		2	Yes	ASL
Sodium	3 / 6	280 : 510	95 - 160	SD-1	152		EN	No	EN
Tin	1 / 3	9.1 : 9.8	1.6 - 1.6	ISCO2	3.7		NA	Yes	NSL
Vanadium	6 / 6		5.4 - 14	BS030	8.7		NA	Yes	NSL
Zinc	6 / 6		20 - 57	BS030	35		121	No	BSL
Inorganics (mg/kg)									
Chloride	3 / 3		130 - 140	SD-1	133		NA	Yes	NSL
Nitrogen, as Ammonia	6 / 6		54 - 290	ISCO2	172		NA	Yes	NSL
Sulfate	3 / 3		600 - 830	ISCO2	690		NA	Yes	NSL
EPH (mg/kg)									
C11-C22 Aromatics	2 / 2		1100 - 9,400	ISCO2	5,250		0.09	Yes	ASL
C19-C36 Aliphatics	2 / 2		690 - 6,400	ISCO2	3,545		9.88	Yes	ASL
C9-C18 Aliphatics	2 / 2		96 - 770	ISCO2	433		3.17	Yes	ASL
Specialty Compounds (mg/kg)									
Hydrazine	2 / 2		0.0013 - 0.0024	ISCO2	0.0019		NA	Yes	NSL

Table 3.13-12
Selection of COPECs - Sediment - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	3 / 3		44,000 - 52,000		48,000				

Prepared by: KJC 03/25/13
Checked by: SFR 3/26/2013
Revised: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH and nonionic organic compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH and nonionic organic compound screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and nonionic organics and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbons
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-13
Selection of COPECs - Sediment - On-PWD-WDW
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
Acetone	2 / 8	15 : 31	0.095 - 0.34	RSD-02	7.6		0.0091	Yes	ASL
Semivolatile Organics (mg/kg)									
Bis(2-Ethylhexyl)phthalate	9 / 23	2 : 12	2.9 - 14	RSD-01	4.2		433	No	BSL
Nonionic Organics (mg/kg)									
Benzene	1 / 8	0.018 : 1.5	4.4 - 4.4	RSD-02	0.93	275	16	Yes	ASL
Chlorobenzene	1 / 8	0.018 : 1.5	0.11 - 0.11	RSD-02	0.39	7	41	No	BSL
Polyaromatic Hydrocarbons (mg/kg)									
Benzo(b)fluoranthene	1 / 23	1.6 : 12	3 - 3	WDW-27	2.1	188	979	No	FOD
Fluoranthene	1 / 23	1.6 : 12	6.1 - 6.1	WDW-27	2.3	381	707	No	FOD
Phenanthrene	1 / 23	1.6 : 12	3.2 - 3.2	WDW-27	2.1	200	596	No	FOD
Pyrene	1 / 23	1.6 : 12	4.2 - 4.2	WDW-27	2.2	263	697	No	FOD
Metals (mg/kg)									
Aluminum	18 / 18		2,800 - 14,000	RSD-02	7,567		25,500	No	BSL
Arsenic	1 / 7	4 : 9	7.77 - 7.77	SD-SD1	3.3		9.79	No	BSL
Barium	3 / 3		3.4 - 37.6	SD-SD1	18.0		NA	Yes	NSL
Beryllium	1 / 3	0.1 : 0.164	0.61 - 0.61	RSD-02	0.25		NA	Yes	NSL
Cadmium	4 / 9	0.2 : 2	0.229 - 1.2	WDW-27	0.57		0.99	Yes	ASL
Calcium	2 / 2		200 - 900	RSD-02	550		EN	No	EN
Chromium	31 / 33	9 : 10	4.5 - 69	WDW-19	24		43.4	Yes	ASL
Copper	2 / 2		2.1 - 17	RSD-02	9.6		31.6	No	BSL
Iron	18 / 18		270 - 17,000	SD-SD1	8,618		20,000	No	BSL
Lead	8 / 9	9 : 9	4.6 - 110	WDW-16	50		35.8	Yes	ASL
Magnesium	2 / 2		88 - 180	RSD-02	134		EN	No	EN
Manganese	2 / 2		4 - 22	RSD-02	13.0		460	No	BSL
Mercury	5 / 8	0.06 : 0.3	0.23 - 0.44	WDW-27	0.23		0.18	Yes	ASL
Nickel	2 / 3	2 : 2	6.7 - 9.31	SD-SD1	5.7		22.7	No	BSL
Sodium	1 / 2	99 : 99	3,200 - 3,200	RSD-02	1,625		EN	No	EN
Vanadium	3 / 3		3 - 27	RSD-02	15.7		NA	Yes	NSL
Zinc	3 / 3		5.2 - 47.4	SD-SD1	22		121	No	BSL

Table 3.13-13
Selection of COPECs - Sediment - On-PWD-WDW
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	1 / 1		16,000 - 16,000	SD-SD1	16,000				

Prepared by: KJC 03/25/13
Checked by: SFR 3/26/2013
Revised: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH and nonionic organic compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH and nonionic organic compound screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and nonionic organics and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
On-PWD-WDW - On Property West Ditch and West Ditch Wetland
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-14
Selection of COPECs - Sediment - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
2,4,4-Trimethyl-1-pentene	1 / 2	0.0051 : 0.0051	0.011 - 0.011	SD-502	0.0068		NA	Yes	NSL
2,4,4-Trimethyl-2-pentene	1 / 2	0.0051 : 0.0051	0.0088 - 0.0088	SD-502	0.0057		NA	Yes	NSL
2-Butanone	2 / 2		0.025 - 0.027	SD-501	0.026		5.4	No	BSL
Acetone	2 / 2		0.11 - 0.12	SD-501	0.12		0.0091	Yes	ASL
Methyl Tertbutyl Ether	1 / 2	0.0029 : 0.0029	0.0017 - 0.0017	SD-501	0.0016		NA	Yes	NSL
Toluene	1 / 2	0.0029 : 0.0029	0.00098 - 0.00098	SD-501	0.0012		6.4	No	BSL
Semivolatile Organics (mg/kg)									
3 & 4 Methylphenol	2 / 2		4.3 - 6.1	SD-502	5.2		NA	Yes	NSL
Acetophenone	2 / 2		0.15 - 0.26	SD-502	0.21		NA	Yes	NSL
Benzaldehyde	2 / 2		1.4 - 1.9	SD-502	1.7		NA	Yes	NSL
Phenol	2 / 2		1.7 - 2.2	SD-502	2.0		0.42	Yes	ASL
Polyaromatic Hydrocarbons (mg/kg)									
Benzo(b)fluoranthene	1 / 2	0.46 : 0.46	0.14 - 0.14	SD-502	0.19	1,647	979	Yes	ASL
Fluoranthene	2 / 2		0.21 - 0.29	SD-502	0.25	3,412	707	Yes	ASL
Phenanthrene	1 / 2	0.46 : 0.46	0.21 - 0.21	SD-502	0.22	2,471	596	Yes	ASL
Pyrene	2 / 2		0.18 - 0.23	SD-502	0.21	2,706	697	Yes	ASL
Metals (mg/kg)									
Aluminum	10 / 10		6,500 - 12,000	SD-SD4	8,770		25,500	No	BSL
Arsenic	2 / 2		6.2 - 8.1	SD-502	7.2		9.79	No	BSL
Barium	2 / 2		45 - 46	SD-502	46		NA	Yes	NSL
Beryllium	2 / 2		0.09 - 0.094	SD-501	0.092		NA	Yes	NSL
Cadmium	2 / 2		0.21 - 0.26	SD-502	0.24		0.99	No	BSL
Calcium	2 / 2		3800 - 3,900	SD-501	3,850		EN	No	EN
Chromium	10 / 10		18 - 140	SD-SD4	36		43.4	Yes	ASL
Chromium, Hexavalent	2 / 2		0.21 - 0.27	SD-502	0.24		NA	Yes	NSL
Cobalt	2 / 2		3.9 - 4	SD-501	4.0		50	No	BSL
Copper	2 / 2		21 - 21	SD-501 SD-502	21		31.6	No	BSL
Iron	10 / 10		9,200 - 17,000	SD-SD4	12,390		20,000	No	BSL
Lead	2 / 2		50 - 51	SD-501	51		35.8	Yes	ASL
Magnesium	2 / 2		1800 - 2,000	SD-501	1,900		EN	No	EN
Manganese	2 / 2		440 - 590	SD-501	515		460	Yes	ASL
Mercury	2 / 2		0.057 - 0.07	SD-501	0.064		0.18	No	BSL
Nickel	2 / 2		8.7 - 8.7	SD-501 SD-502	8.7		22.7	No	BSL
Potassium	2 / 2		730 - 790	SD-501	760		EN	No	EN
Selenium	1 / 2	0.72 : 0.72	0.7 - 0.7	SD-501	0.53		2	No	BSL
Sodium	2 / 2		140 - 150	SD-502	145		EN	No	EN

Table 3.13-14
Selection of COPECs - Sediment - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Tin	2 / 2		2.1 - 2.2	SD-502	2.2		NA	Yes	NSL
Vanadium	2 / 2		16 - 17	SD-501	16.5		NA	Yes	NSL
Zinc	2 / 2		65 - 65	SD-501 SD-502	65		121	No	BSL
Inorganics (mg/kg)									
Chloride	2 / 2		18 - 24	SD-501	21		NA	Yes	NSL
Nitrogen, as Ammonia	2 / 2		17 - 35	SD-502	26		NA	Yes	NSL
Sulfate	2 / 2		510 - 1,200	SD-502	855		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	2 / 2		80 - 90		85				

Prepared by: KJC 03/24/13
Checked by: SFR 3/26/2013
Revised: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-15
Selection of COPECs - Sediment - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
2,4,4-Trimethyl-1-pentene	2 / 2		0.0024 - 0.0078	SD-504	0.0051		NA	Yes	NSL
2,4,4-Trimethyl-2-pentene	2 / 2		0.0014 - 0.0039	SD-504	0.0027		NA	Yes	NSL
2-Butanone	2 / 2		0.033 - 0.035	SD-503	0.034		5.4	No	BSL
Acetone	2 / 2		0.13 - 0.15	SD-503	0.14		0.0091	Yes	ASL
Semivolatile Organics (mg/kg)									
3 & 4 Methylphenol	2 / 2		1.8 - 4	SD-503	2.9		NA	Yes	NSL
Acetophenone	1 / 2	0.58 : 0.58	0.16 - 0.16	SD-503	0.23		NA	Yes	NSL
Benzaldehyde	2 / 2		0.62 - 1.3	SD-503	0.96		NA	Yes	NSL
Bis(2-Ethylhexyl)phthalate	1 / 2	2.9 : 2.9	3.1 - 3.1	SD-503	2.3		433	No	BSL
N-Nitrosodiphenylamine	1 / 2	0.58 : 0.58	0.33 - 0.33	SD-503	0.31		2.68	No	BSL
Phenol	2 / 2		1.4 - 1.9	SD-503	1.7		0.42	Yes	ASL
Polyaromatic Hydrocarbons (mg/kg)									
Benzo(a)pyrene	1 / 2	0.52 : 0.52	0.22 - 0.22	SD-504	0.24	2,588	965	Yes	ASL
Metals (mg/kg)									
Aluminum	2 / 2		7,800 - 9,100	SD-503	8,450		25,500	No	BSL
Arsenic	2 / 2		9.4 - 12	SD-503	10.7		9.79	Yes	ASL
Barium	2 / 2		48 - 51	SD-504	50		NA	Yes	NSL
Beryllium	2 / 2		0.089 - 0.12	SD-503	0.10		NA	Yes	NSL
Cadmium	2 / 2		0.55 - 0.56	SD-504	0.56		0.99	No	BSL
Calcium	2 / 2		4700 - 4,800	SD-504	4,750		EN	No	EN
Chromium	2 / 2		33 - 50	SD-503	42		43.4	Yes	ASL
Cobalt	2 / 2		4.5 - 4.8	SD-503	4.7		50	No	BSL
Copper	2 / 2		19 - 25	SD-504	22		31.6	No	BSL
Iron	2 / 2		11,000 - 12,000	SD-503	11,500		20,000	No	BSL
Lead	2 / 2		23 - 26	SD-503	25		35.8	No	BSL
Magnesium	2 / 2		2000 - 2,300	SD-503	2,150		EN	No	EN
Manganese	2 / 2		400 - 440	SD-504	420		460	No	BSL
Mercury	2 / 2		0.062 - 0.075	SD-503	0.069		0.18	No	BSL
Nickel	2 / 2		9.9 - 11	SD-503	10.5		22.7	No	BSL
Potassium	2 / 2		740 - 1,100	SD-503	920		EN	No	EN
Sodium	2 / 2		110 - 150	SD-504	130		EN	No	EN
Tin	2 / 2		2.2 - 2.3	SD-504	2.3		NA	Yes	NSL
Vanadium	2 / 2		19 - 22	SD-503	21		NA	Yes	NSL
Zinc	2 / 2		55 - 73	SD-504	64		121	No	BSL

Table 3.13-15
Selection of COPECs - Sediment - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Inorganics (mg/kg)									
Chloride	2 / 2		6.3 - 13	SD-504	9.7		NA	Yes	NSL
Nitrogen, as Ammonia	2 / 2		14 - 22	SD-504	18.0		NA	Yes	NSL
Sulfate	2 / 2		900 - 1,900	SD-504	1,400		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	2 / 2		60 - 110		85				

Prepared by: KJC 03/24/13
Checked by: SFR 3/26/2013
Revised: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-16
Selection of COPECs - Sediment - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
1,2,4-Trichlorobenzene	1 / 3	0.0035 : 0.0067	0.0038 - 0.0038	OPWD-SD-S	0.0030		2.1	No	BSL
2,4,4-Trimethyl-1-pentene	1 / 3	0.007 : 0.013	0.06 - 0.06	OPWD-SD-S	0.023		NA	Yes	NSL
2,4,4-Trimethyl-2-pentene	1 / 3	0.007 : 0.013	0.008 - 0.008	OPWD-SD-S	0.0060		NA	Yes	NSL
2-Butanone	1 / 3	0.035 : 0.067	0.043 - 0.043	OPWD-SD-S	0.031		5.4	No	BSL
Formaldehyde	2 / 2		0.4 - 0.61	OPWD-2	0.51		NA	Yes	NSL
Semivolatile Organics (mg/kg)									
1,2,4-Trichlorobenzene	2 / 3	0.056 : 0.056	0.027 - 0.066	OPWD-SD-S	0.040		2.1	No	BSL
4-Chlorophenyl phenyl ether	1 / 3	0.056 : 0.087	0.061 - 0.061	OPWD-SD-S	0.044		NA	Yes	NSL
Benzoic Acid	3 / 3		0.054 - 0.42	OPWD-SD-S	0.24		0.65	No	BSL
Bis(2-Ethylhexyl)phthalate	3 / 3		0.047 - 0.12	OPWD-SD-S	0.092		433	No	BSL
Carbazole	3 / 3		0.039 - 0.051	OPWD-2	0.045		NA	Yes	NSL
Diphenyl ether	2 / 3	0.087 : 0.087	0.094 - 0.86	OPWD-SD-S	0.33		NA	Yes	NSL
Diphenylmethanone	2 / 3	0.087 : 0.087	0.028 - 0.2	OPWD-SD-S	0.091		NA	Yes	NSL
N-Nitrosodiphenylamine	2 / 3	0.087 : 0.087	0.098 - 0.8	OPWD-SD-S	0.31		2.68	No	BSL
Polyaromatic Hydrocarbons (mg/kg)									
Benzo(a)anthracene	3 / 3		0.098 - 0.17	OPWD-1	0.14	6.8	841	No	BSL
Benzo(a)pyrene	3 / 3		0.14 - 0.2	OPWD-1	0.17	8.0	965	No	BSL
Benzo(b)fluoranthene	2 / 2		0.3 - 0.31	OPWD-2	0.31	12.4	979	No	BSL
Benzo(ghi)perylene	3 / 3		0.12 - 0.15	OPWD-2	0.14	6.0	1,095	No	BSL
Benzo(k)fluoranthene	2 / 2		0.16 - 0.18	OPWD-1	0.17	7.2	981	No	BSL
Chrysene	3 / 3		0.21 - 0.28	OPWD-2	0.25	11.2	844	No	BSL
Dibenz(a,h)anthracene	2 / 2		0.035 - 0.061	OPWD-2	0.048	2.4	1,123	No	BSL
Fluoranthene	3 / 3		0.34 - 0.59	OPWD-2	0.46	24	707	No	BSL
Indeno(1,2,3-cd)pyrene	3 / 3		0.12 - 0.14	OPWD-2 OPWD-SD-S	0.13	5.6	1,115	No	BSL
Phenanthrene	3 / 3		0.1 - 0.18	OPWD-2	0.13	7.2	596	No	BSL
Pyrene	3 / 3		0.35 - 0.44	OPWD-2	0.40	17.6	697	No	BSL
Metals (mg/kg)									
Aluminum	3 / 3		13,000 - 24,000	OPWD-2	17,000		25,500	No	BSL
Arsenic	3 / 3		6.7 - 14	OPWD-1	10.0		9.79	Yes	ASL
Barium	3 / 3		9.1 - 16	OPWD-2	11.7		NA	Yes	NSL
Beryllium	3 / 3		1.1 - 1.4	OPWD-2	1.2		NA	Yes	NSL
Cadmium	3 / 3		0.099 - 0.62	OPWD-SD-S	0.35		0.99	No	BSL
Calcium	3 / 3		480 - 2,000	OPWD-SD-S	1,110		EN	No	EN
Chromium	3 / 3		250 - 2,400	OPWD-SD-S	1,350		43.4	Yes	ASL
Cobalt	3 / 3		3.2 - 15	OPWD-SD-S	7.5		50	No	BSL
Copper	3 / 3		16 - 39	OPWD-SD-S	25		31.6	Yes	ASL
Iron	3 / 3		6,300 - 13,000	OPWD-SD-S	9,233		20,000	No	BSL

Table 3.13-16
Selection of COPECs - Sediment - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Lead	3 / 3		8 - 14	OPWD-2 OPWD-SD-S	12.0		35.8	No	BSL
Magnesium	3 / 3		830 - 1,100	OPWD-2	977		EN	No	EN
Manganese	3 / 3		40 - 160	OPWD-SD-S	85		460	No	BSL
Nickel	3 / 3		10 - 15	OPWD-SD-S	12.3		22.7	No	BSL
Potassium	3 / 3		1200 - 1,900	OPWD-1	1,500		EN	No	EN
Silver	3 / 3		3.7 - 41	OPWD-SD-S	23.6		2	Yes	ASL
Sodium	3 / 3		74 - 360	OPWD-SD-S	174		EN	No	EN
Vanadium	3 / 3		9.2 - 15	OPWD-2	11.7		NA	Yes	NSL
Zinc	3 / 3		23 - 100	OPWD-SD-S	49		121	No	BSL
Inorganics (mg/kg)									
Chloride	3 / 3		91 - 240	OPWD-SD-S	147		NA	Yes	NSL
Nitrogen, as Ammonia	3 / 3		93 - 540	OPWD-SD-S	254		NA	Yes	NSL
Sulfate	3 / 3		280 - 1500	OPWD-SD-S	697		NA	Yes	NSL
Specialty Compounds (mg/kg)									
Hydrazine	1 / 2	0.0041 : 0.0041	0.0013 - 0.0013	OPWD-1	0.0017		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	3 / 3		13,000 - 34,000		25,000				

Prepared by: KJC 03/25/13
Checked by: SFR 3/26/2013
Revised: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
Off-PWD - Off Property West Ditch
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-17
Selection of COPECs - Sediment - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection			Range of Reporting Limits for Non-Detects			Range of Detected Concentrations			Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)															
2-Butanone	12	/	13	0.028	:	0.028	0.021	-	0.5	MMB-SW/SD-4	0.22		5.4	No	BSL
Acetaldehyde	6	/	11	0.27	:	1.5	0.22	-	0.42	MMB-SW/SD-6	0.35		NA	Yes	NSL
Acetone	13	/	13				0.035	-	1.7	MMB-SW/SD-4	0.72		0.0091	Yes	ASL
Formaldehyde	11	/	11				0.31	-	4	MMB-SW/SD-2	2.2		NA	Yes	NSL
Semivolatile Organics (mg/kg)															
3 & 4 Methylphenol	2	/	13	0.045	:	0.31	0.2	-	0.32	MMB-SW/SD-1	0.12		NA	Yes	NSL
4-Nitrophenol	1	/	13	0.22	:	1.6	0.091	-	0.091	MMB-SW/SD-5	0.43		NA	Yes	NSL
Benzaldehyde	4	/	13	0.045	:	0.31	0.056	-	0.3	MMB-SW/SD-10	0.12		NA	Yes	NSL
Benzoic Acid	13	/	13				0.21	-	1.4	MMB-SW/SD-1	0.59		0.65	Yes	ASL
Benzyl alcohol	1	/	13	0.089	:	0.62	0.35	-	0.35	MMB-SW/SD-6	0.20		0.073	Yes	ASL
Bis(2-Ethylhexyl)phthalate	10	/	13	0.2	:	0.31	0.05	-	0.35	MMB-SW/SD-6	0.15		433	No	BSL
Caprolactam	1	/	8	0.045	:	0.23	0.088	-	0.088	MMB-SW/SD-5	0.068		NA	Yes	NSL
Carbazole	2	/	13	0.045	:	0.31	0.025	-	0.097	MMB-SW/SD-6	0.093		NA	Yes	NSL
Polyaromatic Hydrocarbons (mg/kg)															
Anthracene	1	/	13	0.045	:	0.31	0.082	-	0.082	MMB-SW/SD-6	0.092	0.47	594	No	BSL
Benzo(a)anthracene	4	/	13	0.045	:	0.31	0.082	-	0.4	MMB-SW/SD-6	0.13	2.3	841	No	BSL
Benzo(a)pyrene	6	/	13	0.045	:	0.31	0.08	-	0.4	MMB-SW/SD-6	0.13	2.3	965	No	BSL
Benzo(b)fluoranthene	6	/	13	0.045	:	0.31	0.067	-	0.56	MMB-SW/SD-6	0.16	3.2	979	No	BSL
Benzo(ghi)perylene	5	/	13	0.045	:	0.31	0.092	-	0.32	MMB-SW/SD-6	0.12	1.8	1095	No	BSL
Benzo(k)fluoranthene	5	/	13	0.045	:	0.31	0.071	-	0.26	MMB-SW/SD-8	0.13	1.5	981	No	BSL
Chrysene	7	/	13	0.045	:	0.31	0.085	-	0.48	MMB-SW/SD-6	0.14	2.7	844	No	BSL
Dibenz(a,h)anthracene	4	/	13	0.045	:	0.31	0.041	-	0.15	MMB-SW/SD-6	0.094	0.86	1123	No	BSL
Fluoranthene	9	/	13	0.045	:	0.31	0.079	-	0.88	MMB-SW/SD-6	0.21	5.0	707	No	BSL
Indeno(1,2,3-cd)pyrene	5	/	13	0.045	:	0.31	0.1	-	0.34	MMB-SW/SD-6	0.13	1.9	1115	No	BSL
Naphthalene	1	/	12	0.11	:	0.64	0.12	-	0.12	MMB-SW/SD-6	0.20	0.69	385	No	BSL
Phenanthrene	6	/	13	0.054	:	0.37	0.079	-	0.45	MMB-SW/SD-6	0.14	2.6	596	No	BSL
Pyrene	9	/	13	0.045	:	0.31	0.071	-	0.85	MMB-SW/SD-6	0.22	4.9	697	No	BSL
Metals (mg/kg)															
Aluminum	13	/	13				5,400	-	28,000	MMB-SW/SD-6	12,969		25,500	Yes	ASL
Arsenic	13	/	13				3.5	-	52	MMB-SW/SD-6	17.2		9.79	Yes	ASL
Barium	13	/	13				22	-	190	MMB-SW/SD-6	103		NA	Yes	NSL
Beryllium	12	/	13	0.44	:	0.44	0.17	-	2.6	MMB-SW/SD-8	0.98		NA	Yes	NSL
Cadmium	13	/	13				0.082	-	4.8	MMB-SW/SD-8	2.1		0.99	Yes	ASL
Calcium	13	/	13				930	-	10,000	MMB-SW/SD-11	6,160		EN	No	EN
Chromium	13	/	13				7.5	-	40	MMB-SW/SD-6	22		43.4	No	BSL

Table 3.13-17
Selection of COPECs - Sediment - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Cobalt	13 / 13		2.3 - 34	MMB-SW/SD-8A	12.7		50	No	BSL
Copper	13 / 13		7.4 - 90	MMB-SW/SD-8A	39		31.6	Yes	ASL
Iron	13 / 13		6,400 - 95,000	MMB-SW/SD-6	25,508		20,000	Yes	ASL
Lead	13 / 13		7.2 - 415	MMB-SW/SD-8	138		35.8	Yes	ASL
Magnesium	13 / 13		940 - 4,500	MMB-SW/SD-1	2,095		EN	No	EN
Manganese	13 / 13		110 - 2,100	MMB-SW/SD-2	788		460	Yes	ASL
Mercury	7 / 13	0.095 : 0.47	0.22 - 0.51	MMB-SW/SD-6	0.26		0.18	Yes	ASL
Nickel	13 / 13		5.4 - 44	MMB-SW/SD-8A	18.6		22.7	Yes	ASL
Potassium	13 / 13		410 - 2,600	MMB-SW/SD-8	1,085		EN	No	EN
Selenium	1 / 13	0.75 : 4.3	2 - 2	MMB-SW/SD-8	1.4		2	No	BSL
Silver	1 / 13	0.75 : 4.3	0.74 - 0.74	MMB-SW/SD-6	1.3		2	No	BSL
Sodium	13 / 13		51 - 940	MMB-SW/SD-5	507		EN	No	EN
Thallium	1 / 13	1.5 : 8.6	1.4 - 1.4	MMB-SW/SD-2	2.6		NA	Yes	NSL
Tin	8 / 13	7.5 : 34	7.1 - 16	MMB-SW/SD-3	8.6		NA	Yes	NSL
Vanadium	13 / 13		8.9 - 58	MMB-SW/SD-8	32		NA	Yes	NSL
Zinc	13 / 13		22 - 500	MMB-SW/SD-6	207		121	Yes	ASL
Inorganics (mg/kg)									
Chloride	13 / 13		34 - 1,000	MMB-SW/SD-3	485		NA	Yes	NSL
Nitrogen, as Ammonia	13 / 13		62 - 1,500	MMB-SW/SD-10	567		NA	Yes	NSL
Sulfate	11 / 13	63 : 75	120 - 1,400	MMB-SW/SD-10	600		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	13 / 13		10,000 - 310,000	MMB-SW/SD-4	175,077				

Prepared by: KJC 07/9/2013
Checked by: SFR 07/9/2013
Checked by: EYM 7/12/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH and nonionic organic compound screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
MMB - Maple Meadow Brook
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-18
Selection of COPECs - Sediment - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
2-Butanone	1 / 3	0.044 : 0.05	0.069 - 0.069	LB-3	0.039		5.4	No	BSL
sec-Butylbenzene	1 / 3	0.0044 : 0.005	0.0046 - 0.0046	LB-3	0.0031		NA	Yes	NSL
Semivolatile Organics (mg/kg)									
Bis(2-Ethylhexyl)phthalate	3 / 3		0.16 - 4.7	LB-3	1.8		433	No	BSL
N-Nitrosodiphenylamine	1 / 3	0.29 : 0.32	2 - 2	LB-3	0.77		2.68	No	BSL
Nonionic Organics (mg/kg)									
1,2-Dichlorobenzene	1 / 3	0.0044 : 0.005	0.031 - 0.031	LB-3	0.012	0.74	33	No	BSL
Chlorobenzene	1 / 3	0.0044 : 0.005	0.059 - 0.059	LB-3	0.021	1.4	41	No	BSL
Polyaromatic Hydrocarbons (mg/kg)									
Benzo(a)anthracene	1 / 3	0.29 : 0.32	1.4 - 1.4	LB-3	0.57	34	841	No	BSL
Benzo(a)pyrene	1 / 3	0.29 : 0.32	1.5 - 1.5	LB-3	0.60	36	965	No	BSL
Benzo(b)fluoranthene	2 / 3	0.32 : 0.32	0.11 - 2	LB-3	0.76	48	979	No	BSL
Benzo(ghi)perylene	2 / 3	0.32 : 0.32	0.096 - 1.6	LB-3	0.62	38	1095	No	BSL
Chrysene	1 / 3	0.29 : 0.32	1.8 - 1.8	LB-3	0.70	43	844	No	BSL
Fluoranthene	3 / 3		0.095 - 3.5	LB-3	1.2	84	707	No	BSL
Indeno(1,2,3-cd)pyrene	1 / 3	0.29 : 0.32	1.4 - 1.4	LB-3	0.57	34	1115	No	BSL
Phenanthrene	1 / 3	0.35 : 0.39	1.1 - 1.1	LB-3	0.49	26	596	No	BSL
Pyrene	2 / 3	0.32 : 0.32	0.12 - 2.9	LB-3	1.1	70	697	No	BSL
Metals (mg/kg)									
Aluminum	3 / 3		3,800 - 12,000	LB-3	8,200		25,500	No	BSL
Arsenic	3 / 3		5.5 - 35	LB-3	15.5		9.79	Yes	ASL
Barium	3 / 3		9.4 - 94	LB-3	46		NA	Yes	NSL
Beryllium	3 / 3		0.11 - 0.3	LB-3	0.22		NA	Yes	NSL
Cadmium	3 / 3		0.15 - 1	LB-3	0.64		0.99	Yes	ASL
Calcium	3 / 3		1,000 - 4,700	LB-3	2,433		EN	No	EN
Chromium	3 / 3		20 - 130	LB-3	58		43.4	Yes	ASL
Cobalt	3 / 3		0.65 - 7.2	LB-3	3.3		50	No	BSL
Copper	3 / 3		4.9 - 61	LB-3	30		31.6	Yes	ASL
Iron	3 / 3		3,100 - 25,000	LB-3	12,167		20,000	Yes	ASL
Lead	3 / 3		19 - 260	LB-1	133		35.8	Yes	ASL
Magnesium	3 / 3		330 - 3,700	LB-3	1,943		EN	No	EN
Manganese	3 / 3		75 - 380	LB-3	184		460	No	BSL
Mercury	2 / 3	0.12 : 0.12	0.14 - 1.2	LB-3	0.47		0.18	Yes	ASL
Nickel	3 / 3		1.8 - 19	LB-3	10		22.7	No	BSL
Potassium	3 / 3		240 - 1,900	LB-3	943		EN	No	EN
Silver	3 / 3		0.2 - 1.6	LB-3	0.68		2	No	BSL
Sodium	3 / 3		45 - 220	LB-1	132		EN	No	EN

Table 3.13-18
Selection of COPECs - Sediment - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Tin	1 / 3	10 : 11	6.8 - 6.8	LB-3	5.8		NA	Yes	NSL
Vanadium	3 / 3		5.5 - 29	LB-3	18.8		NA	Yes	NSL
Zinc	3 / 3		22 - 190	LB-3	107		121	Yes	ASL
Inorganics (mg/kg)									
Chloride	3 / 3		61 - 150	LB-3	107		NA	Yes	NSL
Nitrogen, as Ammonia	3 / 3		120 - 580	LB-3	280		NA	Yes	NSL
Sulfate	3 / 3		78 - 310	LB-3	166		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	3 / 3		33,000 - 51,000	LB-3	41,667				

Prepared by: KJC 07/9/2013
Checked by: SFR 07/9/2013
Checked by: EYM 7/12/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH and nonionic organic compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH and nonionic organic compound screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and nonionic organics and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 3.13-19
Selection of COPECs - Sediment - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Volatile Organics (mg/kg)									
2,4,4-Trimethyl-1-pentene	1 / 4	0.0057 : 0.011	0.002 - 0.002	SW/SD-603	0.0038		NA	Yes	NSL
2-Butanone	3 / 4	0.029 : 0.029	0.025 - 0.084	SW/SD-602	0.046		5.4	No	BSL
Acetone	3 / 4	0.29 : 0.29	0.12 - 0.33	SW/SD-602	0.21		0.0091	Yes	ASL
Carbon disulfide	1 / 4	0.0029 : 0.006	0.0073 - 0.0073	SW/SD-601	0.0036		0.001	Yes	ASL
Semivolatile Organics (mg/kg)									
Bis(2-Ethylhexyl)phthalate	1 / 4	1 : 4.8	3.7 - 3.7	SW/SD-602	1.8		433	No	BSL
Carbazole	1 / 4	0.29 : 1.1	0.16 - 0.16	SW/SD-600	0.34		NA	Yes	NSL
Polyaromatic Hydrocarbons (mg/kg)									
Anthracene	1 / 4	0.29 : 1.1	0.19 - 0.19	SW/SD-600	0.34	4.1	594	No	BSL
Benzo(a)anthracene	2 / 4	0.29 : 0.97	0.54 - 0.66	SW/SD-600	0.46	14.4	841	No	BSL
Benzo(a)pyrene	3 / 4	0.29 : 0.29	0.29 - 0.7	SW/SD-600	0.44	15.3	965	No	BSL
Benzo(b)fluoranthene	3 / 4	0.29 : 0.29	0.55 - 1.1	SW/SD-602	0.70	24.0	979	No	BSL
Benzo(ghi)perylene	1 / 4	0.29 : 1.1	0.445 - 0.445	SW/SD-600	0.41	9.7	1,095	No	BSL
Benzo(k)fluoranthene	1 / 4	0.29 : 1.1	0.34 - 0.34	SW/SD-600	0.38	7.4	981	No	BSL
Chrysene	3 / 4	0.29 : 0.29	0.47 - 1.1	SW/SD-601	0.64	24.0	844	No	BSL
Fluoranthene	4 / 4	:	0.18 - 2.2	SW/SD-602	1.3	47.9	707	No	BSL
Fluorene	1 / 4	0.29 : 1.1	0.078 - 0.078	SW/SD-600	0.31	1.7	538	No	BSL
Indeno(1,2,3-cd)pyrene	1 / 4	0.29 : 1.1	0.355 - 0.355	SW/SD-600	0.38	7.7	1,115	No	BSL
Phenanthrene	3 / 4	0.97 : 0.97	0.09 - 1.1	SW/SD-600	0.58	24.0	596	No	BSL
Pyrene	4 / 4	:	0.18 - 2	SW/SD-602	1.2	43.6	697	No	BSL
Metals (mg/kg)									
Aluminum	4 / 4	:	4,400 - 8,400	SW/SD-600	6,550		25,500	No	BSL
Arsenic	3 / 4	7.9 : 7.9	5.05 - 13	SW/SD-601	8.3		9.79	Yes	ASL
Barium	4 / 4	:	28 - 62	SW/SD-600	41		NA	Yes	NSL
Beryllium	4 / 4	:	0.37 - 0.53	SW/SD-601	0.48		NA	Yes	NSL
Cadmium	4 / 4	:	0.25 - 2.2	SW/SD-601	1.4		0.99	Yes	ASL
Calcium	4 / 4	:	2,400 - 4,000	SW/SD-603	2,925		EN	No	EN
Chromium	4 / 4	:	20 - 780	SW/SD-603	278		43.4	Yes	ASL
Chromium, Hexavalent	4 / 4	:	0.285 - 0.9	SW/SD-601	0.59		NA	Yes	NSL
Cobalt	4 / 4	:	4.3 - 9	SW/SD-600	6.7		50	No	BSL
Copper	4 / 4	:	11.55 - 68	SW/SD-602	45		31.6	Yes	ASL
Iron	4 / 4	:	9,000 - 23,000	SW/SD-600	15,500		20,000	Yes	ASL
Lead	4 / 4	:	31 - 110	SW/SD-602	69		35.8	Yes	ASL
Magnesium	4 / 4	:	1,100 - 5,300	SW/SD-600	2,875		EN	No	EN
Manganese	4 / 4	:	120 - 1250	SW/SD-600	420		460	Yes	ASL
Mercury	4 / 4	:	0.013 - 0.17	SW/SD-603	0.10		0.18	No	BSL
Nickel	4 / 4	:	8.7 - 17	SW/SD-600	13.675		22.7	No	BSL
Potassium	4 / 4	:	360 - 2,400	SW/SD-600	1,183		EN	No	EN
Selenium	4 / 4	:	0.46 - 0.92	SW/SD-601	0.79		2	No	BSL
Silver	2 / 4	0.38 : 0.79	0.34 - 0.39	SW/SD-602	0.33		2	No	BSL

Table 3.13-19
Selection of COPECs - Sediment - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non-Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation? [d]	Rationale [d]
Sodium	4 / 4	:	115 - 240	SW/SD-601	184		EN	No	EN
Thallium	1 / 4	1.3 : 1.6	0.82 - 0.82	SW/SD-600	0.76		NA	Yes	NSL
Tin	4 / 4	:	0.7 - 11	SW/SD-603	5.9		NA	Yes	NSL
Vanadium	4 / 4	:	17 - 26	SW/SD-600	23		NA	Yes	NSL
Zinc	4 / 4	:	110 - 360	SW/SD-601	288		121	Yes	ASL
Inorganics (mg/kg)									
Chloride	4 / 4	:	55.5 - 320	SW/SD-601	184		NA	Yes	NSL
Nitrogen, as Ammonia	4 / 4	:	3.2 - 23	SW/SD-603	12		NA	Yes	NSL
Sulfate	3 / 4	21 : 21	200 - 270	SW/SD-602	183		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon [e]	4 / 4		3,600 - 80,000	SW/SD-603	45,900				

Prepared by: SFR 2/12/2014
Checked by: LG 2/15/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non-detects.

[b] The maximum detected concentration of PAH compounds are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 3.12-3. PAH screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[e] TOC concentratration was used to calculate normalized data for PAHs and not evaluated.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 4.1-1
Selection of EPCs - Soil - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
Acetaldehyde	2 / 3	0.26	0.2	NC [1]	0.20	MDC	0.20	MDC
Semivolatile Organics (mg/kg)								
Benzaldehyde	7 / 12	2.2	1.9	0.79 NP [1]	0.79	95% UCL	1.9	MDC
Benzo(a)pyrene	6 / 13	0.25	0.24	0.15 NP [2]	0.15	95% UCL	0.24	MDC
Bis(2-Ethylhexyl)phthalate	12 / 17	22	340	110 NP [3]	110	95% UCL	22	Average
Diphenyl ether	1 / 12	2.1	0.12	NC [2]	0.12	MDC	0.12	MDC
Fluoranthene	9 / 17	1.7	0.94	0.40 NP [2]	0.40	95% UCL	0.94	MDC
Phenanthrene	9 / 17	1.8	0.68	0.27 NP [1]	0.27	95% UCL	0.68	MDC
Pyrene	9 / 17	1.7	0.66	0.31 NP [2]	0.31	95% UCL	0.66	MDC
Pesticides (mg/kg)								
4,4'-DDD	1 / 3	0.056	0.039	NC [2]	0.039	MDC	0.039	MDC
4,4'-DDE	1 / 3	0.059	0.049	NC [2]	0.049	MDC	0.049	MDC
4,4'-DDT	1 / 3	0.27	0.68	NC [2]	0.68	MDC	0.27	Average
Metals (mg/kg)								
Aluminum	13 / 13	8,715	24,000	13,090 G [1]	13,090	95% UCL	8,715	Average
Arsenic	13 / 14	6.7	15	8.8 NP [2]	8.8	95% UCL	6.7	Average
Cadmium	9 / 14	0.51	1.1	0.69 NP [4]	0.69	95% UCL	0.51	Average
Chromium	14 / 15	39	275	116 NP [3]	116	95% UCL	39	Average
Copper	12 / 12	17.9	35	22 ND [1]	22	95% UCL	17.9	Average
Iron	13 / 13	10,908	36,000	22,493 NP [5]	22,493	95% UCL	10,908	Average
Lead	13 / 14	40	80	53 NP [2]	53	95% UCL	40	Average
Mercury	8 / 14	0.15	0.35	0.16 NP [2]	0.2	95% UCL	0.15	Average
Selenium	4 / 14	1.1	3.6	2.4 NP [4]	2.4	95% UCL	1.1	Average
Vanadium	12 / 12	24	44	29 G [1]	29	95% UCL	24	Average
Zinc	12 / 12	49	140	70 ND [1]	70	95% UCL	49	Average
Inorganics (mg/kg)								
Chloride	4 / 12	79	550	242 NP [4]	242	95% UCL	79	Average
Nitrogen, as Ammonia	12 / 12	439	1,200	625 ND [1]	625	95% UCL	439	Average

Table 4.1-1
Selection of EPCs - Soil - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/24/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated
- [1] Dataset too small to calculate
- [2] Only one detect

NP - Nonparametric
- [1] 95% KM (BCA) UCL
- [2] 95% KM (t) UCL
- [3] 95% KM (Chebyshev) UCL
- [4] 95% KM (Percentile Bootstrap) UCL
- [5] 95% Chebyshev (Mean, Sd) UCL

G - Gamma
- [1] 95% Approximate Gamma

ND - Normal Distribution
- [1] 95% Student's-t UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-2
Selection of EPCs - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
Acetaldehyde	1 / 6	0.12	0.046	NC [1]	0.046	MDC	0.046	MDC
Semivolatile Organics (mg/kg)								
Benzaldehyde	12 / 14	0.24	1.2	0.61 NP [1]	0.61	95% UCL	0.24	Average
Benzo(a)pyrene	18 / 69	0.33	3.4	0.35 NP [2]	0.35	95% UCL	0.33	Average
Bis(2-Ethylhexyl)phthalate	56 / 76	9.0	200	30 NP [3]	30	95% UCL	9.0	Average
Fluoranthene	24 / 79	0.85	1.9	0.41 NP [1]	0.41	95% UCL	0.85	Average
Naphthalene	4 / 79	0.82	0.21	0.065 NP [2]	0.065	95% UCL	0.21	MDC
Phenanthrene	17 / 79	0.78	0.69	0.14 NP [2]	0.14	95% UCL	0.69	MDC
Pyrene	24 / 78	0.82	1.3	0.22 NP [2]	0.22	95% UCL	0.82	Average
Pesticides (mg/kg)								
4,4'-DDD	6 / 34	0.021	0.16	0.016 NP [2]	0.016	95% UCL	0.021	Average
4,4'-DDE	11 / 34	0.017	0.011	0.0038 NP [2]	0.0038	95% UCL	0.011	MDC
4,4'-DDT	18 / 34	0.025	0.15	0.068 NP [4]	0.068	95% UCL	0.025	Average
Alpha-BHC	3 / 34	0.015	0.0058	0.0020 NP [2]	0.0020	95% UCL	0.0058	MDC
Gamma-BHC/Lindane	5 / 34	0.019	0.13	0.012 NP [2]	0.012	95% UCL	0.019	Average
Metals (mg/kg)								
Aluminum	43 / 43	7,016	59,000	8,804 G [1]	8,804	95% UCL	7,016	Average
Arsenic	40 / 53	7.6	32	9.1 NP [5]	9.1	95% UCL	7.6	Average
Cadmium	18 / 60	0.42	5.8	0.48 NP [6]	0.48	95% UCL	0.42	Average
Chromium	86 / 86	272	5,000	583 NP [7]	583	95% UCL	272	Average
Chromium, Hexavalent	2 / 29	11	95	38 NP[3]	38	95% UCL	11	Average
Cobalt	31 / 34	5.0	45.5	16.2 NP [3]	16.2	95% UCL	5.0	Average
Copper	33 / 34	14	79.5	27 NP[7]	27	95% UCL	14	Average
Iron	43 / 43	8,973	100,000	19,245 NP [7]	19,245	95% UCL	8,973	Average
Lead	59 / 60	24	210	43 NP [1]	43	95% UCL	24	Average
Manganese	34 / 34	84	1035	171 ND [1]	171	95% UCL	84	Average
Mercury	23 / 55	0.12	0.49	0.14 NP [2]	0.14	95% UCL	0.12	Average
Nickel	33 / 34	10	67	25 NP [3]	25	95% UCL	10	Average
Vanadium	34 / 34	17	54	20 G [1]	20	95% UCL	17	Average
Zinc	29 / 34	23	180	48 NP [1]	48	95% UCL	23	Average
Inorganics (mg/kg)								
Chloride	5 / 19	54	560	119 NP [2]	119	95% UCL	54	Average
Cyanide, Total	6 / 7	5.8	9.05	7.9 NP [2]	7.9	95% UCL	5.8	Average
Nitrogen, as Ammonia	32 / 32	262	1,800	356 G [1]	356	95% UCL	262	Average
Sulfate	15 / 27	1,095	23,900	10,004 NP [4]	10,004	95% UCL	1,095	Average
EPH (mg/kg)								
C11-C22 Aromatics	8 / 12	32	130	56 NP [2]	56	95% UCL	32	Average
C19-C36 Aliphatics	7 / 12	42	190	81 NP [5]	81	95% UCL	42	Average
C9-C18 Aliphatics	5 / 12	6.5	17	16.3 NP [5]	16.3	95% UCL	6.5	Average

Table 4.1-2
Selection of EPCs - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated	NP - Nonparametric	G - Gamma	ND - Normal Distribution
[1] Only one detect	[1] 95% KM (Chebyshev) UCL	[1] 95% Approximate Gamma	[1] 95% H-UCL
	[2] 95% KM (t) UCL		
	[3] 97.5% KM (Chebyshev) UCL		
	[4] 99% KM (Chebyshev) UCL		
	[5] 95% KM (Percentile Bootstrap) UCL		
	[6] 95% KM (BCA) UCL		
	[7] 95% KM Chebyshev (Mean, Sd) UCL		

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern	EPH - Extractable Petroleum Hydrocarbons	RME - Reasonable Maximum Exposure
CTE - Central Tendency Exposure	MDC - Maximum Detected Concentration	UCL - Upper Confidence Limit
EPC - Exposure Point Concentration	mg/kg - milligrams per kilogram	

Table 4.1-3
Selection of EPCs - Soil - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
Acetaldehyde	3 / 3	0.082	0.13	NC NC [1]	0.13	MDC	0.082	Average
Semivolatile Organics (mg/kg)								
Aniline	1 / 12	12.7	0.12	NC NC [2]	0.12	MDC	0.12	MDC
Benzaldehyde	10 / 10	0.12	0.33	0.21 G [1]	0.21	95% UCL	0.12	Average
Benzo(a)pyrene	4 / 10	0.072	0.44	0.15 NP [1]	0.15	95% UCL	0.072	Average
Bis(2-Ethylhexyl)phthalate	11 / 14	31	216	103 NP [2]	103	95% UCL	31	Average
Diphenyl ether	2 / 10	0.37	1.9	1.9 NP [3]	1.9	95% UCL	0.37	Average
Fluoranthene	10 / 13	0.44	2.6	2.5 NP [4]	2.5	95% UCL	0.44	Average
N-Nitrosodi-n-propylamine	1 / 12	2.5	0.26	NC NC [2]	0.26	MDC	0.26	MDC
Phenanthrene	9 / 13	0.26	0.41	0.15 NP [5]	0.15	95% UCL	0.26	Average
Pyrene	7 / 13	0.28	0.79	0.56 NP [6]	0.56	95% UCL	0.28	Average
Pesticides (mg/kg)								
4,4'-DDT	1 / 1	0.045	0.045	NC NC [1]	0.045	MDC	0.045	Average
Hexachlorobenzene	1 / 1	0.029	0.029	NC NC [1]	0.029	MDC	0.029	Average
Metals (mg/kg)								
Aluminum	9 / 9	10,789	43,000	20,005 G [1]	20,005	95% UCL	10,789	Average
Antimony	2 / 7	0.88	0.34	0.36 NP [1]	0.34	MDC	0.34	MDC
Arsenic	10 / 11	19.4	42	27 NP [1]	27	95% UCL	19.4	Average
Cadmium	6 / 10	0.65	0.52	0.42 NP [1]	0.42	95% UCL	0.52	MDC
Chromium	42 / 43	6,648	62,000	26,344 NP [4]	26,344	95% UCL	6,648	Average
Chromium, Hexavalent	4 / 16	79	1,100	559 NP [6]	559	95% UCL	79	Average
Copper	9 / 9	38	190	97 G [1]	97	95% UCL	38	Average
Iron	9 / 9	14,067	31,000	20,139 ND [1]	20,139	95% UCL	14,067	Average
Lead	11 / 11	71	150	93 ND [1]	93	95% UCL	71	Average
Mercury	10 / 11	0.64	3.1	1.9 NP [2]	1.9	95% UCL	0.64	Average
Silver	2 / 11	103	1,100	1,439 NP [4]	1,100	MDC	103	Average
Thallium	1 / 8	1.9	7.4	NC NC [2]	7.4	MDC	1.9	Average
Tin	8 / 9	2924	26,000	31,853 NP [4]	26,000	MDC	2,924	Average
Vanadium	9 / 9	39	150	69 G [1]	69	95% UCL	39	Average
Zinc	9 / 9	17.0	47	31 G [1]	31	95% UCL	17.0	Average
Inorganics (mg/kg)								
Cyanide, Total	1 / 1	6.5	6.5	NC NC [1]	6.5	MDC	6.5	Average
Nitrogen, as Ammonia	9 / 9	406	1,100	749 ND[2]	749	95% UCL	406	Average
Sulfate	2 / 8	74	230	230 NP [3]	230	95% UCL	74	Average
EPH (mg/kg)								
C11-C22 Aromatics	2 / 2	4450	7,500	NC NC [1]	7,500	MDC	4,450	Average
C19-C36 Aliphatics	2 / 2	3350	4,900	NC NC [1]	4,900	MDC	3,350	Average
C9-C18 Aliphatics	2 / 2	490	780	NC NC [1]	780	MDC	490	Average

Table 4.1-3
Selection of EPCs - Soil - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated
- [1] Dataset too small to calculate
- [2] Only one detect

G - Gamma
- [1] 95% Approximate Gamma

NP - Nonparametric
- [1] 95% KM (t) UCL
- [2] 95% KM (Chebyshev) UCL
- [3] 95% KM (% Bootstrap) UCL
- [4] 99% KM (Chebyshev) UCL
- [5] 95% KM (BCA) UCL
- [6] 97.5% KM (Chebyshev) UCL

ND - Normal Distribution
- [1] 95% Student's-t UCL
- [2] 95% H-UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
EPH - Extractable Petroleum Hydrocarbons
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-4
Selection of EPCs - Surface Water - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Semivolatile Organics (mg/L)								
Azobenzene	2 / 12	0.0017	0.00053	0.00056 NP [1]	0.00053	MDC	0.00053	MDC
Benzo(a)pyrene	1 / 12	0.00016	0.00015	NC NC [1]	0.00015	MDC	0.00015	MDC
Bis(2-Ethylhexyl)phthalate	2 / 11	0.0024	0.0061	0.0034 NP [1]	0.0034	95% UCL	0.0024	Average
N-Nitrosodi-n-propylamine	2 / 12	0.0000035	0.0000093	0.0000066 NP [1]	0.0000066	95% UCL	0.0000035	Average
Metals, Total (mg/L)								
Aluminum	131 / 132	4.9	280	19 NP [2]	18.9	95% UCL	4.9	Average
Barium	12 / 12	0.024	0.032	0.027 ND [1]	0.027	95% UCL	0.024	Average
Beryllium	5 / 12	0.00061	0.0011	0.00084 NP [1]	0.00084	95% UCL	0.00061	Average
Chromium	132 / 132	1.1	64	3.3 NP [3]	3.3	95% UCL	1.1	Average
Cobalt	12 / 12	0.028	0.05	0.037 ND [1]	0.037	95% UCL	0.028	Average
Copper	12 / 12	0.0090	0.026	0.017 G [1]	0.017	95% UCL	0.0090	Average
Iron	12 / 12	5.9	13	7.9 ND [1]	7.9	95% UCL	5.9	Average
Lead	10 / 12	0.00063	0.0021	0.00094 NP [4]	0.00094	95% UCL	0.00063	Average
Manganese	12 / 12	1.5	2.2	1.8 ND [1]	1.8	95% UCL	1.5	Average
Silver	1 / 12	0.00027	0.000017	NC NC [1]	0.000017	MDC	0.000017	MDC
Metals, Filtered (mg/L)								
Aluminum	131 / 132	0.69	22	1.5 NP [5]	1.528	95% UCL	0.69	Average
Chromium	132 / 132	0.20	5	0.40 NP [3]	0.398	95% UCL	0.20	Average
Inorganics (mg/L)								
Bromide	10 / 12	0.32	0.48	0.40 NP [6]	0.4	95% UCL	0.32	Average
Chloride	132 / 132	164	300	172 G [1]	172	95% UCL	164	Average
Nitrite as N	12 / 126	0.031	0.043	0.021 NP [6]	0.021	95% UCL	0.031	Average
Nitrogen, as Ammonia	132 / 132	56	250	73 NP [3]	73	95% UCL	56	Average

Table 4.1-4
Selection of EPCs - Surface Water - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric
- [1] 95% KM (t) UCL
- [2] 97.5% KM Chebyshev
- [3] 95% KM Chebyshev (Mean, Sd) UCL
- [4] 95% KM (BCA) UCL
- [5] 95% KM (Chebyshev) UCL
- [6] 95% KM (Percentile Bootstrap) UCL

NC - Not Calculated
- [1] Only one detect

ND - Normal Distribution
- [1] 95% Student's-t UCL

G - Gamma Distribution
- [1] 95% Approximate Gamma UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
UCL - Upper Confidence Limit

Table 4.1-5
Selection of EPCs - Surface Water - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Metals, Total (mg/L)								
Aluminum	1 / 1	0.21	0.21	NC [1]	0.21	MDC	0.21	Average
Barium	1 / 1	0.049	0.049	NC [1]	0.049	MDC	0.049	Average
Manganese	1 / 1	0.7	0.7	NC [1]	0.70	MDC	0.70	Average
Silver	1 / 1	0.000015	0.000015	NC [1]	0.000015	MDC	0.000015	Average
Inorganics (mg/L)								
Bromide	1 / 1	0.13	0.13	NC [1]	0.13	MDC	0.13	Average
Nitrite as N	1 / 1	0.075	0.075	NC [1]	0.075	MDC	0.075	Average
Nitrogen, as Ammonia	1 / 1	28	28	NC [1]	28	MDC	28	Average

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated
[1] Only one detect

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-6
Selection of EPCs - Surface Water - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Semivolatile Organics (mg/L)								
N-Nitrosodiphenylamine	1 / 1	0.0000074	0.0000074	NC [1]	0.0000074	MDC	0.0000074	Average
Metals, Total (mg/L)								
Aluminum	1 / 1	0.9	0.9	NC [1]	0.90	MDC	0.90	Average
Barium	1 / 1	0.026	0.026	NC [1]	0.026	MDC	0.026	Average
Iron	1 / 1	1.5	1.5	NC [1]	1.5	MDC	1.5	Average
Lead	1 / 1	0.003	0.003	NC [1]	0.0030	MDC	0.0030	Average
Silver	1 / 1	0.000056	0.000056	NC [1]	0.000056	MDC	0.000056	Average
Inorganics (mg/L)								
Nitrite as N	1 / 1	0.026	0.026	NC [1]	0.026	MDC	0.026	Average
Nitrogen, as Ammonia	1 / 1	7.5	7.5	NC [1]	7.5	MDC	7.5	Average

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Only one detect

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-7
Selection of EPCs - Surface Water - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/L)								
Carbon disulfide	3 / 6	0.0033	0.0025	0.0025 NP [1]	0.0025	MDC	0.0025	MDC
Semivolatile Organics (mg/L)								
3 & 4 Methylphenol	2 / 6	0.0018	0.00076	0.00078 NP [1]	0.00076	MDC	0.00076	MDC
Benzo(a)anthracene	2 / 6	0.00047	0.002	NC NC [1]	0.0020	MDC	0.00047	Average
Benzo(a)pyrene	4 / 6	0.00089	0.0042	0.0023 NP [2]	0.0023	95% UCL	0.00089	Average
Benzo(b)fluoranthene	4 / 6	0.0016	0.0077	0.0040 NP [2]	0.0040	95% UCL	0.0016	Average
Benzo(ghi)perylene	3 / 6	0.00099	0.0046	0.0026 NP [1]	0.0026	95% UCL	0.00099	Average
Benzo(k)fluoranthene	2 / 6	0.00061	0.0026	0.0026 NP [2]	0.0026	95% UCL	0.00061	Average
Chrysene	4 / 6	0.0012	0.0053	0.0027 NP [2]	0.0027	95% UCL	0.0012	Average
Dibenz(a,h)anthracene	1 / 6	0.00039	0.0012	NC NC [2]	0.0012	MDC	0.00039	Average
Indeno(1,2,3-cd)pyrene	3 / 6	0.00088	0.004	0.0040 NP [3]	0.0040	95% UCL	0.00088	Average
Phenanthrene	4 / 6	0.00053	0.0025	0.0013 NP [2]	0.0013	95% UCL	0.00053	Average
Pyrene	4 / 6	0.0031	0.012	0.0063 NP [2]	0.0063	95% UCL	0.0031	Average
Metals, Total (mg/L)								
Aluminum	6 / 6	0.82	1.6	1.3 ND [1]	1.3	95% UCL	0.82	Average
Barium	6 / 6	0.035	0.046	0.041 ND [1]	0.041	95% UCL	0.035	Average
Chromium	6 / 6	0.050	0.13	0.093 ND [1]	0.093	95% UCL	0.050	Average
Iron	6 / 6	16.4	30	25 ND [1]	25	95% UCL	16.4	Average
Lead	6 / 6	0.0027	0.0058	0.0043 ND [1]	0.0043	95% UCL	0.0027	Average
Manganese	6 / 6	0.85	1.5	1.3 ND [1]	1.3	95% UCL	0.85	Average
Zinc	6 / 6	0.038	0.12	0.095 G [1]	0.095	95% UCL	0.038	Average
Inorganics (mg/L)								
Bromide	5 / 6	0.15	0.21	0.20 NP [1]	0.20	95% UCL	0.15	Average
Nitrite as N	1 / 6	0.023	0.02	NC NC [2]	0.020	MDC	0.020	MDC
Nitrogen, as Ammonia	6 / 6	45	66	60 ND [1]	60	95% UCL	45	Average

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric
- [1] 95% KM (t) UCL
- [2] 95% KM (BCA) UCL
- [3] 95% KM (Percentile Bootstrap) UCL

NC - Not Calculated
- [1] N/A result from ProUCL
- [2] Only one detect

ND - Normal Distribution
- [1] 95% Student's-t UCL

G - Gamma Distribution
- [1] 95% Approximate Gamma UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-8
Selection of EPCs - Surface Water - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Semivolatile Organics (mg/L)								
Benzo(a)pyrene	2 / 22	0.000094	0.00013	0.00014 NP [1]	0.00013	MDC	0.000094	Average
Caprolactam	2 / 22	0.0021	0.00066	NC NC [1]	0.00066	MDC	0.00066	MDC
N-Nitrosodi-n-propylamine	3 / 22	0.0000041	0.00000078	0.00000080 NP [1]	0.00000078	MDC	0.00000078	MDC
Metals, Total (mg/L)								
Aluminum	18 / 22	0.17	1.8	0.68 NP [2]	0.68	95% UCL	0.17	Average
Barium	22 / 22	0.037	0.15	0.046 G [1]	0.046	95% UCL	0.037	Average
Copper	18 / 22	0.0048	0.054	0.015 NP [3]	0.015	95% UCL	0.0048	Average
Iron	22 / 22	3.4	29	9.9 NP [4]	9.9	95% UCL	3.4	Average
Lead	18 / 22	0.0065	0.11	0.038 NP [2]	0.038	95% UCL	0.0065	Average
Manganese	22 / 22	0.91	9.3	2.7 NP [4]	2.7	95% UCL	0.91	Average
Inorganics (mg/L)								
Bromide	2 / 22	0.055	0.12	0.10 NP [1]	0.10	95% UCL	0.055	Average

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric
- [1] 95% KM (t) UCL
- [2] 97.5% KM (Chebyshev) UCL
- [3] 95% KM (Chebyshev) UCL
- [4] 95% KM Chebyshev (Mean, Sd) UCL

NC - Not Calculated
- [1] Only one detect

G - Gamma Distribution
- [1] 95% Approximate Gamma UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-9
Selection of EPCs - Surface Water - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	Average (arithmetic mean) [b]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Semivolatile Organics (mg/L)								
Benzo(a)anthracene	2 / 4	0.00012	0.00012	NC [1]	0.00012	MDC	0.000119	Average
Benzo(a)pyrene	2 / 4	0.00012	0.00017	NC [1]	0.00017	MDC	0.00012	Average
Caprolactam	1 / 4	0.0019	0.00033	NC [1]	0.00033	MDC	0.00033	MDC
Pyrene	3 / 4	0.00080	0.00039	NC [1]	0.00039	MDC	0.00039	MDC
Metals, Total (mg/L)								
Aluminum	3 / 4	0.15	0.22	NC [1]	0.22	MDC	0.15	Average
Barium	4 / 4	0.034	0.041	NC [1]	0.041	MDC	0.034	Average
Iron	4 / 4	1.9	2.9	NC [1]	2.9	MDC	1.9	Average
Lead	4 / 4	0.00093	0.0013	NC [1]	0.0013	MDC	0.00093	Average
Manganese	4 / 4	0.39	0.49	NC [1]	0.49	MDC	0.39	Average
Silver	1 / 4	0.00038	0.000022	NC [1]	0.000022	MDC	0.000022	MDC
Inorganics (mg/L)								
Bromide	2 / 4	0.28	0.65	NC [1]	0.65	MDC	0.28	Average
Chloride	4 / 4	190	320	NC [1]	320	MDC	190	Average

Prepared by: SFR 2/5/2014
Checked by: LG 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Dataset too small to calculate

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-10
Selection of EPCs - Sediment - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-1-pentene	2 / 4	0.018	0.037	NC NC [1]	0.037	MDC	0.018	Average
2,4,4-Trimethyl-2-pentene	2 / 4	0.0029	0.003	NC NC [1]	0.0030	MDC	0.0029	Average
4-iso-Propyltoluene	1 / 4	0.0018	0.0026	NC NC [1]	0.0026	MDC	0.0018	Average
Acetaldehyde	3 / 4	0.085	0.083	NC NC [1]	0.083	MDC	0.083	MDC
Formaldehyde	4 / 4	0.75	1.09	NC NC [1]	1.1	MDC	0.75	Average
Semivolatile Organics (mg/kg)								
3 & 4 Methylphenol	3 / 6	1.3	3	3.0 NP [1]	3.0	95% UCL	1.3	Average
Acetophenone	1 / 6	0.43	0.09	NC NC [2]	0.090	MDC	0.090	MDC
Benzaldehyde	3 / 4	0.35	0.62	NC NC [1]	0.62	MDC	0.35	Average
Caprolactam	1 / 4	0.10	0.053	NC NC [1]	0.053	MDC	0.053	MDC
Diphenyl ether	2 / 4	0.15	0.22	NC NC [1]	0.22	MDC	0.15	Average
Di-n-octylphthalate	1 / 6	0.42	0.15	NC NC [2]	0.15	MDC	0.15	MDC
Diphenylmethanone	1 / 4	0.098	0.0305	NC NC [1]	0.031	MDC	0.031	MDC
Phenol	3 / 6	0.72	0.96	0.96 NP [1]	1.0	95% UCL	0.72	Average
Metals (mg/kg)								
Arsenic	6 / 6	5.3	13	10 G [1]	10	95% UCL	5.3	Average
Barium	6 / 6	27	86	70 G [1]	70	95% UCL	27	Average
Beryllium	5 / 6	0.44	1.0	0.71 NP [2]	0.71	95% UCL	0.44	Average
Chromium	30 / 30	405	1,800	926 LN [1]	926	95% UCL	405	Average
Chromium, Hexavalent	3 / 6	7.0	25	25 NP [1]	25	95% UCL	7.0	Average
Iron	30 / 30	12,445	23,000	13,895 ND [1]	13,895	95% UCL	12,445	Average
Silver	4 / 6	7.5	35	19 NP [3]	19	95% UCL	7.5	Average
Vanadium	6 / 6	10	18	15 ND [1]	15	95% UCL	10	Average
Inorganics (mg/kg)								
Chloride	4 / 4	74	140	NC NC [1]	140	MDC	74	Average
Nitrogen, as Ammonia	6 / 6	148	240	215 ND [1]	215	95% UCL	148	Average
Sulfate	4 / 4	469	700	NC NC [1]	700	MDC	469	Average
Specialty Compounds (mg/kg)								
Hydrazine	2 / 4	0.0012	0.00091	NC NC [1]	0.00091	MDC	0.00091	MDC
Dimethylformamide	2 / 4	0.18	0.3	NC NC [1]	0.30	MDC	0.18	Average
EPH (mg/kg)								
C11-C22 Aromatics	4 / 4	17	24	NC NC [1]	24	MDC	17	Average
C19-C36 Aliphatics	4 / 4	29	43	NC NC [1]	43	MDC	29	Average
C9-C18 Aliphatics	1 / 4	26	96	NC NC [1]	96	MDC	26	Average

Table 4.1-10
Selection of EPCs - Sediment - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated
- [1] Data set too small to calculate UCL
- [2] Only one detect

G - Gamma Distribution
- [1] 95% Approximate Gamma UCL

ND - Normal Distribution
- [1] 95% Student's-t UCL

NP - Nonparametric
- [1] 95% KM (Percentile Bootstrap) UCL
- [2] 95% KM (t) UCL
- [3] 95% KM (BCA) UCL

LN - Lognormal Distribution
- [1] 95% H-UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
EPH - Extractable Petroleum Hydrocarbons
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-11
Selection of EPCs - Sediment - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-1-pentene	2 / 3	0.011	0.02	NC NC [1]	0.020	MDC	0.011	Average
2,4,4-Trimethyl-2-pentene	1 / 3	0.0037	0.0035	NC NC [1]	0.0035	MDC	0.0035	MDC
Acetaldehyde	1 / 2	0.11	0.063	NC NC [1]	0.063	MDC	0.063	MDC
Acetone	1 / 3	0.17	0.12	NC NC [1]	0.12	MDC	0.12	MDC
Formaldehyde	2 / 2	0.44	0.6	NC NC [1]	0.60	MDC	0.44	Average
Semivolatile Organics (mg/kg)								
Aniline	1 / 6	3.7	0.23	NC NC [2]	0.23	MDC	0.23	MDC
Benzaldehyde	1 / 3	0.99	0.12	NC NC [1]	0.12	MDC	0.12	MDC
Bis(2-Ethylhexyl)phthalate	6 / 6	322	920	602 ND [1]	602	95% UCL	322	Average
Di-n-octylphthalate	1 / 6	1.1	0.15	NC NC [2]	0.15	MDC	0.15	MDC
Diphenyl ether	2 / 3	1.8	2.6	NC NC [1]	2.6	MDC	1.8	Average
Diphenylamine	1 / 2	0.062	0.095	NC NC [1]	0.095	MDC	0.062	Average
Pesticides (mg/kg)								
4,4`-DDT	1 / 3	0.025	0.062	NC NC [1]	0.062	MDC	0.025	Average
Hexachlorobenzene	1 / 3	0.016	0.037	NC NC [1]	0.037	MDC	0.016	Average
Metals (mg/kg)								
Barium	6 / 6	12.8	23	17.4 ND [1]	17.4	95% UCL	12.8	Average
Beryllium	5 / 6	0.96	1.9	1.5 NP [1]	1.5	95% UCL	0.96	Average
Cadmium	4 / 6	0.56	1.2	1.0 NP [2]	1.0	95% UCL	0.56	Average
Chromium	6 / 6	1,922	3,000	2,764 ND [1]	2,764	95% UCL	1,922	Average
Chromium, Hexavalent	4 / 5	14.5	28	26 NP [2]	26	95% UCL	14.5	Average
Mercury	5 / 6	0.18	0.39	0.29 NP [1]	0.29	95% UCL	0.18	Average
Nickel	6 / 6	14.1	24	19.6 ND [1]	19.6	95% UCL	14.1	Average
Silver	3 / 6	25	62	62 NP [2]	62	95% UCL	25	Average
Tin	1 / 3	3.7	1.6	NC NC [1]	1.6	MDC	1.6	MDC
Vanadium	6 / 6	8.7	14	11.1 ND [1]	11.1	95% UCL	8.7	Average
Inorganics (mg/kg)								
Chloride	3 / 3	133	140	NC NC [1]	140	MDC	133	Average
Nitrogen, as Ammonia	6 / 6	172	290	252 ND [1]	252	95% UCL	172	Average
Sulfate	3 / 3	690	830	NC NC [1]	830	MDC	690	Average
EPH (mg/kg)								
C11-C22 Aromatics	2 / 2	5,250	9,400	NC NC [1]	9,400	MDC	5,250	Average
C19-C36 Aliphatics	2 / 2	3,545	6,400	NC NC [1]	6,400	MDC	3,545	Average
C9-C18 Aliphatics	2 / 2	433	770	NC NC [1]	770	MDC	433	Average
Specialty Compounds (mg/kg)								
Hydrazine	2 / 2	0.0019	0.0024	NC NC [1]	0.0024	MDC	0.0019	Average

Table 4.1-11
Selection of EPCs - Sediment - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated
- [1] Data set too small to calculate UCL
- [2] Only one detect

ND - Normal Distribution
- [1] 95% Student's-t UCL

NP - Nonparametric
- [1] 95% KM (t) UCL
- [2] 95% KM (Percentile Bootstrap) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
EPH - Extractable Petroleum Hydrocarbons
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-12
Selection of EPCs - Sediment - On-PWD-WDW
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
Acetone	2 / 8	7.6	0.34	0.45 NP [1]	0.34	MDC	0.34	MDC
Nonionic Organics (mg/kg)								
Benzene	1 / 8	0.93	4.4	NC NC [1]	4.4	MDC	0.93	Average
Metals (mg/kg)								
Barium	3 / 3	18.0	37.6	NC NC [2]	38	MDC	18.0	Average
Beryllium	1 / 3	0.25	0.61	NC NC [2]	0.61	MDC	0.25	Average
Cadmium	4 / 9	0.57	1.2	0.94 NP [2]	0.94	95% UCL	0.57	Average
Chromium	31 / 33	24	69	30 NP [3]	30	95% UCL	24	Average
Lead	8 / 9	50	110	76 NP [1]	76	95% UCL	50	Average
Mercury	5 / 8	0.23	0.44	0.34 NP[2]	0.34	95% UCL	0.23	Average
Vanadium	3 / 3	15.7	27	NC NC [2]	27	MDC	15.7	Average

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric
- [1] 95% KM (t) UCL
- [2] 95% KM (Percentile Bootstrap) UCL
- [3] 95% KM (BCA) UCL

NC - Not Calculated
- [1] Only one detect
- [2] Data set too small to calculate UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-13
Selection of EPCs - Sediment - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-1-pentene	1 / 2	0.0068	0.011	NC [1]	0.011	MDC	0.0068	Average
2,4,4-Trimethyl-2-pentene	1 / 2	0.0057	0.0088	NC [1]	0.0088	MDC	0.0057	Average
Acetone	2 / 2	0.12	0.12	NC [1]	0.12	MDC	0.12	Average
Methyl Tertbutyl Ether	1 / 2	0.0016	0.0017	NC [1]	0.0017	MDC	0.0016	Average
Semivolatile Organics (mg/kg)								
3 & 4 Methylphenol	2 / 2	5.2	6.1	NC [1]	6.1	MDC	5.2	Average
Acetophenone	2 / 2	0.21	0.26	NC [1]	0.26	MDC	0.21	Average
Benzaldehyde	2 / 2	1.7	1.9	NC [1]	1.9	MDC	1.7	Average
Phenol	2 / 2	2.0	2.2	NC [1]	2.2	MDC	2.0	Average
Polyaromatic Hydrocarbons (mg/kg)								
Benzo(b)fluoranthene	1 / 2	0.19	0.14	NC [1]	0.14	MDC	0.14	MDC
Fluoranthene	2 / 2	0.25	0.29	NC [1]	0.29	MDC	0.25	Average
Phenanthrene	1 / 2	0.22	0.21	NC [1]	0.21	MDC	0.21	MDC
Pyrene	2 / 2	0.21	0.23	NC [1]	0.23	MDC	0.21	Average
Metals (mg/kg)								
Barium	2 / 2	46	46	NC [1]	46	MDC	46	Average
Beryllium	2 / 2	0.092	0.094	NC [1]	0.094	MDC	0.092	Average
Chromium	9 / 9	38	140	95 NP [1]	140	MDC	38	Average
Chromium, Hexavalent	2 / 2	0.24	0.27	NC [1]	0.27	MDC	0.24	Average
Lead	2 / 2	51	51	NC [1]	51	MDC	51	Average
Manganese	2 / 2	515	590	NC [1]	590	MDC	515	Average
Tin	2 / 2	2.2	2.2	NC [1]	2.2	MDC	2.2	Average
Vanadium	2 / 2	16.5	17	NC [1]	17	MDC	16.5	Average
Inorganics (mg/kg)								
Chloride	2 / 2	21	24	NC [1]	24	MDC	21	Average
Nitrogen, as Ammonia	2 / 2	26	35	NC [1]	35	MDC	26	Average
Sulfate	2 / 2	855	1,200	NC [1]	1,200	MDC	855	Average

Table 4.1-13
Selection of EPCs - Sediment - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated
[1] Data set too small to calculate UCL

NP - Nonparametric
[1] 95% Chebyshev (Mean, Sd) UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration

MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure

UCL - Upper Confidence Limit

Table 4.1-14
Selection of EPCs - Sediment - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-1-pentene	2 / 2	0.0051	0.0078	NC [1]	0.0078	MDC	0.0051	Average
2,4,4-Trimethyl-2-pentene	2 / 2	0.0027	0.0039	NC [1]	0.0039	MDC	0.0027	Average
Acetone	2 / 2	0.14	0.15	NC [1]	0.15	MDC	0.14	Average
Semivolatile Organics (mg/kg)								
3 & 4 Methylphenol	2 / 2	2.9	4	NC [1]	4.0	MDC	2.9	Average
Acetophenone	1 / 2	0.23	0.16	NC [1]	0.16	MDC	0.16	MDC
Benzaldehyde	2 / 2	0.96	1.3	NC [1]	1.3	MDC	0.96	Average
Phenol	2 / 2	1.7	1.9	NC [1]	1.9	MDC	1.7	Average
(mg/kg)								
Benzo(a)pyrene	1 / 2	0.24	0.22	NC [1]	0.22	MDC	0.22	MDC
Metals (mg/kg)								
Arsenic	2 / 2	10.7	12	NC [1]	12.0	MDC	10.7	Average
Barium	2 / 2	50	51	NC [1]	51	MDC	50	Average
Beryllium	2 / 2	0.10	0.12	NC [1]	0.12	MDC	0.10	Average
Chromium	2 / 2	42	50	NC [1]	50	MDC	42	Average
Vanadium	2 / 2	21	22	NC [1]	22	MDC	21	Average
Inorganics (mg/kg)								
Chloride	2 / 2	9.7	13	NC [1]	13.0	MDC	9.7	Average
Nitrogen, as Ammonia	2 / 2	18.0	22	NC [1]	22	MDC	18.0	Average
Sulfate	2 / 2	1,400	1,900	NC [1]	1,900	MDC	1,400	Average

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Data set too small to calculate UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-15
Selection of EPCs - Sediment - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-1-pentene	1 / 3	0.023	0.06	NC [1]	0.060	MDC	0.023	Average
2,4,4-Trimethyl-2-pentene	1 / 3	0.0060	0.008	NC [1]	0.0080	MDC	0.0060	Average
Formaldehyde	2 / 2	0.51	0.61	NC [1]	0.61	MDC	0.51	Average
Semivolatile Organics (mg/kg)								
4-Chlorophenyl phenyl ether	1 / 3	0.044	0.061	NC [1]	0.061	MDC	0.044	Average
Carbazole	3 / 3	0.045	0.051	NC [1]	0.051	MDC	0.045	Average
Diphenyl ether	2 / 3	0.33	0.86	NC [1]	0.86	MDC	0.33	Average
Diphenylmethanone	2 / 3	0.091	0.2	NC [1]	0.20	MDC	0.091	Average
Metals (mg/kg)								
Arsenic	3 / 3	10.0	14	NC [1]	14.0	MDC	10.0	Average
Barium	3 / 3	11.7	16	NC [1]	16.0	MDC	11.7	Average
Beryllium	3 / 3	1.2	1.4	NC [1]	1.4	MDC	1.2	Average
Chromium	3 / 3	1,350	2,400	NC [1]	2,400	MDC	1,350	Average
Copper	3 / 3	25	39	NC [1]	39	MDC	25	Average
Silver	3 / 3	23.6	41	NC [1]	41	MDC	23.6	Average
Vanadium	3 / 3	11.7	15	NC [1]	15.0	MDC	11.7	Average
Inorganics (mg/kg)								
Chloride	3 / 3	147	240	NC [1]	240	MDC	147	Average
Nitrogen, as Ammonia	3 / 3	254	540	NC [1]	540	MDC	254	Average
Sulfate	3 / 3	697	1,500	NC [1]	1,500	MDC	697	Average
Specialty Compounds (mg/kg)								
Hydrazine	1 / 2	0.0017	0.0013	NC [1]	0.0013	MDC	0.0013	MDC

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Data set too small to calculate UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.1-16
Selection of EPCs - Sediment - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
Acetaldehyde	6 / 11	0.35	0.42	0.33 NP [1]	0.33	95% UCL	0.35	Average
Acetone	13 / 13	0.72	1.7	0.96 ND [1]	0.96	95% UCL	0.72	Average
Formaldehyde	11 / 11	2.2	4	2.8 ND [1]	2.8	95% UCL	2.2	Average
Semivolatile Organics (mg/kg)								
3 & 4 Methylphenol	2 / 13	0.12	0.32	0.32 NP [2]	0.32	95% UCL	0.12	Average
4-Nitrophenol	1 / 13	0.43	0.091	NC NC [1]	0.091	MDC	0.091	MDC
Benzaldehyde	4 / 13	0.12	0.3	0.20 NP [2]	0.20	95% UCL	0.12	Average
Benzoic Acid	13 / 13	0.59	1.4	0.76 ND [1]	0.76	95% UCL	0.59	Average
Benzyl alcohol	1 / 13	0.20	0.35	NC NC [1]	0.35	MDC	0.20	Average
Caprolactam	1 / 8	0.068	0.088	NC [1]	0.088	MDC	0.068	Average
Carbazole	2 / 13	0.093	0.097	0.097 NP [2]	0.097	95% UCL	0.093	Average
Metals (mg/kg)								
Aluminum	13 / 13	12,969	28,000	17,498 G [1]	17,498	95% UCL	12,969	Average
Arsenic	13 / 13	17.2	52	26 G [1]	26	95% UCL	17.2	Average
Barium	13 / 13	103	190	131 ND [1]	131	95% UCL	103	Average
Beryllium	12 / 13	0.98	2.6	1.4 NP [1]	1.4	95% UCL	0.98	Average
Cadmium	13 / 13	2.1	4.8	2.9 ND [1]	2.9	95% UCL	2.1	Average
Copper	13 / 13	39	90	53 ND [1]	53	95% UCL	39	Average
Iron	13 / 13	25,508	95,000	38,554 G [1]	38,554	95% UCL	25,508	Average
Lead	13 / 13	138	415	204 ND [1]	204	95% UCL	138	Average
Manganese	13 / 13	788	2,100	1,267 G [1]	1,267	95% UCL	788	Average
Mercury	7 / 13	0.26	0.51	0.41 NP [2]	0.41	95% UCL	0.26	Average
Nickel	13 / 13	18.6	44	25 ND [1]	25	95% UCL	18.6	Average
Thallium	1 / 13	2.6	1.4	NC NC [1]	1.4	MDC	1.4	MDC
Tin	8 / 13	8.6	16	10.1 NP [3]	10.1	95% UCL	8.6	Average
Vanadium	13 / 13	32	58	41 ND [1]	41	95% UCL	32	Average
Zinc	13 / 13	207	500	288 ND [1]	288	95% UCL	207	Average
Inorganics (mg/kg)								
Chloride	13 / 13	485	1,000	658 ND [1]	658	95% UCL	485	Average
Nitrogen, as Ammonia	13 / 13	567	1,500	771 ND [1]	771	95% UCL	567	Average
Sulfate	11 / 13	600	1,400	834 NP [1]	834	95% UCL	600	Average

Table 4.1-16
Selection of EPCs - Sediment - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NP - Nonparametric	ND - Normal Distribution	NC - Not Calculated	G - Gamma Distribution
[1] 95% KM (t) UCL	[1] 95% Student's-t UCL	[1] Only one detect	[1] 95% Approximate Gamma UCL
[2] 95% KM (% Bootstrap) UCL			
[3] 95% KM (BCA) UCL			

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern	MDC - Maximum Detected Concentration	UCL - Upper Confidence Limit
CTE - Central Tendency Exposure	mg/kg - milligrams per kilogram	
EPC - Exposure Point Concentration	RME - Reasonable Maximum Exposure	

Table 4.1-17
Selection of EPCs - Sediment - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs	Frequency of Detection	Average (arithmetic mean) [a]	Maximum Detected Concentration	95% UCL [c]	RME EPC [d]		CTE EPC [e]	
					Value	Source	Value	Source
Volatile Organics (mg/kg)								
2,4,4-Trimethyl-1-pentene	1 / 4	0.0038	0.002	NC [1]	0.002	MDC	0.002	MDC
Acetone	3 / 4	0.21	0.33	NC [1]	0.33	MDC	0.21	Average
Carbon disulfide	1 / 4	0.0036	0.0073	NC [1]	0.0073	MDC	0.0036	Average
Semivolatile Organics (mg/kg)								
Carbazole	1 / 4	0.34	0.16	NC [1]	0.16	MDC	0.16	MDC
Metals (mg/kg)								
Arsenic	3 / 4	8.3	13	NC [1]	13	MDC	8.3	Average
Barium	4 / 4	41	62	NC [1]	62	MDC	41	Average
Beryllium	4 / 4	0.48	0.53	NC [1]	0.53	MDC	0.48	Average
Cadmium	4 / 4	1.4	2.2	NC [1]	2.2	MDC	1.4	Average
Chromium	4 / 4	278	780	NC [1]	780	MDC	278	Average
Chromium, Hexavalent	4 / 4	0.59	0.9	NC [1]	0.9	MDC	0.59	Average
Copper	4 / 4	45	68	NC [1]	68	MDC	45	Average
Iron	4 / 4	15,500	23,000	NC [1]	23,000	MDC	15,500	Average
Lead	4 / 4	69	110	NC [1]	110	MDC	69	Average
Manganese	4 / 4	420	1250	NC [1]	1,250	MDC	420	Average
Thallium	1 / 4	0.76	0.82	NC [1]	0.82	MDC	0.76	Average
Tin	4 / 4	5.9	11	NC [1]	11	MDC	5.9	Average
Vanadium	4 / 4	23	26	NC [1]	26	MDC	23	Average
Zinc	4 / 4	288	360	NC [1]	360	MDC	288	Average
Inorganics (mg/kg)								
Chloride	4 / 4	184	320	NC [1]	320	MDC	184	Average
Nitrogen, as Ammonia	4 / 4	12	23	NC [1]	23	MDC	12	Average
Sulfate	3 / 4	183	270	NC [1]	270	MDC	183	Average

Prepared by: SFR 2/5/2014
Checked by: LG 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] Arithmetic mean is calculated using one-half the detection limits for non-detects.

[c] 95% UCL is calculated using ProUCL software (V. 4.1.00); calculations presented in Attachment 2.

NC - Not Calculated

[1] Data set too small to calculate UCL

[d] The RME EPC is the lesser of the MDC and the 95% UCL.

[e] The CTE EPC is the lesser of the average (arithmetic mean) and the MDC.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
MDC - Maximum Detected Concentration
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
UCL - Upper Confidence Limit

Table 4.2-1
Ecological Soil Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Plants [a]		Invertebrates [b]	
	Value	Source	Value	Source
Volatile Organics (mg/kg)				
Acetaldehyde	NA	NA	NA	NA
Tetrachloroethene	NA	NA	18.1	ECOSAR - CEV
Semivolatile Organics (mg/kg)				
Aniline	NA	NA	NA	NA
Benzaldehyde	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	16.4	ECOSAR - CEV
Bis(2-Ethylhexyl)phthalate	1,300	REACH	1,300	REACH
Butylbenzylphthalate	NA	NA	493	ECOSAR - CEV
Diphenyl ether	NA	NA	NA	NA
Fluoranthene	NA	NA	17.5	ECOSAR - CEV
Naphthalene	NA	NA	16.9	ECOSAR - CEV
N-Nitrosodi-n-propylamine	NA	NA	NA	NA
N-Nitrosodiphenylamine	NA	NA	20	ORNL - Invertebrates
Phenanthrene	NA	NA	17.7	ECOSAR - CEV
Pyrene	NA	NA	17.5	ECOSAR - CEV
Pesticides (mg/kg)				
4,4`-DDD	NA	NA	20	ECOSAR - CEV
4,4`-DDE	NA	NA	21	ECOSAR - CEV
4,4`-DDT	NA	NA	19.6	ECOSAR - CEV
Aldrin	0.00332	Region 5 - Plants	22	ECOSAR - CEV
Alpha-BHC	NA	NA	29	ECOSAR - CEV
Gamma-BHC/Lindane	0.005	Region 5 - Plants	29	ECOSAR - CEV
Hexachlorobenzene	NA	NA	19.7	ECOSAR - CEV
Metals (mg/kg)				
Aluminum	50	ORNL - Plants	NA	NA
Antimony	5	ORNL - Plants	78	Eco-SSL - Invertebrates
Arsenic	18	Eco-SSL - Plants	60	ORNL - Invertebrates
Cadmium	32	Eco-SSL - Plants	140	Eco-SSL - Invertebrates
Chromium	310	OMOE	310	OMOE
Chromium, Hexavalent	NA	NA	NA	NA
Cobalt	13	Eco-SSL - Plants	NA	NA
Copper	70	Eco-SSL - Plants	80	Eco-SSL - Invertebrates
Iron	NA	NA	NA	NA
Lead	120	Eco-SSL - Plants	1,700	Eco-SSL - Invertebrates
Manganese	220	Eco-SSL - Plants	450	Eco-SSL - Invertebrates
Mercury	0.3	ORNL - Plants	0.1	Region 5 - Soil Invertebrates
Nickel	38	Eco-SSL - Plants	280	Eco-SSL - Invertebrates
Selenium	0.52	Eco-SSL - Plants	4.1	Eco-SSL - Invertebrates
Silver	560	Eco-SSL - Plants	NA	NA
Thallium	1	ORNL - Plants	NA	NA
Tin	50	ORNL - Plants	NA	NA
Vanadium	2	ORNL - Plants	NA	NA
Zinc	160	Eco-SSL - Plants	120	Eco-SSL - Invertebrates
Inorganics (mg/kg)				
Chloride	NA	NA	87	ECOSAR - CEV
Cyanide, Total	NA	NA	89	ECOSAR - CEV
Nitrogen, as Ammonia	NA	NA	NA	NA
Sulfate	NA	NA	465	ECOSAR - CEV

Table 4.2-1
Ecological Soil Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Plants [a]		Invertebrates [b]	
	Value	Source	Value	Source
EPH (mg/kg)				
C11-C22 Aromatics	NA	NA	11.6	ECOSAR - CEV
C19-C36 Aliphatics	NA	NA	NA	NA
C9-C18 Aliphatics	NA	NA	NA	NA

Prepared by: EYM 3/13/2013
Checked by: SFR 3/14/2013

Notes:

[a] Sources for plant effects benchmarks are listed in order of preference:

[1] Eco-SSL - Plants (USEPA, 2005)

[2] Region 5 - Plants (USEPA, 2003)

[3] ORNL - Plants (Efroymson *et. al.*, 1997a)

[4] REACH database. Values selected are NOECs x10 for plants and invertebrates.

[5] OMOE - Plants and Invertebrates (OMOE, 2011).

[b] Sources for invertebrate screening benchmarks are listed in order of preference:

[1] Eco-SSL - Invertebrates (USEPA, 2005)

[2] Region 5 - Soil Invertebrates (USEPA, 2003)

[3] ORNL - Invertebrates (Efroymson *et. al.*, 1997b)

[4] Lacking a value from sources listed in [b][1], [b][2], and [b][3] above; effects benchmarks were estimated using the ECOSAR methodology described in Table 3.12-1 and a multiple of 10 was applied to convert estimated NOAELs to LOAELs.

[5] REACH database. Values selected are NOECs x10 for plants and invertebrates.

[6] OMOE - Plants and Invertebrates (OMOE, 2011).

Eco-SSL - Ecological Soil Screening Level

EPH - Extractable Petroleum Hydrocarbons

mg/kg - milligrams per kilogram

NA - Not Available

References:

Efroymson, R.A., M.E., Will, and G.W. Suter II and A.C. Wooten, 1997a. Toxicological Benchmarks for Contaminants of Potential Concern on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. 128 pp.

Efroymson, R.A., M.E., Will, and G.W. Suter II, 1997b. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., and D.M. Opresko, G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for U.S. Department of Energy. ES/ER/TM-86/R3. June 1996.

Ontario Ministry of the Environment. 2011. Rationale for the Development of Soil and ground Water Standards for Use at Contaminated Sites in Ontario. April 15.

USEPA, 2013. Ecological Soil Screening Levels (Eco-SSL) Guidance and Documents Webpage: http://www.epa.gov/oswer/riskassessment/ecorisk/ecossl.htm

USEPA, 2003. USEPA, Region 5, RCRA Ecological Screening Levels. August 22, 2003.

Table 4.2-2
Ecological Surface Water Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Effects Benchmark	Source [a]
Volatile Organics (mg/L)		
Carbon disulfide	0.017	ORNL - SAV
Semivolatile Organics (mg/L)		
3 & 4 Methylphenol	NA	NA
Azobenzene	NA	NA
Benzo(a)anthracene	0.00049	ORNL - SAV
Benzo(a)pyrene	0.00024	ORNL - SAV
Benzo(b)fluoranthene	0.006	ECOSAR - CEV
Benzo(ghi)perylene	0.002	ECOSAR - CEV
Benzo(k)fluoranthene	0.006	ECOSAR - CEV
Bis(2-Ethylhexyl)phthalate	0.027	ORNL - SAV
Caprolactam	NA	NA
Chrysene	0.019	ECOSAR - CEV
Dibenz(a,h)anthracene	0.002	ECOSAR - CEV
Indeno(1,2,3-cd)pyrene	0.002	ECOSAR - CEV
N-Nitrosodi-n-propylamine	NA	NA
N-Nitrosodiphenylamine	3.8	ORNL - SAV
Phenanthrene	0.0004	USEPA Region 3
Pyrene	0.000025	USEPA Region 3
Metals (mg/L)		
Aluminum [b]	0.75	AWQC - CMC
Barium	0.11	ORNL - SAV
Beryllium	0.035	ORNL - SAV
Cadmium [d]	Equation	AWQC - CMC
Chromium [d]	Equation	AWQC - CMC
Cobalt	1.5	ORNL - SAV
Copper [d]	Equation	AWQC - CMC
Iron	NA	NA
Lead [d]	Equation	AWQC - CMC
Manganese	2.3	ORNL - SAV
Silver	0.00123	USEPA Region 4 - Acute
Zinc [d]	Equation	AWQC - CMC
Bromide	NA	NA
Chloride	860	AWQC - CMC
Nitrite as N	NA	NA
Nitrogen, as Ammonia [g]	36	AWQC - CMC

Prepared by: SFR 3/13/2013
Checked by: EYM 3/14/2013

Notes:

[a] Effects benchmark sources are in order of preference:
[1] AWQC - CMC - USEPA, Freshwater Ambient Water Quality Criteria (AWQC) Chronic Maximum Concentration (CMC) (USEPA, 2013).
[2] ORNL - SAV - Oak Ridge National Laboratory (ORNL) Tier II Secondary Acute Values (SAVs) from Suter and Tsao, 1996 as cited in Buchman, 2008, Screening Quick Reference Tables (SQuiRTs from NOAA).
[3] USEPA Region 4 - Acute - (USEPA, 2001)
[4] USEPA Region 3 - (USEPA, 2006)
[5] Lacking a value from sources listed in [a][1], [a][2], [a][3] and [a][4] above; effects benchmarks were estimated using the ECOSAR methodology described in Table 3.12-2 and a multiple of 10 was applied to convert estimated NOAELs to LOAELs.
[b] AWQC-CCC for aluminum is for waters with pH between 6.5 and 9.0.
[c] AWQC-CCC is for the dissolved fraction of the metal.
[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).
[g] AWQC-CCC for ammonia is calculated using the equations in USEPA (2013), using a default pH of 7 and assuming that salmonid fish are absent.

Table 4.2-2
Ecological Surface Water Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Notes (continued):

CEV - Calculated Effects Value
EN - Essential Nutrient
Equation - Value is calculated for site-specific conditions using AWQC equations
LC50 - Lethal Concentration affecting 50% of test population
mg/L - milligrams per liter
NA - Not Available
NOAEL - No Observed Adverse Effects Level

References:

Suter, G.W, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects of Aquatic Biota: 1996 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-96/R2. June 1996.

USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

USEPA, 2012. Ecological Sturcture Activity Relationships Database v.1.11.

USEPA. 2006. EPA Region III BTAG Screening Benchmarks for Freshwater Screening Benchmarks. July, 2006.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. November 30, 2001 update.

Table 4.2-3
Ecological Sediment Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Effects Benchmark	Source [a]
Volatile Organics (mg/kg)		
2,4,4-Trimethyl-1-pentene	NA	NA
2,4,4-Trimethyl-2-pentene	NA	NA
4-iso-Propyltoluene	NA	NA
4-Nitrophenol	NA	NA
Acetone	0.0091	ORNL - LCV
Carbon disulfide	NA	NA
Methyl Tertbutyl Ether	NA	NA
sec-Butylbenzene	NA	NA
Semivolatile Organics (mg/kg)		
3 & 4 Methylphenol	NA	NA
4-Chlorophenyl phenyl ether	NA	NA
4-Nitrophenol	NA	NA
Acetophenone	NA	NA
Aniline	NA	NA
Benzaldehyde	NA	NA
Benzoic Acid	0.65	USEPA Region 3
Benzyl alcohol	0.073	ORNL - LCV
Bis(2-Ethylhexyl)phthalate	4,330	REACH
Caprolactam	NA	NA
Carbazole	NA	NA
Di-n-octylphthalate	NA	NA
Diphenyl ether	NA	NA
Diphenylamine	NA	NA
Diphenylmethanone	NA	NA
Phenol	0.42	USEPA Region 3
Nonionic Organics (mg/kg)		
Benzene	120	ORNL-LCV
Polyaromatic Hydrocarbons (mg/kg)		
Benzo(a)pyrene	1.45	PEC
Benzo(b)fluoranthene	NA	NA
Fluoranthene	2.23	PEC
Phenanthrene	1.17	PEC
Pyrene	1.52	PEC
Pesticides (mg/kg)		
4,4`-DDT	0.0629	PEC
Hexachlorobenzene	0.24	OMEE - SEL
Metals (mg/kg)		
Aluminum	58,030	ARCs - PEC
Arsenic	33	PEC
Barium	NA	NA
Beryllium	NA	NA
Cadmium	4.98	PEC
Chromium	111	PEC
Chromium, Hexavalent	NA	NA
Copper	149	PEC
Iron	40,000	OMEE - SEL
Lead	128	PEC
Manganese	1,100	OMEE - SEL
Mercury	1.06	PEC
Nickel	48.6	PEC
Silver	2	Region 4
Thallium	NA	NA
Tin	NA	NA
Vanadium	NA	NA
Zinc	459	TEC
Inorganics (mg/kg)		
Chloride	NA	NA
Nitrogen, as Ammonia	NA	NA
Sulfate	NA	NA

Table 4.2-3
Ecological Sediment Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Effects Benchmark	Source [a]
EPH (mg/kg)		
C11-C22 Aromatics	0.09	MassDEP
C19-C36 Aliphatics	9.88	MassDEP
C9-C18 Aliphatics	3.17	MassDEP
Hydrazines (mg/kg)		
Hydrazine	NA	NA
Formaldehydes (mg/kg)		
Acetaldehyde	NA	NA
Formaldehyde	NA	NA
Dimethylformamides (mg/kg)		
Dimethylformamide	NA	NA

Prepared by: EYM 3/13/2013
Checked by: SFR 3/14/2013

Notes:

[a] Sources are in order of preference:

[1] PECs - Probable Effects Concentrations (PECs) (MacDonald, *et al.*, 2000).

[2] USEPA Region 4 (USEPA, 2001).

[3] USEPA Region 3 (USEPA, 2006).

[4] ORNL - LCVs - Oak Ridge National Laboratory (ORNL) Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).

[9] ARCs PECs - Assessment and Remediation of Contaminated Sediments (ARCS) Program Probable Effects Concentrations (PECs) (USEPA, 1996).

[10] OMEE SELs - Ontario Ministry of Energy and Environment (OMEE) Screening-Effect Levels (SELs) (Persaud *et al*.,1993).

[9] MassDEP - Sediment Benchmarks for Current MassDEP Petroleum Hydrocarbon Fractions (MassDEP, 2007).

[10] REACH database. Values selected are NOECs x10 for aquatic invertebrates.

Table 4.2-3
Ecological Sediment Effects Benchmarks
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Notes (continued):

EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbon
mg/kg - milligrams per kilogram
NA - Not available

References:

Jones, D.S., G.W. Suter II, and R.N. Hull, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision; Oak Ridge National Laboratories (ES/ER/TM-95/R4); November 1997.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39:20-31.

MassDEP, 2007. Sediment Toxicity of Petroleum Hydrocarbon Fractions. Office of Research and Standards. September, 2007.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto. Cited in Jones, Suter and Hull, 1997.

USEPA. 1996. Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella Azteca and the Midge Chironomus Riparius. Great Lakes National Program Office. EPA-905-R96-08. September, 1996.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. 2001.

USEPA. 2006. EPA Region III BTAG Screening Benchmarks for Freshwater and Sediment. August, 2006.

Table 4.3-1
Comparison of EPCs to Effects Benchmarks - Soil - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	EA 2 EPCs RME [b]	EA 2 EPCs CTE [b]	Background [c] RME	Background [c] CTE	Effects Benchmark [d] Plants	Effects Benchmark [d] Inverts	Hazard Quotients [e] Plants RME	Hazard Quotients [e] Plants CTE	Hazard Quotients [e] Inverts RME	Hazard Quotients [e] Inverts CTE	Incremental Risk HQs [f] Plants RME	Incremental Risk HQs [f] Plants CTE	Incremental Risk HQs [f] Inverts RME	Incremental Risk HQs [f] Inverts CTE
Volatile Organics (mg/kg)															
Acetaldehyde	2 / 3	0.20	0.20	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics (mg/kg)															
Benzaldehyde	7 / 12	0.79	1.9	0.098	0.063	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	6 / 13	0.15	0.24	0.022	0.019	NA	16.4	NA	NA	0.009	0.015	NA	NA	0.008	0.013
Bis(2-Ethylhexyl)phthalate	12 / 17	110	22	0.031	0.019	130	130	0.85	0.17	0.85	0.17	0.85	0.17	0.85	0.17
Diphenyl ether	1 / 12	0.12	0.12	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	9 / 17	0.40	0.94	0.043	0.026	NA	17.5	NA	NA	0.023	0.054	NA	NA	0.020	0.052
Phenanthrene	9 / 17	0.27	0.68	0.035	0.022	NA	17.7	NA	NA	0.015	0.038	NA	NA	0.014	0.037
Pyrene	9 / 17	0.31	0.66	0.049	0.028	NA	17.5	NA	NA	0.018	0.038	NA	NA	0.015	0.036
Pesticides (mg/kg)															
4,4'-DDD	1 / 3	0.039	0.039	NA	NA	NA	20	NA	NA	0.002	0.002	NA	NA	NA	NA
4,4'-DDE	1 / 3	0.049	0.049	NA	NA	NA	21	NA	NA	0.002	0.002	NA	NA	NA	NA
4,4'-DDT	1 / 3	0.68	0.27	NA	NA	NA	19.6	NA	NA	0.035	0.014	NA	NA	NA	NA
Metals (mg/kg)															
Aluminum	13 / 13	13,090	8,715	13,000	7,378	50	NA	**262**	**174**	NA	NA	**1.8**	**27**	NA	NA
Arsenic	13 / 14	8.8	6.7	10	5.0	18	60	0.49	0.37	0.15	0.11	<0	0.093	<0	0.028
Cadmium	9 / 14	0.69	0.51	0.26	0.15	32	140	0.022	0.016	0.005	0.004	0.013	0.011	0.003	0.003
Chromium	14 / 15	116	39	10	6.2	310	310	0.37	0.13	0.37	0.13	0.34	0.11	0.34	0.11
Copper	12 / 12	22	17.9	5.8	4.1	70	80	0.32	0.26	0.28	0.22	0.236	0.20	0.21	0.17
Iron	13 / 13	22,493	10,908	12,000	6,314	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	13 / 14	53	40	26	15.6	120	1,700	0.44	0.33	0.031	0.024	0.221	0.20	0.016	0.014
Mercury	8 / 14	0.2	0.15	0.11	0.077	0.3	0.1	0.5	0.5	**1.6**	**1.5**	0.2	0.23	0.5	0.7
Selenium	4 / 14	2.4	1.1	0.60	0.41	0.52	4.1	**4.6**	**2.1**	0.58	0.27	**3.4**	**1.4**	0.43	0.17
Vanadium	12 / 12	29	24	21	11.9	2.0	NA	**14.7**	**11.8**	NA	NA	**4.2**	**5.8**	NA	NA
Zinc	12 / 12	70	49	18	8.5	160	120	0.44	0.30	0.58	0.41	0.323	0.25	0.43	0.34
Inorganics (mg/kg)															
Chloride	4 / 12	242	79	ND	ND	NA	87	NA	NA	**2.8**	0.90	NA	NA	NA	NA
Nitrogen, as Ammonia	12 / 12	625	439	200	128	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Prepared by: SFR 7/12/2013
Checked by: EYM 7/24/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-15.

[c] RME and CTE EPCs are the maximum and average concentrations in background, respectively.

[d] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[e] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

[f] Incremental Risk HQs are calculated by subtracting the Background HQ (EPC divided by the effects benchmark) from the Exposure Area HQ.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
Inverts - Invertebrates
mg/kg - milligrams per kilogram
NA - Not Available
ND - Not Detected

Table 4.3-2
Comparison of EPCs to Effects Benchmarks - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	EA 4 EPCs		Background [c]		Effects Benchmark [d]		Hazard Quotients [e]				Incremental Risk HQs [f]			
								Plants		Inverts		Plants		Inverts	
		RME [b]	CTE [b]	RME	CTE	Plants	Inverts	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Volatile Organics (mg/kg)															
Acetaldehyde	1 / 6	0.046	0.046	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics (mg/kg)															
Benzaldehyde	12 / 14	0.61	0.24	0.098	0.063	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	18 / 69	0.35	0.33	0.022	0.019	NA	16.4	NA	NA	0.021	0.020	NA	NA	0.020	0.019
Bis(2-Ethylhexyl)phthalate	56 / 76	30	9.0	0.031	0.019	130	130	0.23	0.069	0.23	0.069	0.23	0.0691	0.23	0.069
Fluoranthene	24 / 79	0.41	0.85	0.043	0.026	NA	17.5	NA	NA	0.023	0.049	NA	NA	0.021	0.047
Naphthalene	4 / 79	0.065	0.21	ND	ND	NA	16.9	NA	NA	0.004	0.012	NA	NA	NA	NA
Phenanthrene	17 / 79	0.14	0.69	0.035	0.022	NA	17.7	NA	NA	0.008	0.039	NA	NA	0.0060	0.038
Pyrene	24 / 78	0.22	0.82	0.049	0.028	NA	17.5	NA	NA	0.013	0.047	NA	NA	0.010	0.045
Pesticides (mg/kg)															
4,4'-DDD	6 / 34	0.016	0.021	NA	NA	NA	20	NA	NA	0.0008	0.0011	NA	NA	NA	NA
4,4'-DDE	11 / 34	0.0038	0.011	NA	NA	NA	21	NA	NA	0.0002	0.0005	NA	NA	NA	NA
4,4'-DDT	18 / 34	0.068	0.025	NA	NA	NA	19.6	NA	NA	0.0035	0.0013	NA	NA	NA	NA
Alpha-BHC	3 / 34	0.0020	0.0058	NA	NA	NA	29	NA	NA	0.00007	0.0002	NA	NA	NA	NA
Gamma-BHC/Lindane	5 / 34	0.012	0.019	NA	NA	0.005	29	**2.5**	**3.9**	0.0004	0.0007	NA	NA	NA	NA
Metals (mg/kg)															
Aluminum	43 / 43	8,804	7,016	13,000	7,378	50	NA	**176**	**140**	NA	NA	<0	<0	NA	NA
Arsenic	40 / 53	9.1	7.6	10.0	5.0	18	60	0.51	0.42	0.15	0.13	<0	0.15	<0	0.044
Cadmium	18 / 60	0.48	0.42	0.26	0.15	32	140	0.015	0.013	0.0034	0.0030	0.0068	0.0084	0.0016	0.0019
Chromium	86 / 86	583	272	10.0	6.2	310	310	**1.9**	0.88	**1.9**	0.88	**1.8**	0.86	**1.8**	0.86
Chromium, Hexavalent	2 / 29	38	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	31 / 34	16	5.0	2.9	1.6	13.0	NA	**1.2**	0.39	NA	NA	**1.0**	0.27	NA	NA
Copper	33 / 34	27	13.895	5.8	4.1	70	80	0.39	0.20	0.34	0.17	0.30	0.14	0.27	0.12
Iron	43 / 43	19,245	8,973	12,000	6,314	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	59 / 60	43	24	26	15.6	120	1,700	0.36	0.20	0.025	0.014	0.14	0.072	0.0099	0.0051
Manganese	34 / 34	171	84	69	28	220	450	0.78	0.38	0.38	0.19	0.46	0.25	0.23	0.12
Mercury	23 / 55	0.14	0.12	0.11	0.077	0.30	0.1	0.48	0.39	**1.4**	**1.2**	0.11	0.14	0.33	0.41
Nickel	33 / 34	25	10	7.3	4.0	38	280	0.66	0.27	0.090	0.036	0.47	0.16	0.064	0.022
Vanadium	34 / 34	20	17	21	11.9	2.0	NA	**10.2**	**8.4**	NA	NA	<0	**2.5**	NA	NA
Zinc	29 / 34	48	23	18	8.5	160	120	0.30	0.14	0.40	0.19	0.19	0.089	0.25	0.12

Table 4.3-2
Comparison of EPCs to Effects Benchmarks - Soil - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	EA 4 EPCs		Background [c]		Effects Benchmark [d]		Hazard Quotients [e]				Incremental Risk HQs [f]			
								Plants		Inverts		Plants		Inverts	
		RME [b]	CTE [b]	RME	CTE	Plants	Inverts	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Inorganics (mg/kg)															
Chloride	5 / 19	119	54	NA	NA	NA	87	NA	NA	**1.4**	0.62	NA	NA	NA	NA
Cyanide, Total	6 / 7	7.9	5.8	NA	NA	NA	89	NA	NA	0.088	0.065	NA	NA	NA	NA
Nitrogen, as Ammonia	32 / 32	356	262	200	128	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	15 / 27	10,004	1,095	63	28	NA	465	NA	NA	**22**	**2.4**	NA	NA	**21**	**2.3**
EPH (mg/kg)															
C11-C22 Aromatics	NA / NA	NA	NA	NA	NA	NA	11.6	NA	NA	NA	NA	NA	NA	NA	NA
C19-C36 Aliphatics	NA / NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C9-C18 Aliphatics	NA / NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Prepared by: SFR 7/12/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-15.

[c] RME and CTE EPCs are the maximum and average concentrations in background, respectively.

[d] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[e] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

[f] Incremental Risk HQs are calculated by subtracting the Background HQ (EPC divided by the effects benchmark) from the Exposure Area HQ.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
Inverts - Invertebrates
mg/kg - milligrams per kilogram
NA - Not Available
ND - Not Detected

Table 4.3-3
Comparison of EPCs to Effects Benchmarks - Soil - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	EA 5 EPCs RME [b]	EA 5 EPCs CTE [b]	Background [c] RME	Background [c] CTE	Effects Benchmark [d] Plants	Effects Benchmark [d] Inverts	Hazard Quotients [e] Plants RME	Hazard Quotients [e] Plants CTE	Hazard Quotients [e] Inverts RME	Hazard Quotients [e] Inverts CTE	Incremental Risk HQs [f] Plants RME	Incremental Risk HQs [f] Plants CTE	Incremental Risk HQs [f] Inverts RME	Incremental Risk HQs [f] Inverts CTE
Volatile Organics (mg/kg)															
Acetaldehyde	3 / 3	0.13	0.082	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organics (mg/kg)															
Aniline	1 / 12	0.12	0.12	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzaldehyde	10 / 10	0.21	0.12	0.098	0.063	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	4 / 10	0.15	0.072	0.022	0.019	NA	16.4	NA	NA	0.0092	0.004	NA	NA	0.0079	0.0033
Bis(2-Ethylhexyl)phthalate	11 / 14	103	31	0.031	0.019	130	130	0.80	0.24	0.80	0.24	0.80	0.24	0.80	0.24
Diphenyl ether	2 / 10	1.9	0.37	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	10 / 13	2.5	0.44	0.043	0.026	NA	17.5	NA	NA	0.14	0.025	NA	NA	0.14	0.024
N-Nitrosodi-n-propylamine	1 / 12	0.26	0.26	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	9 / 13	0.15	0.26	0.035	0.022	NA	17.7	NA	NA	0.0082	0.015	NA	NA	0.0062	0.013
Pyrene	7 / 13	0.56	0.28	0.049	0.028	NA	17.5	NA	NA	0.032	0.016	NA	NA	0.029	0.015
Pesticides (mg/kg)															
4,4'-DDT	1 / 1	0.045	0.045	NA	NA	NA	19.6	NA	NA	0.0023	0.0023	NA	NA	NA	NA
Hexachlorobenzene	1 / 1	0.029	0.029	ND	ND	NA	19.7	NA	NA	0.0015	0.0015	NA	NA	NA	NA
Metals (mg/kg)															
Aluminum	9 / 9	20,005	10,789	13,000	7,378	50	NA	**400**	**216**	NA	NA	**140**	**68**	NA	NA
Antimony	2 / 7	0.34	0.34	ND	ND	5.0	78	0.068	0.068	0.0044	0.0044	NA	NA	NA	NA
Arsenic	10 / 11	27	19.4	10.0	5.0	18	60	**1.5**	**1.1**	0.44	0.32	0.93	0.80	0.28	0.24
Cadmium	6 / 10	0.42	0.52	0.26	0.15	32	140	0.013	0.016	0.0030	0.0037	0.0050	0.012	0.0012	0.0026
Chromium	42 / 43	26,344	6,648	10.0	6.2	310	310	**85**	**21**	**85**	**21**	**85**	**21**	**85**	**21**
Chromium, Hexavalent	4 / 16	559	79	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	9 / 9	97	38	5.8	4.1	70	80	**1.4**	0.55	**1.2**	0.48	**1.3**	0.49	**1.1**	0.43
Iron	9 / 9	20,139	14,067	12,000	6,314	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	11 / 11	93	71	26	15.6	120	1,700	0.78	0.59	0.055	0.042	0.56	0.46	0.040	0.032
Mercury	10 / 11	1.9	0.64	0.11	0.077	0.3	0.1	**6.4**	**2.1**	**19.3**	**6.4**	**6.1**	**1.9**	**18.2**	**5.7**
Silver	2 / 11	1,100	103	ND	ND	560	NA	**2.0**	0.18	NA	NA	NA	NA	NA	NA
Thallium	1 / 8	7.4	1.9	ND	ND	1.0	NA	**7.4**	**1.9**	NA	NA	NA	NA	NA	NA
Tin	8 / 9	26,000	2,924	3.5	2.3	50	NA	**520**	**58**	NA	NA	**520**	**58**	NA	NA
Vanadium	9 / 9	69	39	21	11.9	2.0	NA	**35**	**19.5**	NA	NA	**24**	**13.5**	NA	NA
Zinc	9 / 9	31	17.0	18.0	8.5	160	120	0.19	0.11	0.26	0.14	0.081	0.053	0.11	0.070

Table 4.3-3
Comparison of EPCs to Effects Benchmarks - Soil - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	EA 5 EPCs		Background [c]		Effects Benchmark [d]		Hazard Quotients [e]				Incremental Risk HQs [f]			
								Plants		Inverts		Plants		Inverts	
		RME [b]	CTE [b]	RME	CTE	Plants	Inverts	RME	CTE	RME	CTE	RME	CTE	RME	CTE
Inorganics (mg/kg)															
Cyanide, Total	1 / 1	6.5	6.5	NA	NA	NA	89	NA	NA	0.073	0.073	NA	NA	NA	NA
Nitrogen, as Ammonia	9 / 9	749	406	200	128	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	2 / 8	230	74	63	28	NA	465	NA	NA	0.49	0.16	NA	NA	0.36	0.10
EPH (mg/kg)															
C11-C22 Aromatics	2 / 2	7,500	4,450	NA	NA	NA	11.616	NA	NA	**646**	**383**	NA	NA	NA	NA
C19-C36 Aliphatics	2 / 2	4,900	3,350	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C9-C18 Aliphatics	2 / 2	780	490	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Prepared by: SFR 7/12/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-15.

[c] RME and CTE EPCs are the maximum and average concentrations in background, respectively.

[d] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[e] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

[f] Incremental Risk HQs are calculated by subtracting the Background HQ (EPC divided by the effects benchmark) from the Exposure Area HQ.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
Inverts - Invertebrates
mg/kg - milligrams per kilogram
NA - Not Available
ND - Not Detected

Table 4.3-4
Comparison of EPCs to Effects Benchmarks - Surface Water - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Semivolatile Organics (mg/L)						
Azobenzene	2 / 12	0.00053	0.00053	NA	NA	NA
Benzo(a)pyrene	1 / 12	0.00015	0.00015	0.00024	0.63	0.63
Bis(2-Ethylhexyl)phthalate	2 / 11	0.0034	0.0024	0.027	0.13	0.090
N-Nitrosodi-n-propylamine	2 / 12	0.0000066	0.0000035	NA	NA	NA
Metals, Total (mg/L)						
Aluminum	131 / 132	19	4.9	0.75	**25**	**6.5**
Barium	12 / 12	0.027	0.024	0.11	0.24	0.22
Beryllium	5 / 12	0.00084	0.00061	0.035	0.024	0.017
Chromium	132 / 132	3.3	1.1	1.5	**2.2**	0.73
Cobalt	12 / 12	0.037	0.028	1.5	0.024	0.019
Copper	12 / 12	0.017	0.0090	0.026	0.63	0.35
Iron	12 / 12	7.9	5.9	NA	NA	NA
Lead	10 / 12	0.00094	0.00063	0.11	0.0086	0.0057
Manganese	12 / 12	1.8	1.5	2.3	0.78	0.65
Silver	1 / 12	0.000017	0.000017	0.00123	0.014	0.014
Metals, Filtered (mg/L)						
Aluminum	131 / 132	19	4.9	0.75	**25**	**6.5**
Chromium	132 / 132	3.3	1.1	0.46	**7.2**	**2.4**
Inorganics (mg/L)						
Bromide	10 / 12	0.40	0.32	NA	NA	NA
Chloride	132 / 132	172	164	860	0.20	0.19
Nitrite as N	12 / 126	0.021	0.031	NA	NA	NA
Nitrogen, as Ammonia	132 / 132	73	56	36	**2.0**	**1.6**

Prepared by: SFR 7/8/2013
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Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through Table 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
NA - Effects benchmark is not available and HQs could not be calculated

Table 4.3-5
Comparison of EPCs to Effects Benchmarks - Surface Water - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Metals, Total (mg/L)						
Aluminum	1 / 1	0.21	0.21	0.75	0.28	0.28
Barium	1 / 1	0.049	0.049	0.11	0.45	0.45
Manganese	1 / 1	0.70	0.70	2.3	0.30	0.30
Silver	1 / 1	0.000015	0.000015	0.00123	0.012	0.012
Inorganics (mg/L)						
Bromide	1 / 1	0.13	0.13	NA	NA	NA
Nitrite as N	1 / 1	0.075	0.075	NA	NA	NA
Nitrogen, as Ammonia	1 / 1	28	28	36	0.78	0.78

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through Table 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
NA - Effects benchmark is not available and HQs could not be calculated

Table 4.3-6
Comparison of EPCs to Effects Benchmarks - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection			RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
							RME	CTE
Semivolatile Organics (mg/L)								
N-Nitrosodiphenylamine	1	/	1	0.0000074	0.0000074	3.8	0.0000019	0.0000019
Metals, Total (mg/L)								
Aluminum	1	/	1	0.9	0.9	0.75	**1.2**	**1.2**
Barium	1	/	1	0.026	0.026	0.11	0.24	0.24
Iron	1	/	1	1.5	1.5	NA	NA	NA
Lead	1	/	1	0.0030	0.0030	0.086	0.035	0.035
Silver	1	/	1	0.000056	0.000056	0.0012	0.046	0.046
Inorganics (mg/L)								
Nitrite as N	1	/	1	0.026	0.026	NA	NA	NA
Nitrogen, as Ammonia	1	/	1	7.5	7.5	36	0.21	0.21

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through Table 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
NA - Effects benchmark is not available and HQs could not be calculated

Table 4.3-7
Comparison of EPCs to Effects Benchmarks - Surface Water - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/L)						
Carbon disulfide	3 / 6	0.0025	0.0025	0.017	0.15	0.15
Semivolatile Organics (mg/L)						
3 & 4 Methylphenol	2 / 6	0.00076	0.00076	NA	NA	NA
Benzo(a)anthracene	2 / 6	0.0020	0.00047	0.00049	**4.1**	0.95
Benzo(a)pyrene	4 / 6	0.0023	0.00089	0.00024	**9.5**	**3.7**
Benzo(b)fluoranthene	4 / 6	0.0040	0.0016	0.006	0.67	0.27
Benzo(ghi)perylene	3 / 6	0.0026	0.00099	0.002	**1.3**	0.50
Benzo(k)fluoranthene	2 / 6	0.0026	0.00061	0.006	0.43	0.10
Chrysene	4 / 6	0.0027	0.0012	0.019	0.14	0.064
Dibenz(a,h)anthracene	1 / 6	0.0012	0.00039	0.002	0.60	0.20
Indeno(1,2,3-cd)pyrene	3 / 6	0.0040	0.00088	0.002	**2.0**	0.44
Phenanthrene	4 / 6	0.0013	0.00053	0.0004	**3.3**	**1.3**
Pyrene	4 / 6	0.0063	0.0031	0.000025	**253**	**122**
Metals, Total (mg/L)						
Aluminum	6 / 6	1.3	0.82	0.75	**1.7**	**1.1**
Barium	6 / 6	0.041	0.035	0.11	0.37	0.31
Chromium	6 / 6	0.093	0.050	0.61	0.15	0.081
Iron	6 / 6	25	16.4	NA	NA	NA
Lead	6 / 6	0.0043	0.0027	0.029	0.15	0.092
Manganese	6 / 6	1.3	0.85	2.3	0.55	0.37
Zinc	6 / 6	0.095	0.038	0.069	**1.4**	0.54
Inorganics (mg/L)						
Bromide	5 / 6	0.20	0.15	NA	NA	NA
Nitrite as N	1 / 6	0.020	0.020	NA	NA	NA
Nitrogen, as Ammonia	6 / 6	60	45	36	**1.7**	**1.2**

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through Table 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
NA - Effects benchmark is not available and HQs could not be calculated

Table 4.3-8
Comparison of EPCs to Effects Benchmarks - Surface Water - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	MMB Reference Concentrations [c]		Effects Benchmark [d]	Hazard Quotients [e]		Incremental Risk Hazard Quotients [f]	
				Maxium	Average		RME	CTE	RME	CTE
Semivolatile Organics (mg/L)										
Benzo(a)pyrene	2 / 22	0.00013	0.000094	ND	ND	0.00024	0.54	0.39	NA	NA
Caprolactam	2 / 22	0.00066	0.00066	0.00056	0.001405	NA	NA	NA	NA	NA
N-Nitrosodi-n-propylamine	3 / 22	0.00000078	0.00000078	ND	ND	NA	NA	NA	NA	NA
Metals, Total (mg/L)										
Aluminum	18 / 22	0.68	0.17	0.44	0.24	0.75	0.90	0.23	0.31	<0
Barium	22 / 22	0.046	0.037	0.05	0.038	0.11	0.41	0.33	<0	0.24
Copper	18 / 22	0.015	0.0048	0.0039	0.0026	0.011	**1.4**	0.44	**1.0**	0.44
Iron	22 / 22	9.9	3.4	2.0	1.1	NA	NA	NA	NA	NA
Lead	18 / 22	0.038	0.0065	0.0013	0.0011	0.036	**1.0**	0.18	**1.0**	0.18
Manganese	22 / 22	2.7	0.91	0.59	0.31	2.3	**1.2**	0.39	0.93	0.13
Inorganics (mg/L)										
Bromide	2 / 22	0.10	0.055	ND	ND	NA	NA	NA	NA	NA

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through Table 4.1-17.

[c] MMB Reference Concentrations are presented in Attachment 1.

[d] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[e] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

[f] Incremental Risk Hazard Quotients are calculated by subtracting the reference area HQ from the exposure area HQ.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
NA - HQs could not be calculated
ND - Not Detected

Table 4.3-9
Comparison of EPCs to Effects Benchmarks - Surface Water - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Semivolatile Organics (mg/L)						
Benzo(a)anthracene	2 / 4	0.00012	0.000119	0.00049	0.24	0.24
Benzo(a)pyrene	2 / 4	0.00017	0.00012	0.00024	0.71	0.51
Caprolactam	1 / 4	0.00033	0.00033	NA	NA	NA
Pyrene	3 / 4	0.00039	0.00039	0.000025	**16**	**16**
Metals, Total (mg/L)						
Aluminum	3 / 4	0.22	0.15	0.75	0.29	0.20
Barium	4 / 4	0.041	0.034	0.11	0.37	0.31
Iron	4 / 4	2.9	1.9	NA	NA	NA
Lead	4 / 4	0.0013	0.00093	0.060	0.02	0.02
Manganese	4 / 4	0.49	0.39	2.3	0.21	0.17
Silver	1 / 4	0.000022	0.000022	0.0012	0.018	0.018
Inorganics (mg/L)						
Bromide	2 / 4	0.65	0.28	NA	NA	NA
Chloride	4 / 4	320	190	860	0.37	0.22

Prepared by: SFR 2/5/2014
Checked by: LG 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through Table 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/L - milligrams per liter
RME - Reasonable Maximum Exposure
NA - Effects benchmark is not available and HQs could not be calculated

Table 4.3-10
Comparison of EPCs to Effects Benchmarks - Sediment - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
2,4,4-Trimethyl-1-pentene	2 / 4	0.037	0.018	NA	NA	NA
2,4,4-Trimethyl-2-pentene	2 / 4	0.0030	0.0029	NA	NA	NA
4-iso-Propyltoluene	1 / 4	0.0026	0.0018	NA	NA	NA
Acetaldehyde	3 / 4	0.083	0.083	NA	NA	NA
Formaldehyde	4 / 4	1.1	0.75	NA	NA	NA
Semivolatile Organics (mg/kg)						
3 & 4 Methylphenol	3 / 6	3.0	1.3	NA	NA	NA
Acetophenone	1 / 6	0.090	0.090	NA	NA	NA
Benzaldehyde	3 / 4	0.62	0.35	NA	NA	NA
Caprolactam	1 / 4	0.053	0.053	NA	NA	NA
Diphenyl ether	2 / 4	0.22	0.15	NA	NA	NA
Di-n-octylphthalate	1 / 6	0.15	0.15			
Diphenylmethanone	1 / 4	0.031	0.031	NA	NA	NA
Phenol	3 / 6	0.96	0.72	0.42	**2.3**	**1.7**
Metals (mg/kg)						
Arsenic	6 / 6	10.0	5.3	33	0.30	0.16
Barium	6 / 6	70	27	NA	NA	NA
Beryllium	5 / 6	0.71	0.44	NA	NA	NA
Chromium	30 / 30	926	405	111	**8.3**	**3.6**
Chromium, Hexavalent	3 / 6	25	7.0	NA	NA	NA
Iron	30 / 30	13,895	12,445	40,000	0.35	0.31
Silver	4 / 6	19.0	7.5	2	**9.5**	**3.7**
Vanadium	6 / 6	14.5	10.5	NA	NA	NA
Inorganics (mg/kg)						
Chloride	4 / 4	140	74	NA	NA	NA
Nitrogen, as Ammonia	6 / 6	215	148	NA	NA	NA
Sulfate	4 / 4	700	469	NA	NA	NA
Specialty Compounds (mg/kg)						
Hydrazine	2 / 4	0.00091	0.0009	NA	NA	NA
Dimethylformamide	2 / 4	0.30	0.18	NA	NA	NA
EPH (mg/kg)						
C11-C22 Aromatics	4 / 4	24	17	0.09	**267**	**190**
C19-C36 Aliphatics	4 / 4	43	29	9.88	**4.4**	**2.9**
C9-C18 Aliphatics	1 / 4	96	26	3.17	**30**	**8.2**

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013
Revised: SFR 2/20/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
EPH - Extractable Petroleum Hydrocarbons
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
NA - effects benchmark is not available and HQs could not be calculated

Table 4.3-11
Comparison of EPCs to Effects Benchmarks - Sediment - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
2,4,4-Trimethyl-1-pentene	2 / 3	0.020	0.011	NA	NA	NA
2,4,4-Trimethyl-2-pentene	1 / 3	0.0035	0.0035	NA	NA	NA
Acetaldehyde	1 / 2	0.063	0.063	NA	NA	NA
Acetone	1 / 3	0.12	0.12	0.0091	**13.2**	**13.2**
Formaldehyde	2 / 2	0.60	0.44	NA	NA	NA
Semivolatile Organics (mg/kg)						
Aniline	1 / 6	0.23	0.23	NA	NA	NA
Benzaldehyde	1 / 3	0.12	0.12	NA	NA	NA
Bis(2-Ethylhexyl)phthalate	6 / 6	602	322	4330	0.14	0.074
Di-n-octylphthalate	1 / 6	0.15	0.15	NA	NA	NA
Diphenyl ether	2 / 3	2.6	1.8	NA	NA	NA
Diphenylamine	1 / 2	0.095	0.062	NA	NA	NA
Pesticides (mg/kg)						
4,4`-DDT	1 / 3	0.062	0.025	0.063	0.99	0.39
Hexachlorobenzene	1 / 3	0.037	0.016	0.24	0.15	0.07
Metals (mg/kg)						
Barium	6 / 6	17.4	12.8	NA	NA	NA
Beryllium	5 / 6	1.5	0.96	NA	NA	NA
Cadmium	4 / 6	1.0	0.56	4.98	0.21	0.11
Chromium	6 / 6	2,764	1,922	111	**25**	**17.3**
Chromium, Hexavalent	4 / 5	26	14.5	NA	NA	NA
Mercury	5 / 6	0.29	0.18	1.06	0.27	0.17
Nickel	6 / 6	19.6	14.1	48.6	0.40	0.29
Silver	3 / 6	62	25	2	**31**	**12.6**
Tin	1 / 3	1.6	1.6	NA	NA	NA
Vanadium	6 / 6	11.1	8.7	NA	NA	NA
Inorganics (mg/kg)						
Chloride	3 / 3	140	133	NA	NA	NA
Nitrogen, as Ammonia	6 / 6	252	172	NA	NA	NA
Sulfate	3 / 3	830	690	NA	NA	NA
EPH (mg/kg)						
C11-C22 Aromatics	2 / 2	9,400	5,250	0.09	**104,444**	**58,333**
C19-C36 Aliphatics	2 / 2	6,400	3,545	9.88	**648**	**359**
C9-C18 Aliphatics	2 / 2	770	433	3.17	**243**	**137**
Specialty Compounds (mg/kg)						
Hydrazine	2 / 2	0.0024	0.0019	NA	NA	NA

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern

CTE - Central Tendency Exposure

EPC - Exposure Point Concentration

EPH - Extractable Petroleum Hydrocarbons

HQ - Hazard Quotient

mg/kg - milligrams per kilogram

RME - Reasonable Maximum Exposure

NA - effects benchmark is not available and HQs could not be calculated

Table 4.3-12
Comparison of EPCs to Effects Benchmarks - Sediment - On-PWD-WDW
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
Acetone	2 / 8	0.34	0.34	0.0091	**37**	**37**
Nonionic Organics (mg/kg)						
Benzene	1 / 8	4.4	0.93	120	0.037	0.0077
Metals (mg/kg)						
Barium	3 / 3	38	18.0	NA	NA	NA
Beryllium	1 / 3	0.61	0.25	NA	NA	NA
Cadmium	4 / 9	0.94	0.57	4.98	0.19	0.12
Chromium	31 / 33	30	24	111	0.27	0.22
Lead	8 / 9	76	50	128	0.59	0.39
Mercury	5 / 8	0.34	0.23	1.06	0.32	0.22
Vanadium	3 / 3	27	15.7	NA	NA	NA

Prepared by: SFR 7/8/2013
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Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
NA - effects benchmark is not available and HQs could not be calculated

Table 4.3-13
Comparison of EPCs to Effects Benchmarks - Sediment - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
2,4,4-Trimethyl-1-pentene	1 / 2	0.011	0.0068	NA	NA	NA
2,4,4-Trimethyl-2-pentene	1 / 2	0.0088	0.0057	NA	NA	NA
Acetone	2 / 2	0.12	0.12	0.0091	**13.2**	**12.6**
Methyl Tertbutyl Ether	1 / 2	0.0017	0.0016	NA	NA	NA
Semivolatile Organics (mg/kg)						
3 & 4 Methylphenol	2 / 2	6.1	5.2	NA	NA	NA
Acetophenone	2 / 2	0.26	0.21	NA	NA	NA
Benzaldehyde	2 / 2	1.9	1.7	NA	NA	NA
Phenol	2 / 2	2.2	2.0	0.42	**5.2**	**4.6**
Polyaromatic Hydrocarbons (mg/kg)						
Benzo(b)fluoranthene	1 / 2	0.14	0.14	NA	NA	NA
Fluoranthene	2 / 2	0.29	0.25	2.23	0.13	0.11
Phenanthrene	1 / 2	0.21	0.21	1.17	0.18	0.18
Pyrene	2 / 2	0.23	0.21	1.52	0.15	0.13
Metals (mg/kg)						
Barium	2 / 2	46	46	NA	NA	NA
Beryllium	2 / 2	0.094	0.092	NA	NA	NA
Chromium	9 / 9	140	38	111	**1.3**	0.35
Chromium, Hexavalent	2 / 2	0.27	0.24	NA	NA	NA
Lead	2 / 2	51	51	128	0.40	0.39
Manganese	2 / 2	590	515	1100	0.54	0.47
Tin	2 / 2	2.2	2.2	NA	NA	NA
Vanadium	2 / 2	17.0	16.5	NA	NA	NA
Inorganics (mg/kg)						
Chloride	2 / 2	24	21	NA	NA	NA
Nitrogen, as Ammonia	2 / 2	35	26	NA	NA	NA
Sulfate	2 / 2	1,200	855	NA	NA	NA

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
NA - effects benchmark is not available and HQs could not be calculated

Table 4.3-14
Comparison of EPCs to Effects Benchmarks - Sediment - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
2,4,4-Trimethyl-1-pentene	2 / 2	0.0078	0.0051	NA	NA	NA
2,4,4-Trimethyl-2-pentene	2 / 2	0.0039	0.0027	NA	NA	NA
Acetone	2 / 2	0.15	0.14	0.009	**16.5**	**15.4**
Semivolatile Organics (mg/kg)						
3 & 4 Methylphenol	2 / 2	4.0	2.9	NA	NA	NA
Acetophenone	1 / 2	0.16	0.16	NA	NA	NA
Benzaldehyde	2 / 2	1.3	0.96	NA	NA	NA
Phenol	2 / 2	1.9	1.7	0.420	**4.5**	**3.9**
Polyaromatic Hydrocarbons (mg/kg)						
Benzo(a)pyrene	1 / 2	0.22	0.22	1.450	0.15	0.15
Metals (mg/kg)						
Arsenic	2 / 2	12.0	10.7	33.000	0.36	0.32
Barium	2 / 2	51	50	NA	NA	NA
Beryllium	2 / 2	0.12	0.10	NA	NA	NA
Chromium	2 / 2	50	42	111.000	0.45	0.37
Vanadium	2 / 2	22	21	NA	NA	NA
Inorganics (mg/kg)						
Chloride	2 / 2	13.0	9.7	NA	NA	NA
Nitrogen, as Ammonia	2 / 2	22	18.0	NA	NA	NA
Sulfate	2 / 2	1,900	1,400	NA	NA	NA

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern

CTE - Central Tendency Exposure

EPC - Exposure Point Concentration

HQ - Hazard Quotient

mg/kg - milligrams per kilogram

RME - Reasonable Maximum Exposure

NA - effects benchmark is not available and HQs could not be calculated

Table 4.3-15
Comparison of EPCs to Effects Benchmarks - Sediment - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
2,4,4-Trimethyl-1-pentene	1 / 3	0.060	0.023	NA	NA	NA
2,4,4-Trimethyl-2-pentene	1 / 3	0.0080	0.0060	NA	NA	NA
Formaldehyde	2 / 2	0.61	0.51	NA	NA	NA
Semivolatile Organics (mg/kg)						
4-Chlorophenyl phenyl ether	1 / 3	0.061	0.044	NA	NA	NA
Carbazole	3 / 3	0.051	0.045	NA	NA	NA
Diphenyl ether	2 / 3	0.86	0.33	NA	NA	NA
Diphenylmethanone	2 / 3	0.20	0.091	NA	NA	NA
Metals (mg/kg)						
Arsenic	3 / 3	14.0	10.0	33	0.42	0.30
Barium	3 / 3	16.0	11.7	NA	NA	NA
Beryllium	3 / 3	1.4	1.2	NA	NA	NA
Chromium	3 / 3	2,400	1,350	111	**22**	**12.2**
Copper	3 / 3	39	25	149	0.26	0.17
Silver	3 / 3	41	23.6	2	**20.5**	**11.8**
Vanadium	3 / 3	15.0	11.7	NA	NA	NA
Inorganics (mg/kg)						
Chloride	3 / 3	240	147	NA	NA	NA
Nitrogen, as Ammonia	3 / 3	540	254	NA	NA	NA
Sulfate	3 / 3	1,500	697	NA	NA	NA
Specialty Compounds (mg/kg)						
Hydrazine	1 / 2	0.0013	0.0013	NA	NA	NA

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
NA - effects benchmark is not available and HQs could not be calculated

Table 4.3-16
Comparison of EPCs to Effects Benchmarks - Sediment - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	MMB Reference Concentrations [c]		Effects Benchmark [d]	Hazard Quotients [e]		Incremental Risk Hazard Quotients [f]	
				Maxium	Average		RME	CTE	RME	CTE
Volatile Organics (mg/kg)										
Acetaldehyde	6 / 11	0.33	0.35	ND	ND	NA	NA	NA	NA	NA
Acetone	13 / 13	0.96	0.72	2.0	2.0	0.009	**106**	**79**	<0	<0
Formaldehyde	11 / 11	2.8	2.2	ND	ND	NA	NA	NA	NA	NA
Semivolatile Organics (mg/kg)										
3 & 4 Methylphenol	2 / 13	0.32	0.12	ND	0.12	NA	NA	NA	NA	NA
4-Nitrophenol	1 / 13	0.091	0.091	ND	0.55	NA	NA	NA	NA	NA
Benzaldehyde	4 / 13	0.20	0.12	0.33	0.33	NA	NA	NA	NA	NA
Benzoic Acid	13 / 13	0.76	0.59	0.54	0.54	0.65	**1.2**	0.90	0.34	0.071
Benzyl alcohol	1 / 13	0.35	0.20	ND	0.23	0.073	**4.8**	**2.7**	NA	<0
Caprolactam	1 / 8	0.088	0.068	ND	ND	NA	NA	NA	NA	NA
Carbazole	2 / 13	0.097	0.093	ND	0.12	NA	NA	NA	NA	NA
Metals (mg/kg)										
Aluminum	13 / 13	17,498	12,969	5,500	5,500	58,030	0.30	0.22	0.21	0.13
Arsenic	13 / 13	26	17.2	6.6	6.6	33	0.79	0.52	0.59	0.32
Barium	13 / 13	131	103	84	84	NA	NA	NA	NA	NA
Beryllium	12 / 13	1.4	0.98	0.7	0.7	NA	NA	NA	NA	NA
Cadmium	13 / 13	2.9	2.1	0.9	0.9	4.98	0.59	0.41	0.40	0.23
Copper	13 / 13	53	39	15	15	149	0.36	0.26	0.26	0.16
Iron	13 / 13	38,554	25,508	7,500	7,500	40,000	0.96	0.64	0.78	0.45
Lead	13 / 13	204	138	46	46	128	**1.6**	**1.1**	**1.2**	0.72
Manganese	13 / 13	1,267	788	500	500	1,100	**1.2**	0.72	0.70	0.26
Mercury	7 / 13	0.41	0.26	ND	ND	1.06	0.39	0.24	NA	NA
Nickel	13 / 13	25	18.6	6.1	6.1	48.6	0.51	0.38	0.39	0.26
Thallium	1 / 13	1.4	1.4	ND	ND	NA	NA	NA	NA	NA
Tin	8 / 13	10.1	8.6	7.3	7.3	NA	NA	NA	NA	NA
Vanadium	13 / 13	41	32	11	11	NA	NA	NA	NA	NA
Zinc	13 / 13	288	207	73	73	459	0.63	0.45	0.47	0.29
Inorganics (mg/kg)										
Chloride	13 / 13	658	485	420	420	NA	NA	NA	NA	NA
Nitrogen, as Ammonia	13 / 13	771	567	830	830	NA	NA	NA	NA	NA
Sulfate	11 / 13	834	600	420	420	NA	NA	NA	NA	NA

Prepared by: SFR 7/8/2013
Checked by: EYM 7/12/2013

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] MMB Reference Concentrations are presented in Attachment 1.

[d] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

Table 4.3-16
Comparison of EPCs to Effects Benchmarks - Sediment - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

[e] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.
[f] Incremental Risk Hazard Quotients are calculated by subtracting the reference area HQ from the exposure area HQ.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
NA - HQs could not be calculated
ND - Not Detected

Table 4.3-17
Comparison of EPCs to Effects Benchmarks - Sediment - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPECs [a]	Frequency of Detection	RME EPC [b]	CTE EPC [b]	Effects Benchmark [c]	Hazard Quotients [d]	
					RME	CTE
Volatile Organics (mg/kg)						
2,4,4-Trimethyl-1-pentene	1 / 4	0.002	0.002	NA	NA	NA
Acetone	3 / 4	0.33	0.21	0.009	**36**	**23**
Carbon disulfide	1 / 4	0.0073	0.0036	NA	NA	NA
Semivolatile Organics (mg/kg)						
Carbazole	1 / 4	0.16	0.16	NA	NA	NA
Metals (mg/kg)						
Arsenic	3 / 4	13	8.3	33	0.39	0.25
Barium	4 / 4	62	41	NA	NA	NA
Beryllium	4 / 4	0.53	0.48	NA	NA	NA
Cadmium	4 / 4	2.2	1.4	5.0	0.44	0.28
Chromium	4 / 4	780	278	111	**7.0**	**2.5**
Chromium, Hexavalent	4 / 4	0.9	0.59	NA	NA	NA
Copper	4 / 4	68	45	149	0.46	0.30
Iron	4 / 4	23,000	15,500	40,000	0.58	0.39
Lead	4 / 4	110	69	128	0.86	0.54
Manganese	4 / 4	1,250	420	1,100	**1.1**	0.38
Thallium	1 / 4	0.82	0.76	NA	NA	NA
Tin	4 / 4	11	5.9	NA	NA	NA
Vanadium	4 / 4	26	23	NA	NA	NA
Zinc	4 / 4	360	288	459	0.78	0.63
Inorganics (mg/kg)						
Chloride	4 / 4	320	184	NA	NA	NA
Nitrogen, as Ammonia	4 / 4	23	12	NA	NA	NA
Sulfate	3 / 4	270	183	NA	NA	NA

Prepared by: SFR 2/5/2014
Checked by: LG 2/5/2014

Notes:

[a] COPECs are identified in Table 3.13-1 through Table 3.13-19.

[b] RME and CTE EPCs are identified in Table 4.1-1 through 4.1-17.

[c] Effects benchmarks are indentified in Table 4.2-1 through 4.2-3.

[d] Hazard Quotients are calculated by dividing the EPC by the Effects Benchmark.

Bold and shaded cells indicate HQs>1.

COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
EPC - Exposure Point Concentration
HQ - Hazard Quotient
mg/kg - milligrams per kilogram
RME - Reasonable Maximum Exposure
NA - effects benchmark is not available and HQs could not be calculated

Table 4.5-1
Summary of Food Chain Model Hazard Quotients - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	American Robin											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	4.E-04	4.E-05	2.E-05	2.E-06	4.E-04	4.E-05	3.E-04	3.E-05	3.E-05	3.E-06	2.E-04	2.E-05
Bis(2-Ethylhexyl)phthalate	**3.E+01**	**3.E+00**	2.E-02	2.E-03	**3.E+01**	**3.E+00**	**2.E+02**	**2.E+01**	3.E-02	3.E-03	**2.E+02**	**2.E+01**
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	2.E-03	2.E-04	3.E-05	3.E-06	2.E-03	2.E-04	7.E-04	7.E-05	5.E-05	5.E-06	6.E-04	6.E-05
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	5.E-04	5.E-05	4.E-05	4.E-06	4.E-04	4.E-05
Pyrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	5.E-04	5.E-05	6.E-05	6.E-06	5.E-04	5.E-05
Pesticides												
4,4'-DDD	5.E-03	5.E-04	NC	NC	NC	NC	5.E-03	5.E-04	NC	NC	NC	NC
4,4'-DDE	6.E-03	6.E-04	NC	NC	NC	NC	6.E-03	6.E-04	NC	NC	NC	NC
4,4'-DDT	3.E-02	3.E-03	NC	NC	NC	NC	9.E-02	9.E-03	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Metals												
Aluminum	7.E-01	7.E-02	4.E-01	4.E-02	3.E-01	3.E-02	**1.E+00**	1.E-01	8.E-01	8.E-02	3.E-01	3.E-02
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	4.E-02	1.E-02	2.E-02	7.E-03	2.E-02	7.E-03	4.E-02	2.E-02	3.E-02	1.E-02	1.E-02	4.E-03
Cadmium	4.E-02	1.E-02	1.E-02	4.E-03	3.E-02	8.E-03	5.E-02	1.E-02	2.E-02	5.E-03	3.E-02	8.E-03
Chromium	6.E-01	1.E-01	3.E-01	8.E-02	2.E-01	6.E-02	8.E-01	2.E-01	3.E-01	8.E-02	4.E-01	1.E-01
Copper	2.E-02	8.E-03	3.E-03	1.E-03	1.E-02	6.E-03	2.E-02	9.E-03	6.E-03	3.E-03	1.E-02	6.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	1.E-01	5.E-02	3.E-02	1.E-01	7.E-02	2.E-01	1.E-01	9.E-02	5.E-02	1.E-01	7.E-02
Mercury	4.E-02	2.E-02	1.E-02	7.E-03	2.E-02	1.E-02	2.E-02	1.E-02	5.E-03	3.E-03	2.E-02	8.E-03
Selenium	2.E-01	2.E-01	6.E-02	5.E-02	2.E-01	1.E-01	4.E-01	3.E-01	1.E-01	1.E-01	2.E-01	2.E-01
Vanadium	2.E-01	2.E-02	7.E-02	7.E-03	1.E-01	1.E-02	2.E-01	2.E-02	1.E-01	1.E-02	1.E-01	1.E-02
Zinc	6.E-02	6.E-03	7.E-03	8.E-04	5.E-02	5.E-03	7.E-02	8.E-03	2.E-02	2.E-03	5.E-02	5.E-03
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-1
Summary of Food Chain Model Hazard Quotients - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Red-Tailed Hawk											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.E-07	2.E-08	5.E-09	5.E-10	2.E-07	2.E-08	1.E-07	1.E-08	6.E-09	6.E-10	1.E-07	1.E-08
Bis(2-Ethylhexyl)phthalate	4.E-01	4.E-02	1.E-04	1.E-05	4.E-01	4.E-02	**2.E+00**	2.E-01	2.E-04	2.E-05	**2.E+00**	2.E-01
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	7.E-08	7.E-09	7.E-10	7.E-11	7.E-08	7.E-09	3.E-08	3.E-09	1.E-09	1.E-10	3.E-08	3.E-09
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E-08	1.E-09	1.E-10	1.E-11	1.E-08	1.E-09	4.E-09	4.E-10	2.E-10	2.E-11	4.E-09	4.E-10
Pyrene	3.E-08	3.E-09	4.E-10	4.E-11	3.E-08	3.E-09	1.E-08	1.E-09	7.E-10	7.E-11	1.E-08	1.E-09
Pesticides												
4,4'-DDD	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
4,4'-DDE	1.E-05	1.E-06	NC	NC	NC	NC	1.E-05	1.E-06	NC	NC	NC	NC
4,4'-DDT	3.E-05	3.E-06	NC	NC	NC	NC	7.E-05	7.E-06	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Metals												
Aluminum	2.E-04	2.E-05	7.E-05	7.E-06	1.E-04	1.E-05	3.E-04	3.E-05	1.E-04	1.E-05	2.E-04	2.E-05
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	4.E-05	2.E-05	1.E-05	5.E-06	3.E-05	1.E-05	6.E-05	2.E-05	2.E-05	1.E-05	3.E-05	1.E-05
Cadmium	1.E-05	3.E-06	1.E-06	3.E-07	9.E-06	2.E-06	1.E-05	4.E-06	2.E-06	5.E-07	1.E-05	3.E-06
Chromium	3.E-04	6.E-05	1.E-05	4.E-06	2.E-04	6.E-05	8.E-04	2.E-04	2.E-05	6.E-06	7.E-04	2.E-04
Copper	4.E-05	2.E-05	4.E-06	2.E-06	4.E-05	2.E-05	5.E-05	3.E-05	5.E-06	2.E-06	5.E-05	2.E-05
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	3.E-04	2.E-04	4.E-05	2.E-05	2.E-04	1.E-04	3.E-04	2.E-04	6.E-05	4.E-05	3.E-04	2.E-04
Mercury	1.E-06	7.E-07	3.E-07	1.E-07	1.E-06	6.E-07	2.E-06	8.E-07	4.E-07	2.E-07	1.E-06	6.E-07
Selenium	4.E-05	3.E-05	5.E-06	4.E-06	3.E-05	3.E-05	8.E-05	6.E-05	7.E-06	6.E-06	7.E-05	6.E-05
Vanadium	4.E-05	4.E-06	7.E-06	7.E-07	3.E-05	3.E-06	5.E-05	5.E-06	1.E-05	1.E-06	4.E-05	4.E-06
Zinc	3.E-05	4.E-06	2.E-06	2.E-07	3.E-05	3.E-06	5.E-05	5.E-06	4.E-06	5.E-07	4.E-05	5.E-06
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-1
Summary of Food Chain Model Hazard Quotients - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Short-Tailed Shrew											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	1.E-05	1.E-06	NC	NC	NC	NC	1.E-05	1.E-06	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	7.E-05	3.E-05	2.E-06	1.E-06	6.E-05	3.E-05	3.E-05	1.E-05	3.E-06	2.E-06	2.E-05	1.E-05
Benzo(a)pyrene	4.E-01	4.E-02	3.E-02	3.E-03	4.E-01	4.E-02	3.E-01	3.E-02	4.E-02	4.E-03	2.E-01	2.E-02
Bis(2-Ethylhexyl)phthalate	**5.E+00**	5.E-01	4.E-03	4.E-04	**5.E+00**	5.E-01	**2.E+01**	**2.E+00**	6.E-03	6.E-04	**2.E+01**	**2.E+00**
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	6.E-02	6.E-03	NC	NC	NC	NC	6.E-02	6.E-03	NC	NC	NC	NC
Fluoranthene	6.E-02	3.E-02	2.E-03	8.E-04	6.E-02	3.E-02	2.E-02	1.E-02	3.E-03	1.E-03	2.E-02	1.E-02
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E+00	1.E-01	5.E-02	5.E-03	1.E+00	1.E-01	6.E-01	6.E-02	8.E-02	8.E-03	5.E-01	5.E-02
Pyrene	7.E-02	4.E-02	3.E-03	2.E-03	7.E-02	4.E-02	3.E-02	2.E-02	5.E-03	3.E-03	3.E-02	2.E-02
Pesticides												
4,4'-DDD	8.E-02	2.E-02	NC	NC	NC	NC	8.E-02	2.E-02	NC	NC	NC	NC
4,4'-DDE	1.E-01	2.E-02	NC	NC	NC	NC	1.E-01	2.E-02	NC	NC	NC	NC
4,4'-DDT	6.E-01	1.E-01	NC	NC	NC	NC	1.E+00	3.E-01	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Metals												
Aluminum	**2.E+01**	**2.E+00**	**2.E+01**	**2.E+00**	**3.E+00**	3.E-01	**3.E+01**	**3.E+00**	**3.E+01**	**3.E+00**	2.E-01	2.E-02
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	1.E+00	1.E-01	9.E-01	9.E-02	3.E-01	3.E-02	1.E+00	1.E-01	1.E+00	1.E-01	-4.E-02	-4.E-03
Cadmium	3.E-02	7.E-03	1.E-02	3.E-03	1.E-02	4.E-03	3.E-02	9.E-03	2.E-02	5.E-03	2.E-02	4.E-03
Chromium	5.E-01	3.E-02	5.E-01	3.E-02	2.E-02	1.E-03	6.E-01	3.E-02	5.E-01	3.E-02	8.E-02	-2.E-04
Copper	2.E-02	2.E-03	3.E-03	3.E-04	1.E-02	1.E-03	2.E-02	2.E-03	9.E-03	9.E-04	8.E-03	8.E-04
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-01	4.E-03	6.E-02	2.E-03	9.E-02	3.E-03	2.E-01	5.E-03	1.E-01	3.E-03	6.E-02	2.E-03
Mercury	2.E-02	2.E-03	8.E-03	8.E-04	7.E-03	7.E-04	8.E-03	8.E-04	2.E-03	2.E-04	6.E-03	6.E-04
Selenium	2.E-01	1.E-01	7.E-02	4.E-02	1.E-01	7.E-02	3.E-01	2.E-01	1.E-01	8.E-02	1.E-01	7.E-02
Vanadium	5.E-01	5.E-02	2.E-01	2.E-02	2.E-01	2.E-02	6.E-01	6.E-02	4.E-01	4.E-02	2.E-01	2.E-02
Zinc	6.E-03	2.E-03	1.E-03	3.E-04	5.E-03	2.E-03	8.E-03	2.E-03	4.E-03	1.E-03	4.E-03	1.E-03
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-1
Summary of Food Chain Model Hazard Quotients - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Red Fox											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	1.E-08	1.E-09	NC	NC	NC	NC	1.E-08	1.E-09	NC	NC	NC	NC
Tetrachloroethene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	6.E-08	3.E-08	7.E-10	4.E-10	6.E-08	3.E-08	3.E-08	1.E-08	1.E-09	6.E-10	2.E-08	1.E-08
Benzo(a)pyrene	8.E-05	8.E-06	2.E-06	2.E-07	8.E-05	8.E-06	5.E-05	5.E-06	3.E-06	3.E-07	5.E-05	5.E-06
Bis(2-Ethylhexyl)phthalate	1.E-02	1.E-03	3.E-06	3.E-07	1.E-02	1.E-03	5.E-02	5.E-03	5.E-06	5.E-07	5.E-02	5.E-03
Butylbenzylphthalate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diphenyl ether	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Fluoranthene	3.E-06	1.E-06	3.E-08	1.E-08	3.E-06	1.E-06	1.E-06	6.E-07	5.E-08	2.E-08	1.E-06	6.E-07
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	5.E-05	5.E-06	6.E-07	6.E-08	5.E-05	5.E-06	2.E-05	2.E-06	1.E-06	1.E-07	2.E-05	2.E-06
Pyrene	3.E-06	2.E-06	4.E-08	3.E-08	3.E-06	2.E-06	1.E-06	8.E-07	8.E-08	5.E-08	1.E-06	7.E-07
Pesticides												
4,4'-DDD	1.E-05	3.E-06	NC	NC	NC	NC	1.E-05	3.E-06	NC	NC	NC	NC
4,4'-DDE	8.E-05	2.E-05	NC	NC	NC	NC	8.E-05	2.E-05	NC	NC	NC	NC
4,4'-DDT	2.E-04	4.E-05	NC	NC	NC	NC	5.E-04	1.E-04	NC	NC	NC	NC
Alpha-BHC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Metals												
Aluminum	1.E-02	1.E-03	3.E-03	3.E-04	7.E-03	7.E-04	2.E-02	2.E-03	5.E-03	5.E-04	1.E-02	1.E-03
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	1.E-03	1.E-04	2.E-04	2.E-05	8.E-04	8.E-05	1.E-03	1.E-04	5.E-04	5.E-05	8.E-04	8.E-05
Cadmium	1.E-05	4.E-06	3.E-06	7.E-07	1.E-05	3.E-06	2.E-05	4.E-06	3.E-06	9.E-07	1.E-05	3.E-06
Chromium	6.E-05	3.E-06	2.E-05	9.E-07	4.E-05	2.E-06	1.E-04	6.E-06	2.E-05	1.E-06	9.E-05	5.E-06
Copper	2.E-05	2.E-06	3.E-06	3.E-07	2.E-05	2.E-06	3.E-05	3.E-06	3.E-06	3.E-07	2.E-05	2.E-06
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	9.E-05	3.E-06	2.E-05	5.E-07	8.E-05	2.E-06	1.E-04	3.E-06	2.E-05	7.E-07	9.E-05	3.E-06
Mercury	9.E-07	9.E-08	3.E-07	3.E-08	6.E-07	6.E-08	7.E-07	7.E-08	2.E-07	2.E-08	5.E-07	5.E-08
Selenium	9.E-05	5.E-05	2.E-05	1.E-05	7.E-05	4.E-05	1.E-04	7.E-05	2.E-05	1.E-05	1.E-04	5.E-05
Vanadium	2.E-04	2.E-05	4.E-05	4.E-06	2.E-04	2.E-05	3.E-04	3.E-05	7.E-05	7.E-06	2.E-04	2.E-05
Zinc	2.E-06	6.E-07	3.E-07	9.E-08	2.E-06	5.E-07	3.E-06	7.E-07	4.E-07	1.E-07	2.E-06	6.E-07
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Checked by: EYM 7/24/2013

Revised: SFR 2/25/2014

Table 4.5-2
Summary of Food Chain Model Hazard Quotients - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	American Robin											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	6.E-04	6.E-05	2.E-05	2.E-06	6.E-04	6.E-05	6.E-04	6.E-05	3.E-05	3.E-06	6.E-04	6.E-05
Bis(2-Ethylhexyl)phthalate	**1.E+01**	1.E+00	2.E-02	2.E-03	**1.E+01**	1.E+00	**5.E+01**	**5.E+00**	3.E-02	3.E-03	**5.E+01**	**5.E+00**
Fluoranthene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	7.E-04	7.E-05	5.E-05	5.E-06	7.E-04	7.E-05
Naphthalene	6.E-02	6.E-03	NC	NC	NC	NC	2.E-02	2.E-03	NC	NC	NC	NC
Phenanthrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	2.E-04	2.E-05	4.E-05	4.E-06	2.E-04	2.E-05
Pyrene	1.E-03	1.E-04	3.E-05	3.E-06	1.E-03	1.E-04	4.E-04	4.E-05	6.E-05	6.E-06	3.E-04	3.E-05
Pesticides												
4,4'-DDD	3.E-03	3.E-04	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
4,4'-DDE	1.E-03	1.E-04	NC	NC	NC	NC	5.E-04	5.E-05	NC	NC	NC	NC
4,4'-DDT	3.E-03	3.E-04	NC	NC	NC	NC	9.E-03	9.E-04	NC	NC	NC	NC
Alpha-BHC	5.E-03	5.E-04	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
Gamma-BHC/Lindane	2.E-02	2.E-03	NC	NC	NC	NC	1.E-02	1.E-03	NC	NC	NC	NC
Metals												
Aluminum	6.E-01	6.E-02	4.E-01	4.E-02	1.E-01	1.E-02	7.E-01	7.E-02	8.E-01	8.E-02	-3.E-02	-3.E-03
Arsenic	4.E-02	1.E-02	2.E-02	7.E-03	2.E-02	7.E-03	4.E-02	2.E-02	3.E-02	1.E-02	1.E-02	4.E-03
Cadmium	4.E-02	1.E-02	1.E-02	4.E-03	2.E-02	6.E-03	4.E-02	1.E-02	2.E-02	5.E-03	2.E-02	5.E-03
Chromium	1.E+00	3.E-01	3.E-01	8.E-02	9.E-01	2.E-01	**2.E+00**	5.E-01	3.E-01	8.E-02	**2.E+00**	4.E-01
Chromium, Hexavalent	8.E-01	8.E-02	NC	NC	NC	NC	9.E-01	9.E-02	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-02	7.E-03	3.E-03	1.E-03	1.E-02	5.E-03	2.E-02	1.E-02	6.E-03	3.E-03	2.E-02	8.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-01	7.E-02	5.E-02	3.E-02	8.E-02	4.E-02	2.E-01	1.E-01	9.E-02	5.E-02	9.E-02	5.E-02
Manganese	1.E-03	1.E-04	2.E-04	2.E-05	8.E-04	8.E-05	2.E-03	2.E-04	6.E-04	6.E-05	1.E-03	1.E-04
Mercury	5.E-02	2.E-02	1.E-02	7.E-03	3.E-02	2.E-02	5.E-02	3.E-02	5.E-03	3.E-03	5.E-02	2.E-02
Nickel	4.E-02	3.E-02	1.E-02	8.E-03	3.E-02	2.E-02	1.E-01	7.E-02	2.E-02	1.E-02	8.E-02	5.E-02
Vanadium	1.E-01	1.E-02	7.E-02	7.E-03	7.E-02	7.E-03	2.E-01	2.E-02	1.E-01	1.E-02	5.E-02	5.E-03
Zinc	3.E-02	4.E-03	7.E-03	8.E-04	3.E-02	3.E-03	5.E-02	6.E-03	2.E-02	2.E-03	3.E-02	4.E-03
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-2
Summary of Food Chain Model Hazard Quotients - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Red-Tailed Hawk											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.E-06	2.E-07	5.E-09	5.E-10	2.E-06	2.E-07	2.E-06	2.E-07	6.E-09	6.E-10	2.E-06	2.E-07
Bis(2-Ethylhexyl)phthalate	1.E+00	1.E-01	1.E-04	1.E-05	1.E+00	1.E-01	**4.E+00**	4.E-01	2.E-04	2.E-05	**4.E+00**	4.E-01
Fluoranthene	5.E-07	5.E-08	7.E-10	7.E-11	5.E-07	5.E-08	2.E-07	2.E-08	1.E-09	1.E-10	2.E-07	2.E-08
Naphthalene	5.E-07	5.E-08	NC	NC	NC	NC	2.E-07	2.E-08	NC	NC	NC	NC
Phenanthrene	8.E-08	8.E-09	1.E-10	1.E-11	8.E-08	8.E-09	2.E-08	2.E-09	2.E-10	2.E-11	2.E-08	2.E-09
Pyrene	2.E-07	2.E-08	4.E-10	4.E-11	2.E-07	2.E-08	6.E-08	6.E-09	7.E-10	7.E-11	6.E-08	6.E-09
Pesticides												
4,4'-DDD	6.E-06	6.E-07	NC	NC	NC	NC	5.E-06	5.E-07	NC	NC	NC	NC
4,4'-DDE	2.E-05	2.E-06	NC	NC	NC	NC	6.E-06	6.E-07	NC	NC	NC	NC
4,4'-DDT	2.E-05	2.E-06	NC	NC	NC	NC	5.E-05	5.E-06	NC	NC	NC	NC
Alpha-BHC	8.E-08	8.E-09	NC	NC	NC	NC	3.E-08	3.E-09	NC	NC	NC	NC
Gamma-BHC/Lindane	2.E-07	2.E-08	NC	NC	NC	NC	1.E-07	1.E-08	NC	NC	NC	NC
Metals												
Aluminum	1.E-03	1.E-04	7.E-05	7.E-06	1.E-03	1.E-04	2.E-03	2.E-04	1.E-04	1.E-05	1.E-03	1.E-04
Arsenic	4.E-04	1.E-04	1.E-05	5.E-06	3.E-04	1.E-04	4.E-04	2.E-04	2.E-05	1.E-05	4.E-04	2.E-04
Cadmium	6.E-05	2.E-05	1.E-06	3.E-07	6.E-05	2.E-05	6.E-05	2.E-05	2.E-06	5.E-07	6.E-05	2.E-05
Chromium	1.E-02	3.E-03	1.E-05	4.E-06	1.E-02	3.E-03	3.E-02	7.E-03	2.E-05	6.E-06	3.E-02	7.E-03
Chromium, Hexavalent	8.E-04	8.E-05	NC	NC	NC	NC	3.E-03	3.E-04	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	2.E-04	1.E-04	4.E-06	2.E-06	2.E-04	1.E-04	4.E-04	2.E-04	5.E-06	2.E-06	4.E-04	2.E-04
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-03	6.E-04	4.E-05	2.E-05	1.E-03	6.E-04	2.E-03	1.E-03	6.E-05	4.E-05	2.E-03	1.E-03
Manganese	1.E-06	1.E-07	2.E-08	2.E-09	1.E-06	1.E-07	3.E-06	3.E-07	6.E-08	6.E-09	3.E-06	3.E-07
Mercury	8.E-06	4.E-06	3.E-07	1.E-07	8.E-06	4.E-06	1.E-05	5.E-06	4.E-07	2.E-07	1.E-05	5.E-06
Nickel	2.E-05	2.E-05	4.E-07	3.E-07	2.E-05	2.E-05	5.E-05	4.E-05	8.E-07	6.E-07	5.E-05	4.E-05
Vanadium	2.E-04	2.E-05	7.E-06	7.E-07	2.E-04	2.E-05	2.E-04	2.E-05	1.E-05	1.E-06	2.E-04	2.E-05
Zinc	1.E-04	1.E-05	2.E-06	2.E-07	1.E-04	1.E-05	2.E-04	2.E-05	4.E-06	5.E-07	2.E-04	2.E-05
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-2
Summary of Food Chain Model Hazard Quotients - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Short-Tailed Shrew											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	3.E-06	3.E-07	NC	NC	NC	NC	3.E-06	3.E-07	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	8.E-06	4.E-06	2.E-06	1.E-06	6.E-06	3.E-06	2.E-05	1.E-05	3.E-06	2.E-06	2.E-05	9.E-06
Benzo(a)pyrene	6.E-01	6.E-02	3.E-02	3.E-03	5.E-01	5.E-02	6.E-01	6.E-02	4.E-02	4.E-03	6.E-01	6.E-02
Bis(2-Ethylhexyl)phthalate	**2.E+00**	2.E-01	4.E-03	4.E-04	**2.E+00**	2.E-01	**6.E+00**	6.E-01	6.E-03	6.E-04	**6.E+00**	6.E-01
Fluoranthene	5.E-02	3.E-02	2.E-03	8.E-04	5.E-02	3.E-02	3.E-02	1.E-02	3.E-03	1.E-03	2.E-02	1.E-02
Naphthalene	1.E-02	1.E-03	NC	NC	NC	NC	3.E-03	3.E-04	NC	NC	NC	NC
Phenanthrene	**2.E+00**	2.E-01	5.E-02	5.E-03	1.E+00	1.E-01	3.E-01	3.E-02	8.E-02	8.E-03	2.E-01	2.E-02
Pyrene	8.E-02	5.E-02	3.E-03	2.E-03	8.E-02	5.E-02	2.E-02	1.E-02	5.E-03	3.E-03	2.E-02	1.E-02
Pesticides												
4,4'-DDD	4.E-02	9.E-03	NC	NC	NC	NC	3.E-02	7.E-03	NC	NC	NC	NC
4,4'-DDE	3.E-02	5.E-03	NC	NC	NC	NC	9.E-03	2.E-03	NC	NC	NC	NC
4,4'-DDT	6.E-02	1.E-02	NC	NC	NC	NC	1.E-01	3.E-02	NC	NC	NC	NC
Alpha-BHC	2.E-03	4.E-04	NC	NC	NC	NC	6.E-04	2.E-04	NC	NC	NC	NC
Gamma-BHC/Lindane	6.E-03	3.E-03	NC	NC	NC	NC	4.E-03	2.E-03	NC	NC	NC	NC
Metals												
Aluminum	**2.E+01**	**2.E+00**	**2.E+01**	**2.E+00**	-8.E-01	-8.E-02	**2.E+01**	**2.E+00**	**3.E+01**	**3.E+00**	-9.E+00	-9.E-01
Arsenic	1.E+00	1.E-01	9.E-01	9.E-02	3.E-01	3.E-02	1.E+00	1.E-01	1.E+00	1.E-01	-5.E-02	-5.E-03
Cadmium	2.E-02	6.E-03	8.E-03	2.E-03	2.E-02	4.E-03	3.E-02	7.E-03	2.E-02	5.E-03	8.E-03	2.E-03
Chromium	7.E-01	4.E-02	5.E-01	3.E-02	2.E-01	1.E-02	1.E+00	6.E-02	5.E-01	3.E-02	5.E-01	3.E-02
Chromium, Hexavalent	9.E-02	9.E-02	NC	NC	NC	NC	3.E-01	3.E-01	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-02	1.E-03	3.E-03	3.E-04	9.E-03	9.E-04	2.E-02	2.E-03	9.E-03	9.E-04	1.E-02	1.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	1.E-01	3.E-03	6.E-02	2.E-03	5.E-02	1.E-03	1.E-01	5.E-03	1.E-01	3.E-03	4.E-02	1.E-03
Manganese	5.E-03	2.E-03	2.E-03	6.E-04	4.E-03	1.E-03	8.E-03	3.E-03	5.E-03	1.E-03	4.E-03	1.E-03
Mercury	2.E-02	2.E-03	8.E-03	8.E-04	1.E-02	1.E-03	2.E-02	2.E-03	2.E-03	2.E-04	2.E-02	2.E-03
Nickel	7.E-02	4.E-02	3.E-02	1.E-02	4.E-02	2.E-02	2.E-01	9.E-02	5.E-02	3.E-02	1.E-01	6.E-02
Vanadium	3.E-01	3.E-02	2.E-01	2.E-02	1.E-01	1.E-02	4.E-01	4.E-02	4.E-01	4.E-02	-1.E-02	-1.E-03
Zinc	4.E-03	1.E-03	1.E-03	3.E-04	3.E-03	9.E-04	6.E-03	2.E-03	4.E-03	1.E-03	2.E-03	7.E-04
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-2
Summary of Food Chain Model Hazard Quotients - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Red Fox											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	2.E-08	2.E-09	NC	NC	NC	NC	2.E-08	2.E-09	NC	NC	NC	NC
Semivolatile Organics												
Benzaldehyde	5.E-08	3.E-08	7.E-10	4.E-10	5.E-08	3.E-08	1.E-07	7.E-08	1.E-09	6.E-10	1.E-07	7.E-08
Benzo(a)pyrene	8.E-04	8.E-05	2.E-06	2.E-07	8.E-04	8.E-05	8.E-04	8.E-05	3.E-06	3.E-07	8.E-04	8.E-05
Bis(2-Ethylhexyl)phthalate	3.E-02	3.E-03	3.E-06	3.E-07	3.E-02	3.E-03	1.E-01	1.E-02	5.E-06	5.E-07	1.E-01	1.E-02
Fluoranthene	2.E-05	9.E-06	3.E-08	1.E-08	2.E-05	9.E-06	9.E-06	4.E-06	5.E-08	2.E-08	9.E-06	4.E-06
Naphthalene	2.E-06	2.E-07	NC	NC	NC	NC	8.E-07	8.E-08	NC	NC	NC	NC
Phenanthrene	4.E-04	4.E-05	6.E-07	6.E-08	4.E-04	4.E-05	8.E-05	8.E-06	1.E-06	1.E-07	7.E-05	7.E-06
Pyrene	2.E-05	1.E-05	4.E-08	3.E-08	2.E-05	1.E-05	7.E-06	4.E-06	8.E-08	5.E-08	7.E-06	4.E-06
Pesticides												
4,4'-DDD	5.E-05	1.E-05	NC	NC	NC	NC	4.E-05	8.E-06	NC	NC	NC	NC
4,4'-DDE	1.E-04	2.E-05	NC	NC	NC	NC	4.E-05	8.E-06	NC	NC	NC	NC
4,4'-DDT	1.E-04	3.E-05	NC	NC	NC	NC	4.E-04	8.E-05	NC	NC	NC	NC
Alpha-BHC	4.E-07	1.E-07	NC	NC	NC	NC	1.E-07	4.E-08	NC	NC	NC	NC
Gamma-BHC/Lindane	1.E-06	7.E-07	NC	NC	NC	NC	8.E-07	4.E-07	NC	NC	NC	NC
Metals												
Aluminum	6.E-02	6.E-03	3.E-03	3.E-04	5.E-02	5.E-03	7.E-02	7.E-03	5.E-03	5.E-04	7.E-02	7.E-03
Arsenic	8.E-03	8.E-04	2.E-04	2.E-05	8.E-03	8.E-04	9.E-03	9.E-04	5.E-04	5.E-05	8.E-03	8.E-04
Cadmium	9.E-05	2.E-05	3.E-06	7.E-07	8.E-05	2.E-05	9.E-05	2.E-05	3.E-06	9.E-07	9.E-05	2.E-05
Chromium	2.E-03	1.E-04	2.E-05	9.E-07	2.E-03	1.E-04	4.E-03	2.E-04	2.E-05	1.E-06	4.E-03	2.E-04
Chromium, Hexavalent	2.E-05	2.E-05	NC	NC	NC	NC	4.E-05	4.E-05	NC	NC	NC	NC
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-04	1.E-05	3.E-06	3.E-07	1.E-04	1.E-05	2.E-04	2.E-05	3.E-06	3.E-07	2.E-04	2.E-05
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	4.E-04	1.E-05	2.E-05	5.E-07	4.E-04	1.E-05	7.E-04	2.E-05	2.E-05	7.E-07	6.E-04	2.E-05
Manganese	2.E-05	5.E-06	3.E-07	9.E-08	2.E-05	5.E-06	3.E-05	1.E-05	7.E-07	2.E-07	3.E-05	1.E-05
Mercury	6.E-06	6.E-07	3.E-07	3.E-08	6.E-06	6.E-07	7.E-06	7.E-07	2.E-07	2.E-08	7.E-06	7.E-07
Nickel	3.E-05	1.E-05	1.E-06	5.E-07	3.E-05	1.E-05	7.E-05	4.E-05	1.E-06	7.E-07	7.E-05	4.E-05
Vanadium	1.E-03	1.E-04	4.E-05	4.E-06	1.E-03	1.E-04	1.E-03	1.E-04	7.E-05	7.E-06	1.E-03	1.E-04
Zinc	9.E-06	3.E-06	3.E-07	9.E-08	9.E-06	3.E-06	1.E-05	4.E-06	4.E-07	1.E-07	1.E-05	4.E-06
Inorganics												
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

Table 4.5-3
Summary of Food Chain Model Hazard Quotients - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	American Robin											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Aniline	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	9.E-05	9.E-06	2.E-05	2.E-06	7.E-05	7.E-06	2.E-04	2.E-05	3.E-05	3.E-06	2.E-04	2.E-05
Bis(2-Ethylhexyl)phthalate	**3.E+01**	**3.E+00**	2.E-02	2.E-03	**3.E+01**	**3.E+00**	**1.E+02**	**1.E+01**	3.E-02	3.E-03	**1.E+02**	**1.E+01**
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	5.E-04	5.E-05	3.E-05	3.E-06	5.E-04	5.E-05	3.E-03	3.E-04	5.E-05	5.E-06	3.E-03	3.E-04
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	3.E-04	3.E-05	3.E-05	3.E-06	3.E-04	3.E-05	2.E-04	2.E-05	4.E-05	4.E-06	1.E-04	1.E-05
Pyrene	3.E-04	3.E-05	3.E-05	3.E-06	3.E-04	3.E-05	7.E-04	7.E-05	6.E-05	6.E-06	6.E-04	6.E-05
Pesticides												
4,4'-DDT	4.E-03	4.E-04	NC	NC	NC	NC	4.E-03	4.E-04	NC	NC	NC	NC
Hexachlorobenzene	1.E-02	1.E-03	NC	NC	NC	NC	1.E-02	1.E-03	NC	NC	NC	NC
Metals												
Aluminum	6.E-01	6.E-02	4.E-01	4.E-02	2.E-01	2.E-02	**1.E+00**	1.E-01	8.E-01	8.E-02	4.E-01	4.E-02
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	4.E-02	2.E-02	2.E-02	7.E-03	2.E-02	9.E-03	5.E-02	2.E-02	3.E-02	1.E-02	2.E-02	8.E-03
Cadmium	3.E-02	8.E-03	9.E-03	2.E-03	2.E-02	6.E-03	3.E-02	7.E-03	2.E-02	5.E-03	7.E-03	2.E-03
Chromium	**1.E+01**	**3.E+00**	3.E-01	8.E-02	**1.E+01**	**3.E+00**	**1.E+03**	**3.E+02**	3.E-01	8.E-02	**1.E+03**	**3.E+02**
Chromium, Hexavalent	8.E-01	8.E-02	NC	NC	NC	NC	**5.E+01**	**5.E+00**	NC	NC	NC	NC
Copper	2.E-02	9.E-03	3.E-03	1.E-03	1.E-02	7.E-03	3.E-02	2.E-02	6.E-03	3.E-03	3.E-02	1.E-02
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	1.E-01	5.E-02	3.E-02	1.E-01	8.E-02	2.E-01	1.E-01	9.E-02	5.E-02	1.E-01	8.E-02
Mercury	8.E-02	4.E-02	1.E-02	7.E-03	7.E-02	3.E-02	2.E-01	8.E-02	5.E-03	3.E-03	1.E-01	7.E-02
Silver	8.E-01	8.E-02	NC	NC	NC	NC	**9.E+00**	9.E-01	NC	NC	NC	NC
Thallium	3.E-02	3.E-03	NC	NC	NC	NC	1.E-01	1.E-02	NC	NC	NC	NC
Tin	**2.E+00**	9.E-01	2.E-03	7.E-04	**2.E+00**	9.E-01	**2.E+01**	**8.E+00**	3.E-03	1.E-03	**2.E+01**	**8.E+00**
Vanadium	2.E-01	2.E-02	7.E-02	7.E-03	2.E-01	2.E-02	4.E-01	4.E-02	1.E-01	1.E-02	3.E-01	3.E-02
Zinc	2.E-02	2.E-03	7.E-03	8.E-04	1.E-02	1.E-03	3.E-02	3.E-03	2.E-02	2.E-03	8.E-03	9.E-04
Inorganics												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-3
Summary of Food Chain Model Hazard Quotients - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Red-Tailed Hawk											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
Aniline	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.E-08	2.E-09	5.E-09	5.E-10	1.E-08	1.E-09	4.E-08	4.E-09	6.E-09	6.E-10	3.E-08	3.E-09
Bis(2-Ethylhexyl)phthalate	2.E-01	2.E-02	1.E-04	1.E-05	2.E-01	2.E-02	6.E-01	6.E-02	2.E-04	2.E-05	6.E-01	6.E-02
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Fluoranthene	1.E-08	1.E-09	7.E-10	7.E-11	1.E-08	1.E-09	7.E-08	7.E-09	1.E-09	1.E-10	7.E-08	7.E-09
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Phenanthrene	1.E-09	1.E-10	1.E-10	1.E-11	1.E-09	1.E-10	8.E-10	8.E-11	2.E-10	2.E-11	6.E-10	6.E-11
Pyrene	4.E-09	4.E-10	4.E-10	4.E-11	4.E-09	4.E-10	8.E-09	8.E-10	7.E-10	7.E-11	7.E-09	7.E-10
Pesticides												
4,4'-DDT	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Hexachlorobenzene	7.E-07	7.E-08	NC	NC	NC	NC	7.E-07	7.E-08	NC	NC	NC	NC
Metals												
Aluminum	1.E-04	1.E-05	7.E-05	7.E-06	3.E-05	3.E-06	2.E-04	2.E-05	1.E-04	1.E-05	6.E-05	6.E-06
Antimony	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	5.E-05	2.E-05	1.E-05	5.E-06	3.E-05	1.E-05	6.E-05	3.E-05	2.E-05	1.E-05	4.E-05	2.E-05
Cadmium	4.E-06	1.E-06	1.E-06	3.E-07	3.E-06	7.E-07	3.E-06	8.E-07	2.E-06	5.E-07	1.E-06	3.E-07
Chromium	2.E-02	4.E-03	1.E-05	4.E-06	2.E-02	4.E-03	6.E-02	2.E-02	2.E-05	6.E-06	6.E-02	2.E-02
Chromium, Hexavalent	3.E-04	3.E-05	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
Copper	3.E-05	2.E-05	4.E-06	2.E-06	3.E-05	1.E-05	8.E-05	4.E-05	5.E-06	2.E-06	8.E-05	4.E-05
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-04	1.E-04	4.E-05	2.E-05	1.E-04	8.E-05	2.E-04	1.E-04	6.E-05	4.E-05	2.E-04	9.E-05
Mercury	2.E-06	1.E-06	3.E-07	1.E-07	2.E-06	1.E-06	7.E-06	3.E-06	4.E-07	2.E-07	7.E-06	3.E-06
Silver	4.E-06	4.E-07	NC	NC	NC	NC	4.E-05	4.E-06	NC	NC	NC	NC
Thallium	9.E-06	9.E-07	NC	NC	NC	NC	4.E-05	4.E-06	NC	NC	NC	NC
Tin	2.E-01	8.E-02	2.E-04	6.E-05	2.E-01	8.E-02	**2.E+00**	7.E-01	2.E-04	9.E-05	**2.E+00**	7.E-01
Vanadium	2.E-05	2.E-06	7.E-06	7.E-07	2.E-05	2.E-06	4.E-05	4.E-06	1.E-05	1.E-06	3.E-05	3.E-06
Zinc	4.E-06	4.E-07	2.E-06	2.E-07	2.E-06	2.E-07	7.E-06	8.E-07	4.E-06	5.E-07	3.E-06	3.E-07
Inorganics												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-3
Summary of Food Chain Model Hazard Quotients - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Short-Tailed Shrew											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	5.E-06	5.E-07	NC	NC	NC	NC	8.E-06	8.E-07	NC	NC	NC	NC
Semivolatile Organics												
Aniline	9.E-05	9.E-06	NC	NC	NC	NC	9.E-05	9.E-06	NC	NC	NC	NC
Benzaldehyde	4.E-06	2.E-06	2.E-06	1.E-06	2.E-06	1.E-06	7.E-06	4.E-06	3.E-06	2.E-06	4.E-06	2.E-06
Benzo(a)pyrene	1.E-01	1.E-02	3.E-02	3.E-03	9.E-02	9.E-03	3.E-01	3.E-02	4.E-02	4.E-03	2.E-01	2.E-02
Bis(2-Ethylhexyl)phthalate	**6.E+00**	6.E-01	4.E-03	4.E-04	**6.E+00**	6.E-01	**2.E+01**	**2.E+00**	6.E-03	6.E-04	**2.E+01**	**2.E+00**
Diphenyl ether	2.E-01	2.E-02	NC	NC	NC	NC	1.E+00	1.E-01	NC	NC	NC	NC
Fluoranthene	3.E-02	1.E-02	2.E-03	8.E-04	3.E-02	1.E-02	2.E-01	8.E-02	3.E-03	1.E-03	2.E-01	8.E-02
N-Nitrosodi-n-propylamine	5.E-03	5.E-04	NC	NC	NC	NC	5.E-03	5.E-04	NC	NC	NC	NC
Phenanthrene	6.E-01	6.E-02	5.E-02	5.E-03	5.E-01	5.E-02	3.E-01	3.E-02	8.E-02	8.E-03	2.E-01	2.E-02
Pyrene	3.E-02	2.E-02	3.E-03	2.E-03	3.E-02	2.E-02	6.E-02	3.E-02	5.E-03	3.E-03	5.E-02	3.E-02
Pesticides												
4,4'-DDT	1.E-01	2.E-02	NC	NC	NC	NC	1.E-01	2.E-02	NC	NC	NC	NC
Hexachlorobenzene	1.E-01	3.E-02	NC	NC	NC	NC	1.E-01	3.E-02	NC	NC	NC	NC
Metals												
Aluminum	**2.E+01**	**2.E+00**	**2.E+01**	**2.E+00**	**7.E+00**	7.E-01	**4.E+01**	**4.E+00**	**3.E+01**	**3.E+00**	**2.E+01**	**2.E+00**
Antimony	2.E-03	1.E-03	NC	NC	NC	NC	2.E-03	1.E-03	NC	NC	NC	NC
Arsenic	**2.E+00**	2.E-01	9.E-01	9.E-02	9.E-01	9.E-02	**2.E+00**	2.E-01	**1.E+00**	1.E-01	8.E-01	8.E-02
Cadmium	3.E-02	7.E-03	8.E-03	2.E-03	2.E-02	5.E-03	2.E-02	6.E-03	2.E-02	5.E-03	6.E-03	2.E-03
Chromium	**6.E+00**	4.E-01	5.E-01	3.E-02	**5.E+00**	3.E-01	**2.E+03**	**1.E+02**	5.E-01	3.E-02	**2.E+03**	**1.E+02**
Chromium, Hexavalent	7.E-01	7.E-01	NC	NC	NC	NC	**5.E+00**	**5.E+00**	NC	NC	NC	NC
Copper	2.E-02	2.E-03	3.E-03	3.E-04	2.E-02	2.E-03	4.E-02	4.E-03	9.E-03	9.E-04	3.E-02	3.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	6.E-03	6.E-02	2.E-03	1.E-01	4.E-03	2.E-01	7.E-03	1.E-01	3.E-03	1.E-01	4.E-03
Mercury	5.E-02	5.E-03	8.E-03	8.E-04	4.E-02	4.E-03	9.E-02	9.E-03	2.E-03	2.E-04	8.E-02	8.E-03
Silver	3.E-01	2.E-01	NC	NC	NC	NC	**4.E+00**	**2.E+00**	NC	NC	NC	NC
Thallium	4.E-01	4.E-02	NC	NC	NC	NC	**1.E+00**	1.E-01	NC	NC	NC	NC
Tin	**2.E+01**	**1.E+01**	1.E-02	9.E-03	**2.E+01**	**1.E+01**	**2.E+02**	**1.E+02**	2.E-02	1.E-02	**2.E+02**	**1.E+02**
Vanadium	8.E-01	8.E-02	2.E-01	2.E-02	5.E-01	5.E-02	**1.E+00**	1.E-01	4.E-01	4.E-02	9.E-01	9.E-02
Zinc	4.E-03	1.E-03	1.E-03	3.E-04	3.E-03	8.E-04	5.E-03	1.E-03	4.E-03	1.E-03	1.E-03	3.E-04
Inorganics												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Table 4.5-3
Summary of Food Chain Model Hazard Quotients - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Red Fox											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	2.E-09	2.E-10	NC	NC	NC	NC	3.E-09	3.E-10	NC	NC	NC	NC
Semivolatile Organics												
Aniline	3.E-08	3.E-09	NC	NC	NC	NC	3.E-08	3.E-09	NC	NC	NC	NC
Benzaldehyde	1.E-09	7.E-10	7.E-10	4.E-10	7.E-10	3.E-10	3.E-09	1.E-09	1.E-09	6.E-10	1.E-09	7.E-10
Benzo(a)pyrene	9.E-06	9.E-07	2.E-06	2.E-07	6.E-06	6.E-07	2.E-05	2.E-06	3.E-06	3.E-07	2.E-05	2.E-06
Bis(2-Ethylhexyl)phthalate	5.E-03	5.E-04	3.E-06	3.E-07	5.E-03	5.E-04	2.E-02	2.E-03	5.E-06	5.E-07	2.E-02	2.E-03
Diphenyl ether	2.E-06	2.E-07	NC	NC	NC	NC	1.E-05	1.E-06	NC	NC	NC	NC
Fluoranthene	5.E-07	3.E-07	3.E-08	1.E-08	5.E-07	2.E-07	3.E-06	1.E-06	5.E-08	2.E-08	3.E-06	1.E-06
N-Nitrosodi-n-propylamine	2.E-06	2.E-07	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Phenanthrene	7.E-06	7.E-07	6.E-07	6.E-08	6.E-06	6.E-07	4.E-06	4.E-07	1.E-06	1.E-07	3.E-06	3.E-07
Pyrene	4.E-07	3.E-07	4.E-08	3.E-08	4.E-07	2.E-07	9.E-07	5.E-07	8.E-08	5.E-08	8.E-07	5.E-07
Pesticides												
4,4'-DDT	1.E-05	3.E-06	NC	NC	NC	NC	1.E-05	3.E-06	NC	NC	NC	NC
Hexachlorobenzene	4.E-06	9.E-07	NC	NC	NC	NC	4.E-06	9.E-07	NC	NC	NC	NC
Metals												
Aluminum	5.E-03	5.E-04	3.E-03	3.E-04	1.E-03	1.E-04	8.E-03	8.E-04	5.E-03	5.E-04	3.E-03	3.E-04
Antimony	9.E-08	9.E-08	NC	NC	NC	NC	9.E-08	9.E-08	NC	NC	NC	NC
Arsenic	8.E-04	8.E-05	2.E-04	2.E-05	5.E-04	5.E-05	1.E-03	1.E-04	5.E-04	5.E-05	5.E-04	5.E-05
Cadmium	5.E-06	1.E-06	3.E-06	7.E-07	2.E-06	6.E-07	4.E-06	1.E-06	3.E-06	9.E-07	1.E-06	3.E-07
Chromium	2.E-03	1.E-04	2.E-05	9.E-07	2.E-03	1.E-04	7.E-03	4.E-04	2.E-05	1.E-06	7.E-03	4.E-04
Chromium, Hexavalent	1.E-05	3.E-06	NC	NC	NC	NC	7.E-05	2.E-05	NC	NC	NC	NC
Copper	2.E-05	2.E-06	3.E-06	3.E-07	1.E-05	1.E-06	3.E-05	3.E-06	3.E-06	3.E-07	3.E-05	3.E-06
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	5.E-05	2.E-06	2.E-05	5.E-07	3.E-05	1.E-06	6.E-05	2.E-06	2.E-05	7.E-07	4.E-05	1.E-06
Mercury	1.E-06	1.E-07	3.E-07	3.E-08	9.E-07	9.E-08	3.E-06	3.E-07	2.E-07	2.E-08	3.E-06	3.E-07
Silver	5.E-06	3.E-06	NC	NC	NC	NC	6.E-05	3.E-05	NC	NC	NC	NC
Thallium	7.E-05	7.E-06	NC	NC	NC	NC	3.E-04	3.E-05	NC	NC	NC	NC
Tin	3.E-02	2.E-02	2.E-05	1.E-05	3.E-02	2.E-02	2.E-01	2.E-01	3.E-05	2.E-05	2.E-01	2.E-01
Vanadium	1.E-04	1.E-05	4.E-05	4.E-06	9.E-05	9.E-06	2.E-04	2.E-05	7.E-05	7.E-06	2.E-04	2.E-05
Zinc	4.E-07	1.E-07	3.E-07	9.E-08	1.E-07	3.E-08	6.E-07	2.E-07	4.E-07	1.E-07	1.E-07	4.E-08
Inorganics												
Cyanide, Total	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH												
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013

Checked by: SFR 7/18/2013

Revised: SFR 2/25/2014

Table 4.5-4
Summary of Food Chain Model Hazard Quotients - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	2.E-07	2.E-08	2.E-04	2.E-05	3.E-04	3.E-05
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-08	2.E-09	3.E-08	3.E-09	3.E-05	3.E-06	3.E-05	3.E-06
4-iso-Propyltoluene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	9.E-10	9.E-11	9.E-10	9.E-11	3.E-07	3.E-08	3.E-07	3.E-08
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	2.E-06	2.E-07	3.E-06	3.E-07	6.E-04	6.E-05	9.E-04	9.E-05
Semivolatile Organics																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	4.E-09	4.E-10	8.E-09	8.E-10	1.E-06	1.E-07	3.E-06	3.E-07
Acetophenone	NC	NC	NC	NC	NC	NC	NC	NC	3.E-11	3.E-12	3.E-11	3.E-12	1.E-08	1.E-09	1.E-08	1.E-09
Azobenzene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	4.E-10	4.E-11	4.E-10	4.E-11	9.E-09	9.E-10	9.E-09	9.E-10	3.E-09	3.E-10	3.E-09	3.E-10	3.E-06	3.E-07	3.E-06	3.E-07
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	2.E-09	1.E-09	4.E-09	2.E-09	7.E-07	4.E-07	1.E-06	6.E-07
Bis(2-Ethylhexyl)phthalate	5.E-01	5.E-02	**2.E+00**	2.E-01	**2.E+01**	**2.E+00**	**9.E+01**	**9.E+00**	1.E-05	1.E-06	5.E-05	5.E-06	1.E-02	1.E-03	6.E-02	6.E-03
Caprolactam	NC	NC	NC	NC	NC	NC	NC	NC	2.E-11	2.E-12	2.E-11	2.E-12	6.E-09	6.E-10	6.E-09	6.E-10
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	2.E-07	2.E-08	2.E-04	2.E-05	3.E-04	3.E-05
Di-n-octylphthalate	2.E-03	2.E-04	2.E-03	2.E-04	6.E-02	6.E-03	6.E-02	6.E-03	7.E-09	2.E-09	7.E-09	2.E-09	8.E-06	2.E-06	8.E-06	2.E-06
Diphenylmethanone	NC	NC	NC	NC	NC	NC	NC	NC	6.E-09	6.E-10	6.E-09	6.E-10	7.E-06	7.E-07	7.E-06	7.E-07
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	9.E-10	9.E-11	2.E-09	2.E-10	9.E-07	9.E-08	2.E-06	2.E-07
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-09	4.E-09	7.E-09	5.E-09	2.E-06	1.E-06	2.E-06	2.E-06
Metals																
Aluminum	1.E-04	1.E-05	4.E-04	4.E-05	2.E-03	2.E-04	9.E-03	9.E-04	5.E-05	5.E-06	2.E-04	2.E-05	5.E-02	5.E-03	2.E-01	2.E-02
Arsenic	1.E-03	4.E-04	2.E-03	7.E-04	3.E-02	1.E-02	5.E-02	2.E-02	5.E-05	5.E-06	9.E-05	9.E-06	6.E-02	6.E-03	1.E-01	1.E-02
Barium	1.E-04	5.E-05	3.E-04	1.E-04	4.E-03	2.E-03	1.E-02	5.E-03	4.E-07	2.E-07	1.E-06	5.E-07	4.E-04	2.E-04	1.E-03	5.E-04
Beryllium	1.E-02	1.E-03	2.E-02	2.E-03	5.E-01	5.E-02	8.E-01	8.E-02	3.E-07	3.E-07	5.E-07	5.E-07	2.E-04	2.E-04	3.E-04	3.E-04
Chromium	7.E-01	2.E-01	3.E-02	6.E-03	7.E-01	2.E-01	1.E+00	3.E-01	8.E-05	5.E-06	2.E-04	1.E-05	6.E-01	4.E-02	1.E-01	8.E-03
Chromium, Hexavalent	3.E-03	3.E-04	1.E-02	1.E-03	9.E-02	9.E-03	3.E-01	3.E-02	2.E-07	2.E-07	9.E-07	9.E-07	2.E-04	2.E-04	9.E-04	9.E-04
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-06	6.E-07	2.E-06	1.E-06	3.E-05	1.E-05	5.E-05	2.E-05	1.E-08	1.E-09	2.E-08	2.E-09	1.E-05	1.E-06	2.E-05	2.E-06
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	3.E-07	2.E-07	5.E-07	3.E-07	7.E-06	4.E-06	1.E-05	6.E-06	3.E-09	8.E-11	4.E-09	1.E-10	2.E-06	7.E-08	4.E-06	1.E-07
Manganese	4.E-06	4.E-07	4.E-06	4.E-07	8.E-05	8.E-06	1.E-04	1.E-05	3.E-07	1.E-07	4.E-07	1.E-07	3.E-04	1.E-04	4.E-04	1.E-04
Silver	2.E-03	2.E-04	5.E-03	5.E-04	5.E-02	5.E-03	1.E-01	1.E-02	4.E-07	2.E-07	1.E-06	5.E-07	5.E-04	2.E-04	1.E-03	6.E-04
Vanadium	9.E-04	9.E-05	1.E-03	1.E-04	4.E-02	4.E-03	5.E-02	5.E-03	2.E-05	2.E-06	2.E-05	2.E-06	7.E-03	7.E-04	1.E-02	1.E-03
Inorganics																
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table 4.5-4
Summary of Food Chain Model Hazard Quotients - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Specialty Compounds																
Hydrazine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Dimethylformamide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
EPH																
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
EPH - Extractable Petroleum Hydrocarbons
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013
Revised: SFR 2/25/2014

Table 4.5-5
Summary of Food Chain Model Hazard Quotients - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	6.E-08	6.E-09	1.E-07	1.E-08	7.E-05	7.E-06	1.E-04	1.E-05
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-08	2.E-09	2.E-08	2.E-09	3.E-05	3.E-06	3.E-05	3.E-06
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	6.E-10	6.E-11	6.E-10	6.E-11	2.E-07	2.E-08	2.E-07	2.E-08
Acetone	4.E-10	4.E-11	4.E-10	4.E-11	3.E-08	3.E-09	3.E-08	3.E-09	1.E-09	3.E-10	1.E-09	3.E-10	4.E-07	8.E-08	4.E-07	8.E-08
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	1.E-06	1.E-07	1.E-06	1.E-07	3.E-04	3.E-05	4.E-04	4.E-05
Semivolatile Organics																
Aniline	NC	NC	NC	NC	NC	NC	NC	NC	3.E-08	3.E-09	3.E-08	3.E-09	8.E-06	8.E-07	8.E-06	8.E-07
Azobenzene	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	--	--	--	--
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	6.E-10	3.E-10	6.E-10	3.E-10	2.E-07	1.E-07	2.E-07	1.E-07
Benzo(a)pyrene	3.E-10	3.E-11	3.E-10	3.E-11	7.E-09	7.E-10	7.E-09	7.E-10	2.E-09	2.E-10	2.E-09	2.E-10	2.E-06	2.E-07	2.E-06	2.E-07
Bis(2-Ethylhexyl)phthalate	**2.E+00**	2.E-01	**3.E+00**	3.E-01	**5.E+01**	**5.E+00**	**9.E+01**	**9.E+00**	6.E-05	6.E-06	1.E-04	1.E-05	8.E-02	8.E-03	1.E-01	1.E-02
Di-n-octylphthalate	8.E-04	8.E-05	8.E-04	8.E-05	2.E-02	2.E-03	2.E-02	2.E-03	5.E-09	1.E-09	5.E-09	1.E-09	7.E-06	2.E-06	7.E-06	2.E-06
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	2.E-06	2.E-07	2.E-06	2.E-07	2.E-03	2.E-04	3.E-03	3.E-04
Diphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	8.E-09	7.E-10	1.E-08	1.E-09	1.E-05	1.E-06	1.E-05	1.E-06
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	7.E-10	7.E-11	1.E-09	1.E-10	7.E-07	7.E-08	1.E-06	1.E-07
Pesticides																
4,4`-DDT	2.E-05	2.E-06	4.E-05	4.E-06	3.E-04	3.E-05	8.E-04	8.E-05	1.E-07	3.E-08	3.E-07	7.E-08	2.E-04	4.E-05	4.E-04	9.E-05
Hexachlorobenzene	2.E-05	2.E-06	4.E-05	4.E-06	9.E-04	9.E-05	2.E-03	2.E-04	1.E-07	2.E-08	2.E-07	5.E-08	1.E-04	3.E-05	3.E-04	6.E-05
Metals																
Aluminum	9.E-05	9.E-06	3.E-04	3.E-05	2.E-03	2.E-04	8.E-03	8.E-04	4.E-05	4.E-06	2.E-04	2.E-05	4.E-02	4.E-03	1.E-01	1.E-02
Barium	4.E-05	2.E-05	6.E-05	3.E-05	1.E-03	7.E-04	2.E-03	1.E-03	2.E-07	7.E-08	2.E-07	1.E-07	2.E-04	7.E-05	2.E-04	1.E-04
Beryllium	2.E-02	2.E-03	3.E-02	3.E-03	9.E-01	9.E-02	1.E+00	1.E-01	5.E-07	5.E-07	8.E-07	8.E-07	3.E-04	3.E-04	4.E-04	4.E-04
Cadmium	1.E-03	3.E-04	2.E-03	5.E-04	3.E-02	7.E-03	5.E-02	1.E-02	7.E-07	2.E-07	1.E-06	3.E-07	9.E-04	2.E-04	2.E-03	4.E-04
Chromium	3.E-02	8.E-03	4.E-02	1.E-02	**2.E+00**	4.E-01	**2.E+00**	6.E-01	3.E-04	2.E-05	3.E-03	2.E-04	2.E-01	1.E-02	3.E-01	2.E-02
Chromium, Hexavalent	5.E-03	5.E-04	9.E-03	9.E-04	1.E-01	1.E-02	3.E-01	3.E-02	4.E-07	4.E-07	7.E-07	7.E-07	4.E-04	4.E-04	7.E-04	7.E-04
Cobalt	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Copper	1.E-06	5.E-07	2.E-06	9.E-07	2.E-05	1.E-05	4.E-05	2.E-05	9.E-09	9.E-10	2.E-08	2.E-09	9.E-06	9.E-07	2.E-05	2.E-06
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	3.E-07	1.E-07	4.E-07	2.E-07	6.E-06	3.E-06	9.E-06	5.E-06	2.E-09	6.E-11	3.E-09	9.E-11	2.E-06	6.E-08	3.E-06	9.E-08
Manganese	3.E-06	3.E-07	4.E-06	4.E-07	7.E-05	7.E-06	8.E-05	8.E-06	3.E-07	8.E-08	3.E-07	1.E-07	2.E-04	8.E-05	3.E-04	9.E-05
Mercury	6.E-03	3.E-03	1.E-02	5.E-03	2.E-01	8.E-02	3.E-01	1.E-01	2.E-06	2.E-07	3.E-06	3.E-07	2.E-03	2.E-04	4.E-03	4.E-04
Nickel	9.E-04	6.E-04	1.E-03	9.E-04	2.E-02	2.E-02	3.E-02	2.E-02	1.E-06	6.E-07	2.E-06	8.E-07	1.E-03	7.E-04	2.E-03	1.E-03
Silver	5.E-03	5.E-04	1.E-02	1.E-03	1.E-01	1.E-02	3.E-01	3.E-02	1.E-06	5.E-07	3.E-06	1.E-06	1.E-03	6.E-04	3.E-03	2.E-03
Tin	7.E-06	3.E-06	7.E-06	3.E-06	5.E-04	2.E-04	5.E-04	2.E-04	2.E-08	1.E-08	2.E-08	1.E-08	1.E-05	8.E-06	1.E-05	8.E-06
Vanadium	6.E-04	6.E-05	8.E-04	8.E-05	3.E-02	3.E-03	3.E-02	3.E-03	1.E-05	1.E-06	1.E-05	1.E-06	5.E-03	5.E-04	6.E-03	6.E-04
Inorganics																
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table 4.5-5
Summary of Food Chain Model Hazard Quotients - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Specialty Compounds																
Hydrazine	NC	NC	NC	NC	NC	NC	NC	NC	5.E-10	3.E-10	7.E-10	4.E-10	4.E-07	2.E-07	5.E-07	3.E-07
EPH																
C11-C22 Aromatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C19-C36 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
C9-C18 Aliphatics	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
EPH - Extractable Petroleum Hydrocarbons
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013
Revised: SFR 2/25/2014

Table 4.5-6
Summary of Food Chain Model Hazard Quotients - On-PWD/WDW
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
Acetone	2.E-08	2.E-09	2.E-08	2.E-09	5.E-07	5.E-08	5.E-07	5.E-08	7.E-08	1.E-08	7.E-08	1.E-08	8.E-06	2.E-06	8.E-06	2.E-06
Nonionic Organics																
Benzene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	7.E-07	7.E-08	2.E-05	2.E-06	8.E-05	8.E-06
Metals																
Barium	1.E-03	6.E-04	2.E-03	1.E-03	1.E-02	6.E-03	3.E-02	1.E-02	5.E-06	2.E-06	1.E-05	4.E-06	2.E-03	7.E-04	3.E-03	1.E-03
Beryllium	1.E-01	1.E-02	3.E-01	3.E-02	1.E+00	1.E-01	**3.E+00**	3.E-01	3.E-06	3.E-06	6.E-06	6.E-06	4.E-04	4.E-04	1.E-03	1.E-03
Cadmium	2.E-02	6.E-03	3.E-02	9.E-03	2.E-01	4.E-02	3.E-01	7.E-02	1.E-05	4.E-06	2.E-05	6.E-06	6.E-03	2.E-03	1.E-02	3.E-03
Chromium	7.E-01	2.E-01	2.E-01	4.E-02	1.E+00	3.E-01	1.E+00	3.E-01	5.E-04	3.E-05	2.E-04	1.E-05	2.E-01	1.E-02	6.E-02	4.E-03
Lead	9.E-02	5.E-02	1.E-01	7.E-02	7.E-01	4.E-01	1.E+00	6.E-01	2.E-04	5.E-06	3.E-04	8.E-06	7.E-02	2.E-03	1.E-01	3.E-03
Mercury	2.E-01	8.E-02	2.E-01	1.E-01	1.E+00	6.E-01	**2.E+00**	9.E-01	4.E-05	4.E-06	6.E-05	6.E-06	2.E-02	2.E-03	3.E-02	3.E-03
Vanadium	2.E-02	2.E-03	4.E-02	4.E-03	3.E-01	3.E-02	5.E-01	5.E-02	4.E-04	4.E-05	7.E-04	7.E-05	6.E-02	6.E-03	1.E-01	1.E-02

Notes:
CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013
Revised: SFR 2/25/2014

Table 4.5-7
Summary of Food Chain Model Hazard Quotients - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	3.E-07	3.E-08	2.E-04	2.E-05	3.E-04	3.E-05
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	3.E-07	3.E-08	2.E-04	2.E-05	3.E-04	3.E-05
Acetone	2.E-09	2.E-10	2.E-09	2.E-10	1.E-07	1.E-08	1.E-07	1.E-08	6.E-09	1.E-09	6.E-09	1.E-09	2.E-06	4.E-07	2.E-06	4.E-07
Methyl Tertbutyl Ether	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	5.E-09	6.E-08	6.E-09	2.E-05	2.E-06	2.E-05	2.E-06
Acetophenone	NC	NC	NC	NC	NC	NC	NC	NC	3.E-10	3.E-11	3.E-10	3.E-11	8.E-08	8.E-09	1.E-07	1.E-08
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	4.E-08	2.E-08	4.E-08	2.E-08	1.E-05	6.E-06	1.E-05	7.E-06
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	4.E-08	5.E-08	4.E-08	2.E-05	1.E-05	2.E-05	1.E-05
Polyaromatic Hydrocarbons																
Benzo(b)fluoranthene	1.E-03	1.E-04	1.E-03	1.E-04	6.E-02	6.E-03	6.E-02	6.E-03	2.E-06	2.E-07	2.E-06	2.E-07	2.E-03	2.E-04	2.E-03	2.E-04
Fluoranthene	2.E-03	2.E-04	2.E-03	2.E-04	1.E-01	1.E-02	1.E-01	1.E-02	1.E-07	7.E-08	2.E-07	8.E-08	2.E-04	9.E-05	2.E-04	1.E-04
Phenanthrene	2.E-03	2.E-04	2.E-03	2.E-04	9.E-02	9.E-03	9.E-02	9.E-03	3.E-06	3.E-07	3.E-06	3.E-07	4.E-03	4.E-04	4.E-03	4.E-04
Pyrene	2.E-03	2.E-04	2.E-03	2.E-04	9.E-02	9.E-03	1.E-01	1.E-02	2.E-07	1.E-07	2.E-07	1.E-07	2.E-04	1.E-04	2.E-04	1.E-04
Metals																
Aluminum	2.E-05	2.E-06	2.E-05	2.E-06	4.E-04	4.E-05	4.E-04	4.E-05	8.E-06	8.E-07	8.E-06	8.E-07	7.E-03	7.E-04	7.E-03	7.E-04
Barium	7.E-04	3.E-04	7.E-04	3.E-04	2.E-02	1.E-02	2.E-02	1.E-02	3.E-06	1.E-06	3.E-06	1.E-06	3.E-03	1.E-03	3.E-03	1.E-03
Beryllium	9.E-03	9.E-04	9.E-03	9.E-04	4.E-01	4.E-02	4.E-01	4.E-02	2.E-07	2.E-07	2.E-07	2.E-07	1.E-04	1.E-04	1.E-04	1.E-04
Chromium	4.E-02	1.E-02	4.E-02	1.E-02	1.E+00	3.E-01	1.E+00	4.E-01	5.E-05	3.E-06	1.E-04	6.E-06	5.E-02	3.E-03	8.E-02	5.E-03
Chromium, Hexavalent	4.E-04	4.E-05	4.E-04	4.E-05	1.E-02	1.E-03	1.E-02	1.E-03	3.E-08	3.E-08	3.E-08	3.E-08	3.E-05	3.E-05	3.E-05	3.E-05
Lead	2.E-02	1.E-02	2.E-02	1.E-02	6.E-01	3.E-01	6.E-01	3.E-01	4.E-05	1.E-06	4.E-05	1.E-06	4.E-02	1.E-03	5.E-02	1.E-03
Manganese	1.E-04	1.E-05	1.E-04	1.E-05	6.E-03	6.E-04	7.E-03	7.E-04	1.E-05	5.E-06	2.E-05	5.E-06	1.E-02	4.E-03	2.E-02	5.E-03
Silver	1.E-08	1.E-09	1.E-08	1.E-09	3.E-07	3.E-08	3.E-07	3.E-08	3.E-11	1.E-11	3.E-11	1.E-11	3.E-08	1.E-08	3.E-08	1.E-08
Tin	4.E-05	2.E-05	4.E-05	2.E-05	3.E-03	1.E-03	3.E-03	1.E-03	1.E-07	8.E-08	1.E-07	8.E-08	7.E-05	5.E-05	7.E-05	5.E-05
Vanadium	5.E-03	5.E-04	5.E-03	5.E-04	2.E-01	2.E-02	2.E-01	2.E-02	9.E-05	9.E-06	9.E-05	9.E-06	4.E-02	4.E-03	4.E-02	4.E-03
Inorganics																
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013
Revised: SFR 2/25/2014

Table 4.5-8
Summary of Food Chain Model Hazard Quotients - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	2.E-07	2.E-08	2.E-07	2.E-08	2.E-04	2.E-05	3.E-04	3.E-05
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	1.E-07	1.E-08	1.E-04	1.E-05	2.E-04	2.E-05
Acetone	3.E-09	3.E-10	3.E-09	3.E-10	2.E-07	2.E-08	2.E-07	2.E-08	8.E-09	2.E-09	9.E-09	2.E-09	3.E-06	5.E-07	3.E-06	6.E-07
Semivolatile Organics																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	3.E-08	3.E-09	5.E-08	5.E-09	1.E-05	1.E-06	2.E-05	2.E-06
Acetophenone	NC	NC	NC	NC	NC	NC	NC	NC	2.E-10	2.E-11	2.E-10	2.E-11	8.E-08	8.E-09	8.E-08	8.E-09
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	3.E-08	1.E-08	4.E-08	2.E-08	9.E-06	4.E-06	1.E-05	6.E-06
N-Nitrosodiphenylamine	NC	NC	NC	NC	NC	NC	NC	NC	3.E-11	3.E-12	3.E-11	3.E-12	3.E-08	3.E-09	3.E-08	3.E-09
Phenol	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	4.E-08	6.E-08	4.E-08	2.E-05	1.E-05	2.E-05	1.E-05
Polyaromatic Hydrocarbons																
Benzo(a)pyrene	2.E-03	2.E-04	2.E-03	2.E-04	1.E-01	1.E-02	1.E-01	1.E-02	3.E-06	3.E-07	3.E-06	3.E-07	3.E-03	3.E-04	3.E-03	3.E-04
Metals																
Aluminum	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Arsenic	9.E-03	3.E-03	1.E-02	4.E-03	2.E-01	9.E-02	3.E-01	1.E-01	4.E-04	4.E-05	5.E-04	5.E-05	5.E-01	5.E-02	6.E-01	6.E-02
Barium	9.E-04	4.E-04	9.E-04	5.E-04	3.E-02	2.E-02	3.E-02	2.E-02	4.E-06	2.E-06	4.E-06	2.E-06	4.E-03	2.E-03	4.E-03	2.E-03
Beryllium	1.E-02	1.E-03	1.E-02	1.E-03	5.E-01	5.E-02	6.E-01	6.E-02	3.E-07	3.E-07	3.E-07	3.E-07	2.E-04	2.E-04	2.E-04	2.E-04
Chromium	3.E-01	8.E-02	5.E-02	1.E-02	1.E+00	3.E-01	1.E+00	3.E-01	2.E-04	1.E-05	6.E-05	4.E-06	3.E-01	2.E-02	6.E-02	4.E-03
Vanadium	8.E-03	8.E-04	9.E-03	9.E-04	3.E-01	3.E-02	4.E-01	4.E-02	1.E-04	1.E-05	1.E-04	1.E-05	6.E-02	6.E-03	7.E-02	7.E-03
Inorganics																
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure

COPEC - Chemical of Potential Ecological Concern

HQ - Hazard Quotient

LOAEL - Lowest Observed Adverse Effects Level

NC- Not calculated

NOAEL - No Observed Adverse Effects Level

RME - Reasonable Maximum Exposure

Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
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Revised: SFR 2/25/2014

Table 4.5-9
Summary of Food Chain Model Hazard Quotients - Off-PWD
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	4.E-07	4.E-08	1.E-06	1.E-07	5.E-04	5.E-05	1.E-03	1.E-04
2,4,4-Trimethyl-2-pentene	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	2.E-07	2.E-08	2.E-04	2.E-05	2.E-04	2.E-05
Carbon disulfide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	4.E-06	4.E-07	5.E-06	5.E-07	1.E-03	1.E-04	1.E-03	1.E-04
Semivolatile Organics																
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	4.E-10	4.E-11	4.E-10	4.E-11	4.E-07	4.E-08	4.E-07	4.E-08
4-Chlorophenyl phenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	3.E-10	3.E-11	4.E-10	4.E-11	4.E-07	4.E-08	6.E-07	6.E-08
Benzo(a)anthracene	3.E-09	3.E-10	1.E-08	1.E-09	8.E-08	8.E-09	3.E-07	3.E-08	2.E-08	2.E-09	1.E-07	1.E-08	2.E-05	2.E-06	1.E-04	1.E-05
Benzo(a)pyrene	7.E-09	7.E-10	2.E-08	2.E-09	1.E-07	1.E-08	4.E-07	4.E-08	5.E-08	5.E-09	1.E-07	1.E-08	4.E-05	4.E-06	1.E-04	1.E-05
Benzo(b)fluoranthene	1.E-08	1.E-09	3.E-08	3.E-09	3.E-07	3.E-08	7.E-07	7.E-08	8.E-08	8.E-09	2.E-07	2.E-08	8.E-05	8.E-06	2.E-04	2.E-05
Benzo(ghi)perylene	7.E-09	7.E-10	2.E-08	2.E-09	2.E-07	2.E-08	4.E-07	4.E-08	5.E-08	5.E-09	1.E-07	1.E-08	5.E-05	5.E-06	1.E-04	1.E-05
Benzo(k)fluoranthene	4.E-09	4.E-10	2.E-08	2.E-09	1.E-07	1.E-08	4.E-07	4.E-08	3.E-08	3.E-09	1.E-07	1.E-08	3.E-05	3.E-06	1.E-04	1.E-05
Carbazole	NC	NC	NC	NC	NC	NC	NC	NC	1.E-07	1.E-08	1.E-07	1.E-08	1.E-04	1.E-05	2.E-04	2.E-05
Chrysene	9.E-09	9.E-10	2.E-08	2.E-09	2.E-07	2.E-08	5.E-07	5.E-08	6.E-08	6.E-09	1.E-07	1.E-08	6.E-05	6.E-06	1.E-04	1.E-05
Dibenz(a,h)anthracene	3.E-09	3.E-10	9.E-09	9.E-10	6.E-08	6.E-09	2.E-07	2.E-08	2.E-08	2.E-09	6.E-08	6.E-09	2.E-05	2.E-06	6.E-05	6.E-06
Diphenyl ether	NC	NC	NC	NC	NC	NC	NC	NC	9.E-07	9.E-08	2.E-06	2.E-07	1.E-03	1.E-04	3.E-03	3.E-04
Diphenylmethanone	NC	NC	NC	NC	NC	NC	NC	NC	5.E-08	5.E-09	1.E-07	1.E-08	6.E-05	6.E-06	1.E-04	1.E-05
Indeno(1,2,3-cd)pyrene	7.E-09	7.E-10	3.E-08	3.E-09	1.E-07	1.E-08	7.E-07	7.E-08	5.E-08	5.E-09	2.E-07	2.E-08	4.E-05	4.E-06	2.E-04	2.E-05
Phenanthrene	4.E-09	4.E-10	1.E-08	1.E-09	9.E-08	9.E-09	2.E-07	2.E-08	4.E-08	4.E-09	1.E-07	1.E-08	4.E-05	4.E-06	9.E-05	9.E-06
Pyrene	2.E-08	2.E-09	5.E-08	5.E-09	5.E-07	5.E-08	1.E-06	1.E-07	1.E-08	6.E-09	2.E-08	1.E-08	1.E-05	6.E-06	2.E-05	1.E-05
Metals																
Aluminum	5.E-05	5.E-06	8.E-05	8.E-06	1.E-03	1.E-04	2.E-03	2.E-04	2.E-05	2.E-06	3.E-05	3.E-06	2.E-02	2.E-03	3.E-02	3.E-03
Arsenic	5.E-03	2.E-03	7.E-03	3.E-03	1.E-01	5.E-02	2.E-01	8.E-02	3.E-04	3.E-05	4.E-04	4.E-05	3.E-01	3.E-02	4.E-01	4.E-02
Barium	1.E-04	7.E-05	2.E-04	9.E-05	5.E-03	2.E-03	6.E-03	3.E-03	5.E-07	2.E-07	7.E-07	3.E-07	5.E-04	2.E-04	7.E-04	3.E-04
Beryllium	9.E-02	9.E-03	1.E-01	1.E-02	**4.E+00**	4.E-01	**4.E+00**	4.E-01	2.E-06	2.E-06	2.E-06	2.E-06	1.E-03	1.E-03	1.E-03	1.E-03
Chromium	8.E-02	2.E-02	1.E-01	3.E-02	**4.E+00**	**1.E+00**	**7.E+00**	**2.E+00**	4.E-03	3.E-04	8.E-03	5.E-04	4.E-01	3.E-03	7.E-01	4.E-02
Copper	4.E-02	2.E-02	7.E-02	3.E-02	**1.E+00**	6.E-01	**2.E+00**	9.E-01	3.E-05	3.E-06	5.E-05	5.E-06	4.E-02	4.E-03	7.E-02	7.E-03
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	4.E-06	2.E-06	6.E-06	4.E-06	9.E-05	5.E-05	1.E-04	8.E-05	3.E-08	9.E-10	5.E-08	1.E-09	3.E-05	9.E-07	5.E-05	1.E-06
Manganese	6.E-06	6.E-07	9.E-06	9.E-07	1.E-04	1.E-05	2.E-04	2.E-05	5.E-07	2.E-07	8.E-07	2.E-07	5.E-04	2.E-04	7.E-04	2.E-04
Silver	2.E-02	2.E-03	3.E-02	3.E-03	4.E-01	4.E-02	7.E-01	7.E-02	3.E-06	2.E-06	6.E-06	3.E-06	4.E-03	2.E-03	7.E-03	4.E-03
Vanadium	3.E-03	3.E-04	4.E-03	4.E-04	1.E-01	1.E-02	2.E-01	2.E-02	5.E-05	5.E-06	6.E-05	6.E-06	2.E-02	2.E-03	3.E-02	3.E-03
Zinc	2.E-05	2.E-06	4.E-05	5.E-06	4.E-04	4.E-05	1.E-03	1.E-04	3.E-08	8.E-09	7.E-08	2.E-08	3.E-05	7.E-06	6.E-05	2.E-05
Inorganics																
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrite as N	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Specialty Compounds																
Hydrazine	NC	NC	NC	NC	NC	NC	NC	NC	4.E-10	2.E-10	4.E-10	2.E-10	1.E-07	6.E-08	1.E-07	6.E-08

Notes:

CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013
Revised: SFR 2/25/2014

Table 4.5-10
Summary of Food Chain Model Hazard Quotients - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC	Green Heron											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Acetone	1.E-07	1.E-08	4.E-07	4.E-08	-2.E-07	-2.E-08	2.E-07	2.E-08	4.E-07	4.E-08	-2.E-07	-2.E-08
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
4-Nitrophenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	1.E-08	1.E-09	8.E-06	8.E-07	-8.E-06	-8.E-07	1.E-08	1.E-09	8.E-06	8.E-07	-8.E-06	-8.E-07
Benzoic Acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzyl alcohol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Caprolactam	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Carbazole	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Metals												
Aluminum	5.E-01	5.E-02	2.E-01	2.E-02	3.E-01	3.E-02	6.E-01	6.E-02	2.E-01	2.E-02	4.E-01	4.E-02
Arsenic	1.E-01	5.E-02	5.E-02	2.E-02	8.E-02	3.E-02	2.E-01	8.E-02	5.E-02	2.E-02	1.E-01	6.E-02
Barium	2.E-02	8.E-03	1.E-02	7.E-03	3.E-03	1.E-03	2.E-02	1.E-02	1.E-02	7.E-03	8.E-03	4.E-03
Beryllium	1.E+00	1.E-01	8.E-01	8.E-02	3.E-01	3.E-02	**2.E+00**	2.E-01	8.E-01	8.E-02	8.E-01	8.E-02
Cadmium	2.E-01	5.E-02	8.E-02	2.E-02	1.E-01	3.E-02	3.E-01	7.E-02	8.E-02	2.E-02	2.E-01	5.E-02
Copper	1.E+00	5.E-01	4.E-01	2.E-01	6.E-01	3.E-01	1.E+00	7.E-01	4.E-01	2.E-01	1.E+00	5.E-01
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	6.E-01	3.E-01	2.E-01	1.E-01	4.E-01	2.E-01	9.E-01	5.E-01	2.E-01	1.E-01	7.E-01	4.E-01
Manganese	2.E-03	2.E-04	1.E-03	1.E-04	6.E-04	6.E-05	3.E-03	3.E-04	1.E-03	1.E-04	2.E-03	2.E-04
Mercury	5.E-01	2.E-01	NC	NC	NC	NC	7.E-01	4.E-01	NC	NC	NC	NC
Nickel	6.E-02	4.E-02	2.E-02	1.E-02	4.E-02	3.E-02	8.E-02	5.E-02	2.E-02	1.E-02	6.E-02	4.E-02
Thallium	3.E-01	3.E-02	NC	NC	NC	NC	3.E-01	3.E-02	NC	NC	NC	NC
Tin	2.E-03	8.E-04	2.E-03	6.E-04	3.E-04	1.E-04	2.E-03	9.E-04	2.E-03	6.E-04	6.E-04	3.E-04
Vanadium	1.E-01	1.E-02	4.E-02	4.E-03	7.E-02	7.E-03	1.E-01	1.E-02	4.E-02	4.E-03	1.E-01	1.E-02
Zinc	1.E-01	1.E-02	4.E-02	5.E-03	8.E-02	9.E-03	2.E-01	2.E-02	4.E-02	5.E-03	1.E-01	1.E-02
Inorganics												
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
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Table 4.5-10
Summary of Food Chain Model Hazard Quotients - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC	Marsh Wren											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Acetone	1.E-06	1.E-07	3.E-06	3.E-07	-2.E-06	-2.E-07	1.E-06	1.E-07	3.E-06	3.E-07	-2.E-06	-2.E-07
Formaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics												
3 & 4 Methylphenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
4-Nitrophenol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzo(a)pyrene	3.E-08	3.E-09	3.E-05	3.E-06	-3.E-05	-3.E-06	4.E-08	4.E-09	3.E-05	3.E-06	-3.E-05	-3.E-06
Benzoic Acid	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzyl alcohol	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Caprolactam	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Carbazole	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
N-Nitrosodi-n-propylamine	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Metals												
Aluminum	**2.E+00**	2.E-01	1.E+00	1.E-01	1.E+00	1.E-01	**3.E+00**	3.E-01	1.E+00	1.E-01	**2.E+00**	2.E-01
Arsenic	4.E-01	2.E-01	2.E-01	6.E-02	3.E-01	1.E-01	6.E-01	3.E-01	2.E-01	6.E-02	5.E-01	2.E-01
Barium	7.E-02	3.E-02	6.E-02	3.E-02	1.E-02	6.E-03	9.E-02	4.E-02	6.E-02	3.E-02	3.E-02	2.E-02
Beryllium	**5.E+00**	5.E-01	**4.E+00**	4.E-01	**2.E+00**	2.E-01	**8.E+00**	8.E-01	**4.E+00**	4.E-01	**4.E+00**	4.E-01
Cadmium	6.E-01	2.E-01	2.E-01	7.E-02	3.E-01	9.E-02	8.E-01	2.E-01	2.E-01	7.E-02	6.E-01	2.E-01
Copper	**3.E+00**	**2.E+00**	1.E+00	6.E-01	**2.E+00**	9.E-01	**4.E+00**	**2.E+00**	1.E+00	6.E-01	**3.E+00**	1.E+00
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	**2.E+00**	1.E+00	7.E-01	4.E-01	1.E+00	8.E-01	**3.E+00**	**2.E+00**	7.E-01	4.E-01	**2.E+00**	1.E+00
Manganese	1.E-02	1.E-03	8.E-03	8.E-04	4.E-03	4.E-04	2.E-02	2.E-03	8.E-03	8.E-04	1.E-02	1.E-03
Mercury	1.E+00	7.E-01	NC	NC	NC	NC	**2.E+00**	1.E+00	NC	NC	NC	NC
Nickel	2.E-01	1.E-01	6.E-02	4.E-02	1.E-01	8.E-02	2.E-01	2.E-01	6.E-02	4.E-02	2.E-01	1.E-01
Thallium	3.E-02	3.E-03	NC	NC	NC	NC	3.E-02	3.E-03	NC	NC	NC	NC
Tin	2.E-02	6.E-03	1.E-02	5.E-03	2.E-03	1.E-03	2.E-02	7.E-03	1.E-02	5.E-03	5.E-03	2.E-03
Vanadium	6.E-01	6.E-02	2.E-01	2.E-02	4.E-01	4.E-02	7.E-01	7.E-02	2.E-01	2.E-02	5.E-01	5.E-02
Zinc	5.E-01	6.E-02	2.E-01	2.E-02	3.E-01	4.E-02	7.E-01	8.E-02	2.E-01	2.E-02	5.E-01	6.E-02
Inorganics												
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
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Table 4.5-10
Summary of Food Chain Model Hazard Quotients - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC	Raccoon											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics												
Acetaldehyde	5.E-06	5.E-07	NC	NC	NC	NC	9.E-07	9.E-08	NC	NC	NC	NC
Acetone	1.E-05	3.E-06	4.E-05	7.E-06	-2.E-05	-4.E-06	2.E-06	4.E-07	4.E-05	7.E-06	-3.E-05	-7.E-06
Formaldehyde	8.E-03	8.E-04	NC	NC	NC	NC	2.E-03	2.E-04	NC	NC	NC	NC
Semivolatile Organics												
3 & 4 Methylphenol	4.E-07	4.E-08	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
4-Nitrophenol	3.E-05	3.E-06	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Benzaldehyde	1.E-06	5.E-07	3.E-06	1.E-06	-2.E-06	-9.E-07	1.E-06	5.E-07	3.E-06	1.E-06	-2.E-06	-9.E-07
Benzo(a)pyrene	2.E-06	2.E-07	3.E-04	3.E-05	-3.E-04	-3.E-05	4.E-06	4.E-07	3.E-04	3.E-05	-3.E-04	-3.E-05
Benzoic Acid	4.E-06	3.E-07	5.E-06	3.E-07	-7.E-07	-5.E-08	NC	NC	5.E-06	3.E-07	NC	NC
Benzyl alcohol	5.E-07	5.E-08	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Caprolactam	5.E-08	5.E-09	4.E-08	4.E-09	7.E-09	7.E-10	NC	NC	2.E-08	2.E-09	NC	NC
Carbazole	1.E-04	1.E-05	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
N-Nitrosodi-n-propylamine	3.E-07	3.E-08	NC	NC	NC	NC	2.E-06	2.E-07	NC	NC	NC	NC
Metals												
Aluminum	**3.E+00**	3.E-01	1.E+00	1.E-01	**2.E+00**	2.E-01	2.E-01	2.E-02	1.E+00	1.E-01	-9.E-01	-9.E-02
Arsenic	2.E-01	2.E-02	8.E-02	8.E-03	1.E-01	1.E-02	NC	NC	8.E-02	8.E-03	NC	NC
Barium	2.E-03	9.E-04	2.E-03	8.E-04	4.E-04	2.E-04	4.E-04	2.E-04	2.E-03	8.E-04	-1.E-03	-6.E-04
Beryllium	8.E-04	8.E-04	6.E-04	6.E-04	2.E-04	2.E-04	1.E-03	1.E-03	6.E-04	6.E-04	7.E-04	7.E-04
Cadmium	4.E-03	1.E-03	2.E-03	5.E-04	2.E-03	6.E-04	2.E-03	5.E-04	2.E-03	5.E-04	3.E-04	7.E-05
Copper	2.E-02	2.E-03	9.E-03	9.E-04	1.E-02	1.E-03	3.E-05	3.E-06	9.E-03	9.E-04	-9.E-03	-9.E-04
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	4.E-02	1.E-03	1.E-02	4.E-04	3.E-02	8.E-04	5.E-06	2.E-07	1.E-02	4.E-04	-1.E-02	-4.E-04
Manganese	8.E-03	3.E-03	5.E-03	2.E-03	3.E-03	9.E-04	5.E-04	2.E-04	5.E-03	2.E-03	-5.E-03	-1.E-03
Mercury	4.E-03	4.E-04	NC	NC	NC	NC	4.E-03	4.E-04	NC	NC	NC	NC
Nickel	2.E-03	1.E-03	8.E-04	4.E-04	2.E-03	8.E-04	3.E-03	1.E-03	8.E-04	4.E-04	2.E-03	9.E-04
Thallium	9.E-02	9.E-03	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tin	2.E-04	1.E-04	1.E-04	1.E-04	3.E-05	2.E-05	3.E-05	2.E-05	1.E-04	1.E-04	-1.E-04	-8.E-05
Vanadium	6.E-02	6.E-03	2.E-02	2.E-03	4.E-02	4.E-03	2.E-02	2.E-03	2.E-02	2.E-03	2.E-05	2.E-06
Zinc	4.E-03	1.E-03	1.E-03	4.E-04	3.E-03	8.E-04	NC	NC	1.E-03	4.E-04	NC	NC
Inorganics												
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Table 4.5-10
Summary of Food Chain Model Hazard Quotients - MMB Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Muskrat											
	CTE						RME					
	Exposure Area		Background		Incremental Risk		Exposure Area		Background		Incremental Risk	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
COPEC	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ	HQ
Volatile Organics												
Acetaldehyde	7.E-06	7.E-07	NC	NC	NC	NC	6.E-06	6.E-07	NC	NC	NC	NC
Acetone	2.E-05	3.E-06	5.E-05	9.E-06	-3.E-05	-6.E-06	2.E-05	4.E-06	5.E-05	9.E-06	-2.E-05	-5.E-06
Formaldehyde	1.E-02	1.E-03	NC	NC	NC	NC	1.E-02	1.E-03	NC	NC	NC	NC
Semivolatile Organics												
3 & 4 Methylphenol	6.E-07	6.E-08	NC	NC	NC	NC	1.E-06	1.E-07	NC	NC	NC	NC
4-Nitrophenol	3.E-05	3.E-06	NC	NC	NC	NC	3.E-05	3.E-06	NC	NC	NC	NC
Benzaldehyde	1.E-06	6.E-07	4.E-06	2.E-06	-2.E-06	-1.E-06	2.E-06	1.E-06	4.E-06	2.E-06	-1.E-06	-7.E-07
Benzo(a)pyrene	9.E-06	9.E-07	2.E-03	2.E-04	-2.E-03	-2.E-04	1.E-05	1.E-06	2.E-03	2.E-04	-2.E-03	-2.E-04
Benzoic Acid	5.E-06	4.E-07	9.E-06	6.E-07	-4.E-06	-2.E-07	7.E-06	5.E-07	9.E-06	6.E-07	-2.E-06	-1.E-07
Benzyl alcohol	6.E-07	6.E-08	NC	NC	NC	NC	1.E-06	1.E-07	NC	NC	NC	NC
Caprolactam	1.E-07	1.E-08	2.E-07	2.E-08	-5.E-08	-5.E-09	1.E-07	1.E-08	7.E-08	7.E-09	6.E-08	6.E-09
Carbazole	5.E-04	5.E-05	NC	NC	NC	NC	6.E-04	6.E-05	NC	NC	NC	NC
N-Nitrosodi-n-propylamine	1.E-06	1.E-07	NC	NC	NC	NC	1.E-06	1.E-07	NC	NC	NC	NC
Metals												
Aluminum	**5.E+00**	5.E-01	**2.E+00**	2.E-01	**3.E+00**	3.E-01	**7.E+00**	7.E-01	**2.E+00**	2.E-01	**5.E+00**	5.E-01
Arsenic	1.E+00	1.E-01	4.E-01	4.E-02	6.E-01	6.E-02	1.E+00	1.E-01	4.E-01	4.E-02	1.E+00	1.E-01
Barium	9.E-03	4.E-03	7.E-03	3.E-03	2.E-03	7.E-04	1.E-02	5.E-03	7.E-03	3.E-03	4.E-03	2.E-03
Beryllium	2.E-03	2.E-03	1.E-03	1.E-03	5.E-04	5.E-04	2.E-03	2.E-03	1.E-03	1.E-03	1.E-03	1.E-03
Cadmium	2.E-02	6.E-03	9.E-03	2.E-03	1.E-02	3.E-03	3.E-02	8.E-03	9.E-03	2.E-03	2.E-02	5.E-03
Copper	1.E-01	1.E-02	5.E-02	5.E-03	8.E-02	8.E-03	2.E-01	2.E-02	5.E-02	5.E-03	1.E-01	1.E-02
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	6.E-03	6.E-02	2.E-03	1.E-01	4.E-03	3.E-01	8.E-03	6.E-02	2.E-03	2.E-01	6.E-03
Manganese	3.E-02	1.E-02	2.E-02	6.E-03	1.E-02	4.E-03	5.E-02	2.E-02	2.E-02	6.E-03	3.E-02	1.E-02
Mercury	2.E-02	2.E-03	NC	NC	NC	NC	3.E-02	3.E-03	NC	NC	NC	NC
Nickel	1.E-02	7.E-03	4.E-03	2.E-03	9.E-03	4.E-03	2.E-02	9.E-03	4.E-03	2.E-03	1.E-02	7.E-03
Thallium	4.E-01	4.E-02	NC	NC	NC	NC	4.E-01	4.E-02	NC	NC	NC	NC
Tin	4.E-04	3.E-04	4.E-04	2.E-04	6.E-05	4.E-05	5.E-04	3.E-04	4.E-04	2.E-04	1.E-04	9.E-05
Vanadium	1.E-01	1.E-02	4.E-02	4.E-03	8.E-02	8.E-03	2.E-01	2.E-02	4.E-02	4.E-03	1.E-01	1.E-02
Zinc	2.E-02	5.E-03	7.E-03	2.E-03	1.E-02	4.E-03	3.E-02	8.E-03	7.E-03	2.E-03	2.E-02	6.E-03
Inorganics												
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013
Revised: SFR 2/25/2014

Table 4.5-11
Summary of Food Chain Model Hazard Quotients - North Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Green Heron				Marsh Wren				Raccoon				Muskrat			
	CTE		RME		CTE		RME		CTE		RME		CTE		RME	
	Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area		Exposure Area	
COPEC	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Volatile Organics																
2,4,4-Trimethyl-1-pentene	NC	NC	NC	NC	NC	NC	NC	NC	4.E-07	4.E-08	4.E-07	4.E-08	9.E-05	9.E-06	9.E-05	9.E-06
Acetone	3.E-08	3.E-09	5.E-08	5.E-09	3.E-07	3.E-08	5.E-07	5.E-08	9.E-08	2.E-08	1.E-07	3.E-08	5.E-06	1.E-06	8.E-06	2.E-06
Carbon disulfide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Semivolatile Organics																
Benzo(a)anthracene	1.E-08	1.E-09	1.E-08	1.E-09	3.E-08	3.E-09	3.E-08	3.E-09	7.E-08	7.E-09	7.E-08	7.E-09	1.E-05	1.E-06	1.E-05	1.E-06
Benzo(a)pyrene	1.E-08	1.E-09	1.E-08	1.E-09	4.E-08	4.E-09	5.E-08	5.E-09	8.E-08	8.E-09	1.E-07	1.E-08	1.E-05	1.E-06	2.E-05	2.E-06
Carbazole	NC	NC	NC	NC	NC	NC	NC	NC	4.E-06	4.E-07	4.E-06	4.E-07	9.E-04	9.E-05	9.E-04	9.E-05
Caprolactam	NC	NC	NC	NC	NC	NC	NC	NC	3.E-10	3.E-11	3.E-10	3.E-11	4.E-08	4.E-09	4.E-08	4.E-09
Pyrene	3.E-08	3.E-09	3.E-08	3.E-09	1.E-07	1.E-08	1.E-07	1.E-08	2.E-08	1.E-08	2.E-08	1.E-08	3.E-06	2.E-06	3.E-06	2.E-06
Metals																
Aluminum	1.E-04	1.E-05	2.E-04	2.E-05	4.E-04	4.E-05	5.E-04	5.E-05	5.E-05	5.E-06	7.E-05	7.E-06	8.E-03	8.E-04	1.E-02	1.E-03
Arsenic	5.E-02	2.E-02	8.E-02	3.E-02	2.E-01	8.E-02	3.E-01	1.E-01	2.E-03	2.E-04	4.E-03	4.E-04	5.E-01	5.E-02	7.E-01	7.E-02
Barium	5.E-03	3.E-03	8.E-03	4.E-03	3.E-02	1.E-02	4.E-02	2.E-02	2.E-05	9.E-06	3.E-05	1.E-05	4.E-03	2.E-03	5.E-03	2.E-03
Beryllium	4.E-01	4.E-02	5.E-01	5.E-02	**3.E+00**	3.E-01	**3.E+00**	3.E-01	1.E-05	1.E-05	1.E-05	1.E-05	8.E-04	8.E-04	9.E-04	9.E-04
Cadmium	1.E-01	3.E-02	2.E-01	4.E-02	4.E-01	1.E-01	6.E-01	2.E-01	7.E-05	2.E-05	1.E-04	3.E-05	1.E-02	4.E-03	2.E-02	6.E-03
Chromium	5.E-01	1.E-01	7.E-01	2.E-01	**3.E+00**	6.E-01	**5.E+00**	1.E+00	1.E-02	6.E-04	3.E-02	2.E-03	2.E-01	2.E-03	5.E-01	3.E-02
Chromium, Hexavalent	9.E-03	9.E-04	1.E-02	1.E-03	4.E-02	4.E-03	5.E-02	5.E-03	7.E-07	7.E-07	1.E-06	1.E-06	1.E-04	1.E-04	2.E-04	2.E-04
Copper	9.E-01	5.E-01	1.E+00	7.E-01	**4.E+00**	**2.E+00**	**5.E+00**	**3.E+00**	7.E-04	7.E-05	1.E-03	1.E-04	2.E-01	2.E-02	2.E-01	2.E-02
Iron	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Lead	2.E-01	1.E-01	4.E-01	2.E-01	1.E+00	6.E-01	**2.E+00**	9.E-01	5.E-04	2.E-05	8.E-04	2.E-05	9.E-02	3.E-03	1.E-01	4.E-03
Manganese	2.E-03	2.E-04	5.E-03	5.E-04	1.E-02	1.E-03	3.E-02	3.E-03	1.E-04	3.E-05	3.E-04	1.E-04	2.E-02	5.E-03	5.E-02	2.E-02
Silver	1.E-07	1.E-08	1.E-07	1.E-08	5.E-07	5.E-08	5.E-07	5.E-08	4.E-10	2.E-10	4.E-10	2.E-10	6.E-08	3.E-08	6.E-08	3.E-08
Thallium	1.E-01	1.E-02	2.E-01	2.E-02	2.E-02	2.E-03	2.E-02	2.E-03	1.E-03	1.E-04	1.E-03	1.E-04	2.E-01	2.E-02	3.E-01	3.E-02
Tin	1.E-03	4.E-04	2.E-03	8.E-04	1.E-02	4.E-03	2.E-02	8.E-03	3.E-06	2.E-06	6.E-06	4.E-06	3.E-04	2.E-04	5.E-04	4.E-04
Vanadium	7.E-02	7.E-03	7.E-02	7.E-03	4.E-01	4.E-02	5.E-01	5.E-02	1.E-03	1.E-04	1.E-03	1.E-04	9.E-02	9.E-03	1.E-01	1.E-02
Zinc	1.E-01	2.E-02	2.E-01	2.E-02	7.E-01	8.E-02	9.E-01	1.E-01	1.E-04	4.E-05	2.E-04	5.E-05	3.E-02	8.E-03	3.E-02	1.E-02
Inorganics																
Bromide	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Chloride	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Nitrogen, as Ammonia	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Sulfate	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:

CTE - Central Tendency Exposure
COPEC - Chemical of Potential Ecological Concern
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
NC- Not calculated
NOAEL - No Observed Adverse Effects Level
RME - Reasonable Maximum Exposure
Shaded and Bolded values indicate HQs > 1

Prepared by: EYM 7/16/2013
Checked by: SFR 7/18/2013

Table 4.7-1
Detected Chemicals Not Quantatively Evaluated in the BERA
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Chemical Name
Surface Soil (0-1 ft bgs)
Nitrogen, as Ammonia
C11-C22 Aromatics
C19-C36 Aliphatics
C9-C18 Aliphatics
Surface Water
Azobenzene
Bromide
Nitrite as N
Sediment
4-iso-Propyltoluene
Methyl Tertbutyl Ether
sec-Butylbenzene
Acetaldehyde

Created by: TR 7/15/2014
Checked by: KL 7/15/2015

ATTACHMENT 1

DATA USED IN THE BERA

(Provided on CD ROM)

Attachment 1-1
Surface Soil Data Summary - Background
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-434-0.0/1.0-XXX SS-434 9/16/2009 0-1 ft	OC-SS-435-0.0/1.0-XXX SS-435 9/16/2009 0-1 ft	OC-SS-449-0.0/1.0-XXX SS-449 9/16/2009 0-1 ft	OC-SS-450-0.0/1.0-XXX SS-450 9/16/2009 0-1 ft	OC-SS-451-0.0/1.0-XXX SS-451 9/16/2009 0-1 ft	OC-SS-453-0.0/1.0-XXX SS-453 9/17/2009 0-1 ft	OC-SS-454-0.0/1.0-XXX SS-454 9/17/2009 0-1 ft	OC-SS-455-0.0/1.0-XXX SS-455 9/16/2009 0-1 ft	OC-SS-460-0.0/1.0-XXX SS-460 9/16/2009 0-1 ft
Volatile Organic Compounds (mg/kg)									
1,1,1,2-Tetrachloroethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,1,1-Trichloroethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,1,2,2-Tetrachloroethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.015 U	0.97 UJ	0.018 U	0.019 U	0.015 U	0.019 U	0.014 U	0.015 U	0.016 U
1,1,2-Trichloroethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,1-Dichloroethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,1-Dichloroethene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,1-Dichloropropene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2,3-Trichlorobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2,3-Trichloropropane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2,4-Trichlorobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2,4-Trimethylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2-Dibromo-3-chloropropane	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
1,2-Dibromoethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2-Dichlorobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2-Dichloroethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,2-Dichloropropane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,3,5-Trimethylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,3-Dichlorobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,3-Dichloropropane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,4-Dichlorobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
1,4-Dioxane	0.31 UJ	19 UJ	0.35 UJ	0.37 UJ	0.31 UJ	0.38 UJ	0.29 UJ	0.3 UJ	0.32 UJ
2,2-Dichloropropane	0.0031 U	0.19 UJ	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
2,4,4-Trimethyl-1-pentene	0.0061 U	0.39 UJ	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
2,4,4-Trimethyl-2-pentene	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
2-Butanone	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
2-Chlorotoluene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
2-Hexanone	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
4-Chlorotoluene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
4-iso-Propyltoluene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
4-Methyl-2-pentanone	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
Acetaldehyde	0.24 UJ			0.3 U		0.28 U		0.23 U	0.23 U
Acetic acid, methyl ester	0.061 U	3.9 UJ	0.071 U	0.074 U	0.062 U	0.076 U	0.057 U	0.061 U	0.064 U
Acetone	0.31 UJ	19 UJ	0.35 UJ	0.034 J	0.31 UJ	0.38 UJ	0.29 UJ	0.035 J	0.034 J
Benzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Bromobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Bromochloromethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Bromodichloromethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Bromoform	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Bromomethane	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
Butane, 2-methoxy-2-methyl-	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Carbon disulfide	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Carbon tetrachloride	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Chlorobenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Chlorodibromomethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Chloroethane	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
Chloroform	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Chloromethane	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
Cis-1,2-Dichloroethene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
cis-1,3-Dichloropropene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Cyclohexane	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
Dibromomethane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Dichlorodifluoromethane	0.0061 UJ	0.39 UJ	0.0071 UJ	0.0074 UJ	0.0062 UJ	0.0076 UJ	0.0057 UJ	0.0061 UJ	0.0064 UJ
Diethyl ether	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 UJ	0.0029 U	0.003 UJ	0.0032 U

Attachment 1-1
Surface Soil Data Summary - Background
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-434-0.0/1.0-XXX SS-434 9/16/2009 0-1 ft	OC-SS-435-0.0/1.0-XXX SS-435 9/16/2009 0-1 ft	OC-SS-449-0.0/1.0-XXX SS-449 9/16/2009 0-1 ft	OC-SS-450-0.0/1.0-XXX SS-450 9/16/2009 0-1 ft	OC-SS-451-0.0/1.0-XXX SS-451 9/16/2009 0-1 ft	OC-SS-453-0.0/1.0-XXX SS-453 9/17/2009 0-1 ft	OC-SS-454-0.0/1.0-XXX SS-454 9/17/2009 0-1 ft	OC-SS-455-0.0/1.0-XXX SS-455 9/16/2009 0-1 ft	OC-SS-460-0.0/1.0-XXX SS-460 9/16/2009 0-1 ft
Ethyl benzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Ethyl-t-Butyl Ether	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Formaldehyde	0.11 J			0.35		0.31		0.22	0.22
Hexachlorobutadiene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Isopropyl ether	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Isopropylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Methyl cyclohexane	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Methyl Tertbutyl Ether	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 UJ	0.0029 U	0.003 UJ	0.0032 U
Methylene chloride	0.012 U	0.78 U	0.014 U	0.015 U	0.012 U	0.015 U	0.011 U	0.012 U	0.013 U
Naphthalene	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
n-Butylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Propylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
sec-Butylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Styrene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
tert-Butylbenzene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Tetrachloroethene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Tetrahydrofuran	0.031 U	1.9 U	0.035 U	0.037 U	0.031 U	0.038 U	0.029 U	0.03 U	0.032 U
Toluene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
trans-1,2-Dichloroethene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
trans-1,3-Dichloropropene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Trichloroethene	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Trichlorofluoromethane	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
Vinyl chloride	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Xylene, o	0.0031 U	0.19 U	0.0035 U	0.0037 U	0.0031 U	0.0038 U	0.0029 U	0.003 U	0.0032 U
Xylenes (m&p)	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
Xylenes, Total	0.0061 U	0.39 U	0.0071 U	0.0074 U	0.0062 U	0.0076 U	0.0057 U	0.0061 U	0.0064 U
Semivolatile Organic Compounds (mg/kg)									
1,2,4,5-Tetrachlorobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
1,2,4-Trichlorobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
1,2-Dichlorobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
1,3-Dichlorobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
1,4-Dichlorobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
1-Methylnaphthalene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,3,4,6-Tetrachlorophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,4,5-Trichlorophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,4,6-Trichlorophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,4-Dichlorophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,4-Dimethylphenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,4-Dinitrophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,4-Dinitrotoluene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2,6-Dinitrotoluene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2-Chloronaphthalene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2-Chlorophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2-Methylnaphthalene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2-Methylphenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
2-Nitroaniline	0.2 UJ	0.2 U	0.24 U	0.25 U	0.21 U	0.23 U	0.19 U	0.19 U	0.2 U
2-Nitrophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
3 & 4 Methylphenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
3,3'-Dichlorobenzidine	R	0.078 U	0.095 U	0.099 U	0.086 U	0.092 U	0.077 U	0.078 U	0.079 U
3-Nitroaniline	R	0.2 U	0.24 U	0.25 U	0.21 U	0.23 U	0.19 U	0.19 U	0.2 U
4,6-Dinitro-2-methylphenol	0.2 U	0.2 U	0.24 U	0.25 U	0.21 U	0.23 U	0.19 U	0.19 U	0.2 U
4-Bromophenyl phenyl ether	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
4-Chloro-3-methylphenol	0.08 U	0.078 U	0.095 U	0.099 U	0.086 U	0.092 U	0.077 U	0.078 U	0.079 U
4-Chloroaniline	R	0.078 U	0.095 U	0.099 U	0.086 U	0.092 U	0.077 U	0.078 U	0.079 U
4-Chlorophenyl phenyl ether	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U

Attachment 1-1
Surface Soil Data Summary - Background
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-434-0.0/1.0-XXX SS-434 9/16/2009 0-1 ft	OC-SS-435-0.0/1.0-XXX SS-435 9/16/2009 0-1 ft	OC-SS-449-0.0/1.0-XXX SS-449 9/16/2009 0-1 ft	OC-SS-450-0.0/1.0-XXX SS-450 9/16/2009 0-1 ft	OC-SS-451-0.0/1.0-XXX SS-451 9/16/2009 0-1 ft	OC-SS-453-0.0/1.0-XXX SS-453 9/17/2009 0-1 ft	OC-SS-454-0.0/1.0-XXX SS-454 9/17/2009 0-1 ft	OC-SS-455-0.0/1.0-XXX SS-455 9/16/2009 0-1 ft	OC-SS-460-0.0/1.0-XXX SS-460 9/16/2009 0-1 ft
4-Nitroaniline	0.2 U	0.2 U	0.24 U	0.25 U	0.21 U	0.23 U	0.19 U	0.19 U	0.2 U
4-Nitrophenol	0.2 U	0.2 U	0.24 U	0.25 U	0.21 U	0.23 U	0.19 U	0.19 U	0.2 U
Acenaphthene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Acenaphthylene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Acetophenone	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Aniline	R	0.039 UJ	0.048 UJ	0.05 UJ	0.043 UJ	0.046 UJ	0.038 UJ	0.039 UJ	0.039 UJ
Anthracene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Atrazine	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Azobenzene	0.04 UJ	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Benzaldehyde	0.051	0.036 J	0.058	0.085	0.051	0.075	0.067	0.045	0.098
Benzo(a)anthracene	0.04 U	0.039 U	0.048 U	0.017 J	0.043 U	0.017 J	0.013 J	0.039 U	0.012 J
Benzo(a)pyrene	0.04 U	0.039 U	0.048 U	0.022 J	0.015 J	0.018 J	0.018 J	0.039 U	0.014 J
Benzo(b)fluoranthene	0.04 U	0.039 U	0.048 U	0.019 J	0.018 J	0.029 J	0.019 J	0.039 U	0.02 J
Benzo(ghi)perylene	0.04 U	0.039 U	0.048 U	0.021 J	0.043 U	0.046 U	0.015 J	0.039 U	0.039 U
Benzo(k)fluoranthene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Benzoic Acid	0.2 UJ	0.2 UJ	0.24 UJ	0.25 UJ	0.21 UJ	0.24 U	0.19 UJ	0.19 UJ	0.2 UJ
Benzyl alcohol	0.08 U	0.078 U	0.095 U	0.099 U	0.086 U	0.092 U	0.077 U	0.078 U	0.079 U
Biphenyl	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Bis(2-Chloroethoxy)methane	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Bis(2-Chloroethyl)ether	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Bis(2-Chloroisopropyl)ether	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Bis(2-Ethylhexyl)phthalate	0.04 U	0.012 JEB	0.031 JEB	0.016 JEB	0.02 JEB	0.046 U	0.038 U	0.012 JEB	0.014 JEB
Butylbenzylphthalate	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Caprolactam	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Carbazole	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Chrysene	0.04 U	0.015 J	0.048 U	0.027 J	0.018 J	0.024 J	0.02 J	0.039 U	0.018 J
Dibenz(a,h)anthracene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Dibenzofuran	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Diethylphthalate	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Dimethylphthalate	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Di-n-butylphthalate	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Di-n-octylphthalate	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Diphenyl ether	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Diphenylamine	0.04 U			0.05 U		0.046 U		0.039 U	0.039 U
Diphenylmethanone	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Fluoranthene	0.04 U	0.022 J	0.019 J	0.043 J	0.029 J	0.038 J	0.023 J	0.015 J	0.025 J
Fluorene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Hexachlorobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Hexachlorobutadiene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Hexachlorocyclopentadiene	0.08 UJ	0.078 U	0.095 U	0.099 U	0.086 U	0.092 U	0.077 U	0.078 U	0.079 U
Hexachloroethane	0.04 UJ	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Indeno(1,2,3-cd)pyrene	0.04 UJ	0.015 J	0.017 J	0.03 J	0.021 J	0.03 J	0.017 J	0.017 J	0.021 J
Isophorone	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Naphthalene	0.096 U	0.094 U	0.11 U	0.12 U	0.1 U	0.11 U	0.092 U	0.093 U	0.094 U
Nitrobenzene	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
N-Nitrosodimethylamine	0.006 U	0.039 U	0.048 U	0.0076 U	0.043 U	0.0069 U	0.038 U	0.0059 U	0.0059 U
N-Nitrosodi-n-propylamine	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
N-Nitrosodiphenylamine	0.04 UJ	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Pentachlorophenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Phenanthrene	0.048 U	0.014 J	0.057 U	0.035 J	0.018 J	0.027 J	0.014 J	0.047 U	0.014 J
Phenol	0.04 U	0.039 U	0.048 U	0.05 U	0.043 U	0.046 U	0.038 U	0.039 U	0.039 U
Pyrene	0.04 U	0.02 J	0.017 J	0.049 J	0.033 J	0.043 J	0.027 J	0.016 J	0.029 J
Metals (mg/kg)									
Aluminum	13000	11000	1900	5800	1400	7100	11000	12000	3200
Antimony	0.75 UJ	0.75 UJ	0.9 UJ	0.86 UJ	0.84 UJ	0.83 UJ	0.61 UJ	0.65 UJ	0.7 UJ

Attachment 1-1
Surface Soil Data Summary - Background
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-434-0.0/1.0-XXX SS-434 9/16/2009 0-1 ft	OC-SS-435-0.0/1.0-XXX SS-435 9/16/2009 0-1 ft	OC-SS-449-0.0/1.0-XXX SS-449 9/16/2009 0-1 ft	OC-SS-450-0.0/1.0-XXX SS-450 9/16/2009 0-1 ft	OC-SS-451-0.0/1.0-XXX SS-451 9/16/2009 0-1 ft	OC-SS-453-0.0/1.0-XXX SS-453 9/17/2009 0-1 ft	OC-SS-454-0.0/1.0-XXX SS-454 9/17/2009 0-1 ft	OC-SS-455-0.0/1.0-XXX SS-455 9/16/2009 0-1 ft	OC-SS-460-0.0/1.0-XXX SS-460 9/16/2009 0-1 ft
Arsenic	4.7	6.8	1.4 J	5.8	1.6 J	4.3	9.5	10	0.64 J
Barium	12	15	3.5	13	5.5	9.2	12	8.5	13
Beryllium	0.3	0.29 J	0.087 J	0.18 J	0.042 J	0.18 J	0.32	0.28	0.19 J
Cadmium	0.22 J	0.26 J	0.053 J	0.12 J	0.037 J	0.16 J	0.22 J	0.23 J	0.057 J
Calcium	480	590	86	330	180	320	480	390	460
Chromium	8.8	9.1	1.5	6	1.7	4.7	10	9.7	4
Cobalt	2.3	2.3	0.56 J	2	0.45 J	0.91	2.9	2.1	0.51 J
Copper	3.6	5.8	3.1	4.1	1.7 J	4.1	5.3	4	5.6
Iron	10000	12000	610	5200	760	6600	10000	11000	660
Lead	9.8	14	18	26	12	20	22	11	7.8
Magnesium	520	600	33	740	48	220	1100	780	24
Manganese	32	69	3.8	25	7.5	13	60	38	3.4
Mercury	0.074 J	0.11 J	0.21 U	0.048 J	0.055 J	0.083 J	0.064 J	0.048 J	0.21 U
Nickel	5.8	5.8	1.5 J	3.9	1.3 J	2.8	7.3	5.8	1.7
Potassium	400	440	210 J	430	210 J	320 J	520	580	51 J
Selenium	0.39 J	0.6 J	0.9 U	0.86 U	0.84 U	0.83 U	0.61 U	0.65 U	0.7 U
Silver	0.75 U	0.75 U	0.9 U	0.86 U	0.84 U	0.83 U	0.61 U	0.65 U	0.7 U
Sodium	150 U	150 U	39 J	48 J	37 J	170 U	120 U	130 U	33 J
Thallium	1.5 U	1.5 U	1.8 U	1.7 U	1.7 U	1.7 U	1.2 U	1.3 U	1.4 U
Tin	3.2 J	3.2 J	0.71 J	2.2 J	0.78 J	1.6 J	3.5 J	3.4 J	1.7 J
Vanadium	15	21	5	13	3.6	11	16	19	3.8
Zinc	13	14	1.9 J	6.1	2.2 J	5.6	18	11	5
Inorganics (mg/kg)									
Chloride	23 U	24 U	25 U	20 U	26 U	25 U	19 U	23 U	22 U
Nitrogen, as Ammonia	110	140	130	200	100	160	100	95	120
Percent Moisture (%)	17.2	18	30	36.9	23	28.5	13	12.9	15.9
Percent Solids (%)	83	82	70	65	77	72	87	85	84
Sulfate	46 U	48 U	51 U	63	52 U	51 U	38 U	45 U	45 U
Total Organic Carbon	32000							29000	
Specialty Compounds (mg/kg)									
Hydrazine	0.0024 U			0.0032 U		0.0028 U		0.0023 U	0.0024 U
Monomethylhydrazine (MMH)	0.006 U			0.008 U		0.007 U		0.0058 U	0.006 U
UDMH	0.006 U			0.008 U		0.007 U		0.0058 U	0.006 U
Dimethylformamide	0.88 U			1.1 U		0.86 U		0.68 U	0.77 U
Phthalic Acid/Phthalic anhydride	0.11 UJ			0.15 U		0.14 U		0.12 U	0.11 U

Notes:
mg/kg - milligram per kilogram
mV - millivolts
U - Not detected, value is reporting limit
J - Value is estimated.
EB - Analyte detected in the associated equipment blank
R - Value is rejected

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-BD-C22 BD-C22 10/27/2000 0.6-0.6 ft	1130-OSFILL-1220-RISK OSFILL-1220 11/15/2000	1140-WDW-C34 WDW-C34 5/16/2001 -0.6 ft	AREA 03 AREA-3 7/9/1991 0-1 ft	AREA 04 AREA-4 7/9/1991 0-1 ft	OC-SB-406-0.0/1.0-XXX SB-406 9/17/2009 0-1 ft	OC-SB-413-0.0/1.0-XXX SB-413 9/17/2009 0-1 ft	OC-SB-435-0.0/1.0-XXX SB-435 9/17/2009 0-1 ft	OC-SB-453-0.0/1.0-XXX SB-453 9/17/2009 0-1 ft	OC-SB-509-0.0/1.0-XXX SB-509 12/14/2012 0-1 ft	OC-SB-518-0.0/1.0-XXX SB-518 12/14/2012 0-1 ft	OC-SB-519-0.0/1.0-XXX SB-519 12/14/2012 0-1 ft	OC-SB-521-0.0/1.0-XXX SB-521 12/14/2012 0-1 ft	OC-SB-522-0.0/1.0-XXX SB-522 12/13/2012 0-1 ft	OC-SS-400-0.0/1.0-XXX SS-400 9/14/2009 0-1 ft	OC-SS-402-0.0/1.0-XXX SS-402 9/14/2009 0-1 ft
Volatile Organic Compounds (mg/kg)																
1,1,1,2-Tetrachloroethane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,1,1-Trichloroethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,1,2,2-Tetrachloroethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,1,2-Trichloro-1,2,2-Trifluoroethane						0.029 U	0.023 U	0.099 U	0.095 U						0.024 U	0.026 U
1,1,2-Trichloroethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,1-Dichloroethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,1-Dichloroethene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,1-Dichloropropene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2,3-Trichlorobenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2,3-Trichloropropane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2,4-Trichlorobenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2,4-Trimethylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2-Dibromo-3-chloropropane	0.49 U	0.12 U				0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
1,2-Dibromoethane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2-Dichlorobenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2-Dichloroethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,2-Dichloroethene (total)				0.007 UJ	0.0055 UJ											
1,2-Dichloropropane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,3,5-Trimethylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,3-Dichlorobenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,3-Dichloropropane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,4-Dichlorobenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
1,4-Dioxane						0.59 UJ	0.46 UJ	2 UJ	1.9 UJ						0.48 UJ	0.52 UJ
2,2-Dichloropropane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
2,4,4-Trimethyl-1-pentene	0.49 U	0.12 U		0.014 U	0.011 U	0.012 U	0.0091 U	0.039 U	0.038 U		0.019				0.0096 U	0.01 U
2,4,4-Trimethyl-2-pentene	0.49 U	0.12 U		0.014 U	0.011 U	0.012 U	0.0091 U	0.039 U	0.038 U		0.017				0.0096 U	0.01 U
2-Butanone	9.8 U	2.4 U		0.021 UJ	0.016 UJ	0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
2-Chlorotoluene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
2-Hexanone	2 U	0.48 U		0.021 UJ	0.016 UJ	0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
4-Chlorotoluene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
4-iso-Propyltoluene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
4-Methyl-2-pentanone	2 U	0.48 U		0.021 UJ	0.016 UJ	0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
Acetaldehyde							0.044 J	0.2 J	1.1 U							
Acetic acid, methyl ester						0.12 U	0.091 U	0.39 U	0.38 U						0.096 U	0.1 U
Acetone	9.8 U	2.4 U		0.021 UJ	0.016 U	0.068 J	0.039 J	2 UJ	1.9 UJ						0.48 UJ	0.52 UJ
Benzene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Bromobenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Bromochloromethane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Bromodichloromethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Bromoform	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Bromomethane	0.98 U	0.24 U		0.014 UJ	0.011 UJ	0.012 U	0.0091 U	0.039 U	0.038 U						0.0096 U	0.01 U
Butane, 2-methoxy-2-methyl-						0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Carbon disulfide				0.014 UJ	0.011 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Carbon tetrachloride	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Chlorobenzene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Chlorodibromomethane	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Chloroethane	0.98 U	0.24 U		0.014 UJ	0.011 UJ	0.012 U	0.0091 U	0.039 U	0.038 U						0.0096 U	0.01 U
Chloroform	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Chloromethane	0.98 U	0.24 U		0.014 UJ	0.011 UJ	0.012 U	0.0091 U	0.039 U	0.038 U						0.0096 U	0.01 U
Cis-1,2-Dichloroethene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
cis-1,3-Dichloropropene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Cyclohexane						0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
Dibromomethane	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-BD-C22 BD-C22 10/27/2000 0.6-0.6 ft	1130-OSFILL-1220-RISK OSFILL-1220 11/15/2000	1140-WDW-C34 WDW-C34 5/16/2001 -0.6 ft	AREA 03 AREA-3 7/9/1991 0-1 ft	AREA 04 AREA-4 7/9/1991 0-1 ft	OC-SB-406-0.0/1.0-XXX SB-406 9/17/2009 0-1 ft	OC-SB-413-0.0/1.0-XXX SB-413 9/17/2009 0-1 ft	OC-SB-435-0.0/1.0-XXX SB-435 9/17/2009 0-1 ft	OC-SB-453-0.0/1.0-XXX SB-453 9/17/2009 0-1 ft	OC-SB-509-0.0/1.0-XXX SB-509 12/14/2012 0-1 ft	OC-SB-518-0.0/1.0-XXX SB-518 12/14/2012 0-1 ft	OC-SB-519-0.0/1.0-XXX SB-519 12/14/2012 0-1 ft	OC-SB-521-0.0/1.0-XXX SB-521 12/14/2012 0-1 ft	OC-SB-522-0.0/1.0-XXX SB-522 12/13/2012 0-1 ft	OC-SS-400-0.0/1.0-XXX SS-400 9/14/2009 0-1 ft	OC-SS-402-0.0/1.0-XXX SS-402 9/14/2009 0-1 ft
Dichlorodifluoromethane						0.012 UJ	0.0091 UJ	0.039 UJ	0.038 UJ						0.0096 UJ	0.01 UJ
Diethyl ether						0.0059 U	0.0046 U	0.02 U	0.019 UJ						0.0048 U	0.0052 U
Ethyl benzene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Ethyl-t-Butyl Ether						0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Formaldehyde							0.26	0.86	0.64							
Hexachlorobutadiene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Isopropyl ether						0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Isopropylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Methyl cyclohexane						0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Methyl Tertbutyl Ether	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 UJ						0.0048 U	0.0052 U
Methylene chloride	2 U	0.24 U		0.02 UJ	0.019 UJ	0.024 U	0.018 U	0.079 U	0.076 U						0.019 U	0.021 U
Naphthalene	4.9 U	1.2 U				0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
n-Butylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Propylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
sec-Butylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Styrene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
tert-Butylbenzene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Tetrachloroethene	0.49 U	0.12 U		0.001 J	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Tetrahydrofuran						0.059 U	0.046 U	0.2 U	0.19 U						0.048 U	0.052 U
Toluene	0.49 U	0.12 U		0.007 UJ	0.002 J	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
trans-1,2-Dichloroethene	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
trans-1,3-Dichloropropene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Trichloroethene	0.49 U	0.12 U		0.007 UJ	0.0055 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Trichlorofluoromethane	0.49 U	0.12 U				0.012 U	0.0091 U	0.039 U	0.038 U						0.0096 U	0.01 U
Vinyl acetate				0.021 UJ	0.016 UJ											
Vinyl chloride	0.98 U	0.24 U		0.014 UJ	0.011 UJ	0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Xylene, o	0.49 U	0.12 U				0.0059 U	0.0046 U	0.02 U	0.019 U						0.0048 U	0.0052 U
Xylenes (m&p)	0.49 UK	0.12 U				0.012 U	0.0091 U	0.039 U	0.038 U						0.0096 U	0.01 U
Xylenes, Total	0.49 UK	0.12 U		0.007 UJ	0.0055 UJ	0.012 U	0.0091 U	0.039 U	0.038 U						0.0096 U	0.01 U
Semivolatile Organic Compounds (mg/kg)																
1,2,4,5-Tetrachlorobenzene						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
1,2,4-Trichlorobenzene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
1,2-Dichlorobenzene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
1,2-Diphenylhydrazine	5.5 U	0.36 U														
1,3-Dichlorobenzene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
1,4-Dichlorobenzene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
1-Methylnaphthalene						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2,2'-Dichlorodiisopropylether	5.5 U	0.36 U		0.92 U	0.69 U											
2,3,4,6-Tetrachlorophenol						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2,4,5-Trichlorophenol	5.5 U	0.36 U		4.5 U	3.4 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2,4,6-Trichlorophenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2,4-Dichlorophenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2,4-Dimethylphenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 UJ	0.43 U	0.44 U
2,4-Dinitrophenol	5.5 U	0.36 U		4.5 U	3.4 U	0.077 U	0.046 U	1.9 U	17 U		23 UJ	0.05 UJ		R	0.43 U	0.44 U
2,4-Dinitrotoluene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2,6-Dinitrotoluene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 UJ	0.43 U	0.44 U
2-Chloronaphthalene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2-Chlorophenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2-Methylnaphthalene	5.5 U	0.36 U		0.92 U	0.075 J	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2-Methylphenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
2-Nitroaniline	27 U	1.8 U		4.5 U	3.4 U	0.38 U	0.23 U	9.4 U	86 U		110 U	0.25 U		0.2 U	2.2 U	2.2 U
2-Nitrophenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 UJ	0.43 U	0.44 U
3 & 4 Methylphenol	5.5 U	0.36 U				0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
3,3'-Dichlorobenzidine	11 U	0.71 U		1.8 U	1.4 U	0.15 U	0.091 U	3.8 U	35 U		46 U	0.1 U		0.081 U	0.87 U	0.88 U

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-BD-C22 BD-C22 10/27/2000 0.6-0.6 ft	1130-OSFILL-1220-RISK OSFILL-1220 11/15/2000	1140-WDW-C34 WDW-C34 5/16/2001 -0.6 ft	AREA 03 AREA-3 7/9/1991 0-1 ft	AREA 04 AREA-4 7/9/1991 0-1 ft	OC-SB-406-0.0/1.0-XXX SB-406 9/17/2009 0-1 ft	OC-SB-413-0.0/1.0-XXX SB-413 9/17/2009 0-1 ft	OC-SB-435-0.0/1.0-XXX SB-435 9/17/2009 0-1 ft	OC-SB-453-0.0/1.0-XXX SB-453 9/17/2009 0-1 ft	OC-SB-509-0.0/1.0-XXX SB-509 12/14/2012 0-1 ft	OC-SB-518-0.0/1.0-XXX SB-518 12/14/2012 0-1 ft	OC-SB-519-0.0/1.0-XXX SB-519 12/14/2012 0-1 ft	OC-SB-521-0.0/1.0-XXX SB-521 12/14/2012 0-1 ft	OC-SB-522-0.0/1.0-XXX SB-522 12/13/2012 0-1 ft	OC-SS-400-0.0/1.0-XXX SS-400 9/14/2009 0-1 ft	OC-SS-402-0.0/1.0-XXX SS-402 9/14/2009 0-1 ft
3-Nitroaniline	27 U	1.8 U		4.5 U	3.4 U	0.38 U	0.23 U	9.4 U	86 U		110 U	0.25 U		0.2 U	2.2 U	2.2 U
4,6-Dinitro-2-methylphenol	27 U	1.8 U		4.5 U	3.4 U	0.38 U	0.23 U	9.4 U	86 U		110 U	0.25 U		0.2 U	2.2 U	2.2 U
4-Bromophenyl phenyl ether	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
4-Chloro-3-methylphenol	11 U	0.71 U		0.92 U	0.69 U	0.15 U	0.091 U	3.8 U	35 U		46 U	0.1 U		0.081 U	0.87 U	0.88 U
4-Chloroaniline	11 U	0.71 U		0.92 U	0.69 U	0.15 U	0.091 U	3.8 U	35 U		46 U	0.1 U		0.081 UJ	0.87 U	0.88 U
4-Chlorophenyl phenyl ether	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
4-Methylphenol				0.92 U	0.69 U						23 U	0.05 U		0.04 UJ		
4-Nitroaniline	27 U	1.8 U		4.5 U	3.4 U	0.38 U	0.23 U	9.4 U	86 U		110 U	0.25 U		0.2 U	2.2 U	2.2 U
4-Nitrophenol	27 U	1.8 U		4.5 U	3.4 U	0.38 U	0.23 U	9.4 U	86 U		110 UJ	0.25 UJ		R	2.2 U	2.2 U
Acenaphthene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Acenaphthylene	5.5 U	0.36 U		0.92 U	0.057 J	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Acetophenone						0.038 JEB	0.046 U	1.9 U	17 U		23 U	0.02 J		0.013 J	0.43 U	0.44 U
Aniline	27 U	1.8 U				0.077 U	0.046 UJ	1.9 UJ	17 UJ		23 U	0.05 U		0.04 U	0.43 UJ	0.44 UJ
Anthracene	5.5 U	0.36 U		0.92 U	0.069 J	0.077 U	0.046 U	1.9 U	17 U		23 U	0.094		0.088	0.43 U	0.44 U
Atrazine						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Azobenzene						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Benzaldehyde						0.22	0.086	1.9	17 U		23 U	0.16		0.12	0.43 U	0.29 J
Benzo(a)anthracene	5.5 U	0.36 U		0.099 J	0.36 J	0.077 U	0.015 J	1.9 U	17 U			0.12		0.075	0.13 J	0.44 U
Benzo(a)pyrene		0.36 U		0.072 J	0.24 J	0.077 U	0.021 J	1.9 U				0.03 J		0.082	0.17 J	0.44 U
Benzo(b)fluoranthene	5.5 U	0.36 U		0.16 J	0.56 J	0.077 U	0.028 J	1.9 U	17 U			0.05 U		0.14	0.19 J	0.15 J
Benzo(ghi)perylene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.024 J	1.9 U	17 U		23 U	0.015 J		0.034 J	0.17 J	0.44 U
Benzo(k)fluoranthene	5.5 U	0.36 U		0.039 J	0.15 J	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.056	0.19 J	0.44 U
Benzoic Acid	27 U	1.8 U		4.5 U	3.4 U	0.42 UJ	0.23 UJ	8.1 JEB	34 JEB		110 U	0.25 U		0.2 U	2.2 U	2.2 U
Benzyl alcohol	11 U	0.71 U		0.92 U	0.69 U	0.15 U	0.091 U	3.8 U	35 U		46 U	0.1 U		R	0.87 U	0.88 U
Biphenyl						0.077 U	0.046 U	1.9 U	17 U		23 U	0.032 J		0.04 U	0.43 U	0.44 U
Bis(2-Chloroethoxy)methane	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Bis(2-Chloroethyl)ether	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Bis(2-Chloroisopropyl)ether						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Bis(2-Ethylhexyl)phthalate	10	0.36 U		0.53 J	0.34 J	0.036 JEB	0.022 JEB	1.4 JEB	17 JEB		340	4.9		0.15 J	0.43 U	0.44 U
Butylbenzylphthalate	5.5 U	0.36 U		0.92 U	0.061 J	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Caprolactam						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Carbazole						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Chrysene	5.5 U	0.36 U		0.15 J	0.64 J	0.031 J	0.024 J	1.9 U	17 U		23 U	0.1		0.097	0.24 J	0.16 J
Dibenz(a,h)anthracene		0.36 U		0.92 U	0.074 J	0.077 U	0.046 U	1.9 U				0.05 U		0.04 U	0.31 J	0.44 U
Dibenzofuran	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Diethylphthalate	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Dimethylphthalate	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Di-n-butylphthalate	5.5 U	0.36 U		0.92 U	0.034 J	0.077 U	0.046 U	1.9 U	17 U		110 U	0.25 U		0.2 U	0.43 U	0.44 U
Di-n-octylphthalate	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Diphenyl ether						0.077 U	0.046 U	1.9 U	17 U		23 U	0.12		0.04 U	0.43 U	0.44 U
Diphenylamine							0.046 U	1.9 U	17 U							
Diphenylmethanone						0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Fluoranthene	5.5 U	0.36 U		0.2 J	0.94	0.043 J	0.037 J	1.9 U	17 U		23 U	0.22		0.18	0.39 J	0.27 J
Fluorene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Hexachlorobenzene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Hexachlorobutadiene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Hexachlorocyclopentadiene	5.5 U	0.36 U		0.92 U	0.69 U	0.15 U	0.091 U	3.8 U	35 U		46 U	0.1 U		0.081 U	0.87 U	0.88 U
Hexachloroethane	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Indeno(1,2,3-cd)pyrene	5.5 U	0.36 U		0.092 J	0.2 J	0.038 J	0.032 J	1.9 U	17 U			0.05 U		0.034 J	0.17 J	0.44 U
Isophorone	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Naphthalene	5.5 U	0.36 U		0.92 U	0.066 J	0.18 U	0.11 U	4.5 U	41 U		23 U	0.05 U		0.04 U	1 U	1.1 U
Nitrobenzene	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
N-Nitrosodimethylamine						0.077 U	0.0068 U	0.57 U	0.8 U		23 U	0.05 U		0.04 UJ	0.43 U	0.44 U
N-Nitrosodi-n-propylamine	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-BD-C22 BD-C22 10/27/2000 0.6-0.6 ft	1130-OSFILL-1220-RISK OSFILL-1220 11/15/2000	1140-WDW-C34 WDW-C34 5/16/2001 -0.6 ft	AREA 03 AREA-3 7/9/1991 0-1 ft	AREA 04 AREA-4 7/9/1991 0-1 ft	OC-SB-406-0.0/1.0-XXX SB-406 9/17/2009 0-1 ft	OC-SB-413-0.0/1.0-XXX SB-413 9/17/2009 0-1 ft	OC-SB-435-0.0/1.0-XXX SB-435 9/17/2009 0-1 ft	OC-SB-453-0.0/1.0-XXX SB-453 9/17/2009 0-1 ft	OC-SB-509-0.0/1.0-XXX SB-509 12/14/2012 0-1 ft	OC-SB-518-0.0/1.0-XXX SB-518 12/14/2012 0-1 ft	OC-SB-519-0.0/1.0-XXX SB-519 12/14/2012 0-1 ft	OC-SB-521-0.0/1.0-XXX SB-521 12/14/2012 0-1 ft	OC-SB-522-0.0/1.0-XXX SB-522 12/13/2012 0-1 ft	OC-SS-400-0.0/1.0-XXX SS-400 9/14/2009 0-1 ft	OC-SS-402-0.0/1.0-XXX SS-402 9/14/2009 0-1 ft
N-Nitrosodiphenylamine	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.11		0.02 J	0.43 U	0.44 U
Pentachlorophenol	27 U	1.8 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Phenanthrene	5.5 U	0.36 U		0.15 J	0.68 J	0.032 J	0.026 J	2.3 U	21 U		23 U	0.096		0.09	0.28 J	0.18 J
Phenol	5.5 U	0.36 U		0.92 U	0.69 U	0.077 U	0.046 U	1.9 U	17 U		23 U	0.05 U		0.04 U	0.43 U	0.44 U
Pyrene	5.5 U	0.36 U		0.18 J	0.66 J	0.042 J	0.043 J	1.9 U	17 U		23 U	0.17		0.13	0.38 J	0.21 J
EPH (mg/kg)																
C11-C22 Aromatics		3.6 U														
C11-C22 Aromatics (unadj.)		3.6 U														
C19-C36 Aliphatics		3.6 U														
C9-C18 Aliphatics		3.6 UK														
Extractable Petroleum Hydrocarbons, Total		3.6 U														
Pesticides (mg/kg)																
4,4'-DDD	0.21 U			0.045 UJ	0.039 J											
4,4'-DDE	0.21 U			0.045 UJ	0.049 J											
4,4'-DDT	0.21 U			0.045 UJ	0.68 J											
Aldrin	0.21 U			0.022 UJ	0.017 UJ											
Alpha-BHC	0.21 U			0.022 UJ	0.017 UJ											
Alpha-Chlordane				0.22 UJ	0.17 UJ											
Aroclor-1016		0.11 U		0.22 UJ	0.17 UJ											
Aroclor-1221		0.11 U		0.22 UJ	0.17 UJ											
Aroclor-1232		0.11 U		0.22 UJ	0.17 UJ											
Aroclor-1242		0.11 U		0.22 UJ	0.17 UJ											
Aroclor-1248		0.11 U		0.22 UJ	0.17 UJ											
Aroclor-1254		0.11 U		0.45 UJ	0.34 UJ											
Aroclor-1260		0.11 U		0.45 UJ	0.34 UJ											
Beta-BHC	0.21 U			0.022 UJ	0.017 UJ											
Chlordane	1 U															
Chlordane (technical)				0.22 UJ	0.17 UJ											
Delta-BHC	0.21 U			0.022 UJ	0.017 UJ											
Dieldrin	0.21 U			0.045 UJ	0.68 UJ											
Endosulfan I	0.21 U			0.022 UJ	0.017 UJ											
Endosulfan II	0.21 U			0.045 UJ	0.034 UJ											
Endosulfan sulfate	0.21 U			0.045 UJ	0.034 UJ											
Endrin	0.21 U			0.045 UJ	0.034 UJ											
Endrin aldehyde	0.21 U			0.022 UJ	0.017 UJ											
Endrin ketone				0.045 UJ	0.034 UJ											
Gamma-BHC/Lindane	0.21 U			0.022 UJ	0.017 UJ											
Heptachlor	0.21 U			0.022 UJ	0.017 UJ											
Heptachlor epoxide	0.21 U			0.022 UJ	0.017 UJ											
Methoxychlor	0.41 U			0.22 UJ	0.17 UJ											
Toxaphene	2.1 U			0.45 UJ	0.34 UJ											
Metals (mg/kg)																
Aluminum	1200			6000	4300	24000	17000	4700	5000						3600	12000
Antimony				20 U	20 U	1.4 UJ	1.5 UJ	3.3 UJ	2.8 UJ						0.86 UJ	0.82 UJ
Arsenic	5 U	14.5		11	8.6	15	5.2	2.2 J	1.7 J						8.9	8.2
Barium		13		42	20	25	6.9	87	55						13 J	27 J
Beryllium				1.5 U	1.5 U	0.63	0.27 J	0.4 J	0.42 J						0.1 J	0.32 J
Cadmium	0.9 U	0.2 U		1 U	1 U	0.56 J	0.14 J	0.84 J	0.94 J						0.69	0.49
Calcium				1400	990	930	330	6500	5400						1300	1200
Chromium	5 U	10	20	19	27	20	10	40	18						15	15
Chromium, Hexavalent										27 UJ	28 UJ	30 UJ	R	0.25 UJ		
Cobalt				2.7	1.8	4.3	1.1 J	3.8	2.7 J						2.9	3.2
Copper				19	16	12	5.2	23	14						35	20
Iron	710			7000	6600	23000	7200	5200	5700						36000	18000

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-BD-C22 BD-C22 10/27/2000 0.6-0.6 ft	1130-OSFILL-1220-RISK OSFILL-1220 11/15/2000	1140-WDW-C34 WDW-C34 5/16/2001 -0.6 ft	AREA 03 AREA-3 7/9/1991 0-1 ft	AREA 04 AREA-4 7/9/1991 0-1 ft	OC-SB-406-0.0/1.0-XXX SB-406 9/17/2009 0-1 ft	OC-SB-413-0.0/1.0-XXX SB-413 9/17/2009 0-1 ft	OC-SB-435-0.0/1.0-XXX SB-435 9/17/2009 0-1 ft	OC-SB-453-0.0/1.0-XXX SB-453 9/17/2009 0-1 ft	OC-SB-509-0.0/1.0-XXX SB-509 12/14/2012 0-1 ft	OC-SB-518-0.0/1.0-XXX SB-518 12/14/2012 0-1 ft	OC-SB-519-0.0/1.0-XXX SB-519 12/14/2012 0-1 ft	OC-SB-521-0.0/1.0-XXX SB-521 12/14/2012 0-1 ft	OC-SB-522-0.0/1.0-XXX SB-522 12/13/2012 0-1 ft	OC-SS-400-0.0/1.0-XXX SS-400 9/14/2009 0-1 ft	OC-SS-402-0.0/1.0-XXX SS-402 9/14/2009 0-1 ft
Lead	5 U	3.85		73	61	34	13	76	42						53 J	48 J
Magnesium				1200	1400	1500	290	370	350						170	820
Manganese				54	66	70	14	44	18						100	60
Mercury	0.2 U	0.05 U		0.14	0.01	0.081 J	0.2 U	0.35 J	0.76 U						0.12 J	0.16 J
Nickel				8.1	8	13	3.2	12	8.5						11	9.6
Potassium				440	440	1100	230 J	340 J	300 J						360	370
Selenium	5 U	1 U		0.93	0.5 U	1.4 U	1.5 U	3.6	2 J						0.86 U	0.82 U
Silver		1 U		1.5 U	1.5 U	1.4 U	1.5 U	3.3 U	2.8 U						0.86 U	0.12 J
Sodium				53	34	290 U	290 U	160 J	590						170 U	39 J
Thallium				0.93 U	0.67 U	2.9 U	2.9 U	6.5 U	5.5 U						1.7 U	1.6 U
Tin						6.9 J	4.1 J	18 J	8 J						5.3 J	5 J
Vanadium				24	20	42	18	24	16						19	44
Zinc				52	38	24	6.7 J	140	100						19	32
TCLP Metals (mg/kg)																
Chromium																
Chromium, Hexavalent																
Inorganics (mg/kg)																
Chloride				40 UJ	40 UJ	41 U	26 U	180	550						26 U	27 U
Cyanide, Total				2 UJ	2 UJ											
Nitrogen, as Ammonia				39	23	460	140	1200	730						240	270
Oxidation Reduction Potential (mV)										9	10	17	84	31		
Percent Moisture (%)						57	26.7	80.8	80.7	25	29	34	82	19	24	25
Percent Solids (%)	24	91.45	95.6			43	73	18	19	75	71	66	18	81	76	75
Percent Solids, Residual (%)				70 J	94 J											
pH (units)										5.88	6.47	5.94	3.8	6.6		
Sulfate				37 J	4.2 J	83 U	53 U	210 U	180 U						52 U	54 U
Specialty Compounds (mg/kg)																
Hydrazine							0.0027 U	0.0104 U	0.0104 U							
Monomethylhydrazine (MMH)							0.0068 U	0.025 U	0.025 U							
UDMH							0.0068 U	0.025 U	0.025 U							
Dimethylformamide							0.79 UJ	2.2 UJ	2.8 U							
Phthalic Acid/Phthalic anhydride							0.13 U	0.56 U	0.51 U							

Notes:
mg/kg - milligram per kilogram
mV - millivolts
TCLP - Toxicity Characteristic Leaching Procedure
U - Not detected, value is reporting limit
J - Value is estimated.
G - The result is estimated due to duplicate precision outside of control limits
K - The result is estimated due to blank spike compound recovery outside the control limits
EB - Analyte detected in the associated equipment blank
R - Value is rejected
T - The associated value is an estimated quantity and may be biased high due to the oxidation of Cr+3 to Cr+6

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-406-0.0/1.0-XXX SS-406 9/15/2009 0-1 ft	OC-SS-411-0.0/1.0-XXX SS-411 9/15/2009 0-1 ft	OC-SS-415-0.0/1.0-XXX SS-415 9/15/2009 0-1 ft	SS101XX27-RISK SWMU-27-101 11/23/1998	SS101XX27X SWMU-27-101 11/30/1998 0-2 ft
Volatile Organic Compounds (mg/kg)					
1,1,1,2-Tetrachloroethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,1,1-Trichloroethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,1,2,2-Tetrachloroethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.019 U	0.05 U	0.039 U		
1,1,2-Trichloroethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,1-Dichloroethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,1-Dichloroethene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,1-Dichloropropene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2,3-Trichlorobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2,3-Trichloropropane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2,4-Trichlorobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2,4-Trimethylbenzene	0.0037 U	0.0099 U	0.0079 U	0.025	0.66 U
1,2-Dibromo-3-chloropropane	0.037 U	0.099 U	0.079 U	0.009 U	0.66 U
1,2-Dibromoethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2-Dichlorobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2-Dichloroethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,2-Dichloroethene (total)					
1,2-Dichloropropane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,3,5-Trimethylbenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,3-Dichlorobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,3-Dichloropropane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,4-Dichlorobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
1,4-Dioxane	0.37 UJ	0.99 UJ	0.79 UJ		
2,2-Dichloropropane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
2,4,4-Trimethyl-1-pentene	0.0075 U	0.02 U	0.016 U	0.009 U	
2,4,4-Trimethyl-2-pentene	0.0075 U	0.02 U	0.016 U	0.009 U	
2-Butanone	0.037 U	0.099 U	0.079 U	0.18 U	13 U
2-Chlorotoluene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
2-Hexanone	0.037 U	0.099 U	0.079 U	0.036 U	2.7 U
4-Chlorotoluene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
4-iso-Propyltoluene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
4-Methyl-2-pentanone	0.037 U	0.099 U	0.079 U	0.036 U	2.7 U
Acetaldehyde					
Acetic acid, methyl ester	0.075 U	0.2 U	0.16 U		
Acetone	0.37 UJ	0.99 UJ	0.79 UJ	0.18 U	13 U
Benzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Bromobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Bromochloromethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Bromodichloromethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Bromoform	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Bromomethane	0.0075 U	0.02 U	0.016 U	0.018 U	1.3 U
Butane, 2-methoxy-2-methyl-	0.0037 U	0.0099 U	0.0079 U		
Carbon disulfide	0.0037 U	0.0099 U	0.0079 U		
Carbon tetrachloride	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Chlorobenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Chlorodibromomethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Chloroethane	0.0075 U	0.02 U	0.016 U	0.018 U	1.3 U
Chloroform	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Chloromethane	0.0075 U	0.02 U	0.016 U	0.018 U	1.3 U
Cis-1,2-Dichloroethene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
cis-1,3-Dichloropropene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Cyclohexane	0.037 U	0.099 U	0.079 U		
Dibromomethane	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-406-0.0/1.0-XXX SS-406 9/15/2009 0-1 ft	OC-SS-411-0.0/1.0-XXX SS-411 9/15/2009 0-1 ft	OC-SS-415-0.0/1.0-XXX SS-415 9/15/2009 0-1 ft	SS101XX27-RISK SWMU-27-101 11/23/1998	SS101XX27X SWMU-27-101 11/30/1998 0-2 ft
Dichlorodifluoromethane	0.0075 UJ	0.02 UJ	0.016 UJ	0.009 U	0.66 U
Diethyl ether	0.0037 U	0.0099 U	0.0079 U		
Ethyl benzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Ethyl-t-Butyl Ether	0.0037 U	0.0099 U	0.0079 U		
Formaldehyde					
Hexachlorobutadiene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Isopropyl ether	0.0037 U	0.0099 U	0.0079 U		
Isopropylbenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Methyl cyclohexane	0.0037 U	0.0099 U	0.0079 U		
Methyl Tertbutyl Ether	0.0037 U	0.0099 U	0.0079 U		
Methylene chloride	0.015 U	0.04 U	0.031 U	0.009 U	0.66 U
Naphthalene	0.037 U	0.099 U	0.079 U	0.09 U	6.6 U
n-Butylbenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Propylbenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
sec-Butylbenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Styrene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
tert-Butylbenzene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Tetrachloroethene	0.0037 U	0.0099 U	0.0079 U	0.0093	0.66 U
Tetrahydrofuran	0.037 U	0.099 U	0.079 U		
Toluene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
trans-1,2-Dichloroethene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
trans-1,3-Dichloropropene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Trichloroethene	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Trichlorofluoromethane	0.0075 U	0.02 U	0.016 U	0.009 U	0.66 U
Vinyl acetate					
Vinyl chloride	0.0037 U	0.0099 U	0.0079 U	0.018 U	1.3 U
Xylene, o	0.0037 U	0.0099 U	0.0079 U	0.009 U	0.66 U
Xylenes (m&p)	0.0075 U	0.02 U	0.016 U	0.009 U	0.66 U
Xylenes, Total	0.0075 U	0.02 U	0.016 U	0.009 U	0.66 U
Semivolatile Organic Compounds (mg/kg)					
1,2,4,5-Tetrachlorobenzene	0.44 U	4 U	1.6 U		
1,2,4-Trichlorobenzene	0.44 U	4 U	1.6 U	0.42 U	
1,2-Dichlorobenzene	0.44 U	4 U	1.6 U	0.42 U	
1,2-Diphenylhydrazine				0.42 U	
1,3-Dichlorobenzene	0.44 U	4 U	1.6 U	0.42 U	
1,4-Dichlorobenzene	0.44 U	4 U	1.6 U	0.42 U	
1-Methylnaphthalene	0.44 U	4 U	1.6 U		
2,2'-Dichlorodiisopropylether				0.42 U	
2,3,4,6-Tetrachlorophenol	0.44 U	4 U	1.6 U		
2,4,5-Trichlorophenol	0.44 U	4 U	1.6 U	0.42 U	
2,4,6-Trichlorophenol	0.44 U	4 U	1.6 U	0.42 U	
2,4-Dichlorophenol	0.44 U	4 U	1.6 U	0.42 U	
2,4-Dimethylphenol	0.44 U	4 U	1.6 U	0.42 U	
2,4-Dinitrophenol	0.44 U	4 U	1.6 U	2.1 U	
2,4-Dinitrotoluene	0.44 U	4 U	1.6 U	0.42 U	
2,6-Dinitrotoluene	0.44 U	4 U	1.6 U	0.42 U	
2-Chloronaphthalene	0.44 U	4 U	1.6 U	0.42 U	
2-Chlorophenol	0.44 U	4 U	1.6 U	0.42 U	
2-Methylnaphthalene	0.44 U	4 U	1.6 U	0.42 U	
2-Methylphenol	0.44 U	4 U	1.6 U	0.42 U	
2-Nitroaniline	2.2 U	20 U	7.8 U	2.1 U	
2-Nitrophenol	0.44 U	4 U	1.6 U	0.42 U	
3 & 4 Methylphenol	0.44 U	4 U	1.6 U		
3,3'-Dichlorobenzidine	0.89 U	8.1 U	3.1 UJ	0.83 U	

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-406-0.0/1.0-XXX SS-406 9/15/2009 0-1 ft	OC-SS-411-0.0/1.0-XXX SS-411 9/15/2009 0-1 ft	OC-SS-415-0.0/1.0-XXX SS-415 9/15/2009 0-1 ft	SS101XX27-RISK SWMU-27-101 11/23/1998	SS101XX27X SWMU-27-101 11/30/1998 0-2 ft
3-Nitroaniline	2.2 U	20 U	7.8 U	2.1 U	
4,6-Dinitro-2-methylphenol	2.2 U	20 U	7.8 U	2.1 U	
4-Bromophenyl phenyl ether	0.44 U	4 U	1.6 U	0.42 U	
4-Chloro-3-methylphenol	0.89 U	8.1 U	3.1 U	0.83 U	
4-Chloroaniline	0.89 U	8.1 U	3.1 U	0.83 U	
4-Chlorophenyl phenyl ether	0.44 U	4 U	1.6 U	0.42 U	
4-Methylphenol				0.42 U	
4-Nitroaniline	2.2 U	20 U	7.8 U	2.1 U	
4-Nitrophenol	2.2 U	20 U	7.8 U	2.1 U	
Acenaphthene	0.44 U	4 U	1.6 U	0.42 U	
Acenaphthylene	0.44 U	4 U	1.6 U	0.42 U	
Acetophenone	0.44 U	4 U	1.6 U		
Aniline	0.44 UJ	4 UJ	1.6 UJ	2.1 U	
Anthracene	0.44 U	4 U	1.6 U	0.42 U	
Atrazine	0.44 U	4 U	1.6 U		
Azobenzene	0.44 U	4 U	1.6 U		
Benzaldehyde	0.41 J	4 U	1.6 U		
Benzo(a)anthracene	0.44 U	4 U	1.6 UJ	0.42 U	
Benzo(a)pyrene	0.44 U		1.6 U	0.42 U	
Benzo(b)fluoranthene	0.44 U	4 U	1.6 U	0.42 U	
Benzo(ghi)perylene	0.44 U	4 U	1.6 U	0.42 U	
Benzo(k)fluoranthene	0.44 U	4 U	1.6 U	0.42 U	
Benzoic Acid	2.2 U	5.5 JEB	2 JEB	2.1 U	
Benzyl alcohol	0.89 U	8.1 U	3.1 U	0.83 U	
Biphenyl	0.44 U	4 U	1.6 U		
Bis(2-Chloroethoxy)methane	0.44 U	4 U	1.6 U	0.42 U	
Bis(2-Chloroethyl)ether	0.44 U	4 U	1.6 U	0.42 U	
Bis(2-Chloroisopropyl)ether	0.44 U	4 U	1.6 U		
Bis(2-Ethylhexyl)phthalate	0.44 U	4 U	2.9 JEB	1.4	
Butylbenzylphthalate	0.44 U	4 U	1.6 UJ	0.42 U	
Caprolactam	0.44 U	4 U	1.6 U		
Carbazole	0.44 U	4 U	1.6 U		
Chrysene	0.15 J	4 U	1.6 UJ	0.42 U	
Dibenz(a,h)anthracene	0.28 J		1.6 U	0.42 U	
Dibenzofuran	0.44 U	4 U	1.6 U	0.42 U	
Diethylphthalate	0.44 U	4 U	1.6 U	0.42 U	
Dimethylphthalate	0.44 U	4 U	1.6 U	0.42 U	
Di-n-butylphthalate	0.44 U	4 U	1.6 U	0.42 U	
Di-n-octylphthalate	0.44 U	4 U	1.6 U	0.42 U	
Diphenyl ether	0.44 U	4 U	1.6 U		
Diphenylamine					
Diphenylmethanone	0.44 U	4 U	1.6 U		
Fluoranthene	0.23 J	4 U	1.6 U	0.42 U	
Fluorene	0.44 U	4 U	1.6 U	0.42 U	
Hexachlorobenzene	0.44 U	4 U	1.6 U	0.42 U	
Hexachlorobutadiene	0.44 U	4 U	1.6 U	0.42 U	
Hexachlorocyclopentadiene	0.89 U	8.1 U	3.1 U	0.42 U	
Hexachloroethane	0.44 U	4 U	1.6 U	0.42 U	
Indeno(1,2,3-cd)pyrene	0.44 U	4 U	1.6 U	0.42 U	
Isophorone	0.44 U	4 U	1.6 U	0.42 U	
Naphthalene	1.1 U	9.7 U	3.7 U	0.42 U	
Nitrobenzene	0.44 U	4 U	1.6 U	0.42 U	
N-Nitrosodimethylamine	0.44 U	4 U	1.6 U		
N-Nitrosodi-n-propylamine	0.44 U	4 U	1.6 U	0.42 U	

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-406-0.0/1.0-XXX SS-406 9/15/2009 0-1 ft	OC-SS-411-0.0/1.0-XXX SS-411 9/15/2009 0-1 ft	OC-SS-415-0.0/1.0-XXX SS-415 9/15/2009 0-1 ft	SS101XX27-RISK SWMU-27-101 11/23/1998	SS101XX27X SWMU-27-101 11/30/1998 0-2 ft
N-Nitrosodiphenylamine	0.44 U	4 U	1.6 U	0.42 U	
Pentachlorophenol	0.44 U	4 U	1.6 U	2.1 U	
Phenanthrene	0.16 J	4.8 U	1.9 U	0.42 U	
Phenol	0.44 U	4 U	1.6 U	0.42 U	
Pyrene	0.19 J	4 U	1.6 UJ	0.42 U	
EPH (mg/kg)					
C11-C22 Aromatics					
C11-C22 Aromatics (unadj.)					
C19-C36 Aliphatics					
C9-C18 Aliphatics					
Extractable Petroleum Hydrocarbons, Total					
Pesticides (mg/kg)					
4,4'-DDD					
4,4'-DDE					
4,4'-DDT					
Aldrin					
Alpha-BHC					
Alpha-Chlordane					
Aroclor-1016					
Aroclor-1221					
Aroclor-1232					
Aroclor-1242					
Aroclor-1248					
Aroclor-1254					
Aroclor-1260					
Beta-BHC					
Chlordane					
Chlordane (technical)					
Delta-BHC					
Dieldrin					
Endosulfan I					
Endosulfan II					
Endosulfan sulfate					
Endrin					
Endrin aldehyde					
Endrin ketone					
Gamma-BHC/Lindane					
Heptachlor					
Heptachlor epoxide					
Methoxychlor					
Toxaphene					
Metals (mg/kg)					
Aluminum	14000	12000	4000	6200	
Antimony	0.79 UJ	1.5 UJ	1.4 UJ	3 U	
Arsenic	6.8	2.8 J	2 J	3	
Barium	17 J	81 J	56 J	13	
Beryllium	0.27 J	0.9	0.19 J	0.3 U	
Cadmium	0.23 J	0.5 J	1.1	0.3 U	
Calcium	600	1100	13000	620	
Chromium	14	22	84	260	
Chromium, Hexavalent					
Cobalt	2.6	3.5	5.9	2	
Copper	12	25	26	8.4	
Iron	13000	6900	6800	6000	

Attachment 1-2
Surface Soil Data Summary - Exposure Area 2
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-406-0.0/1.0-XXX SS-406 9/15/2009 0-1 ft	OC-SS-411-0.0/1.0-XXX SS-411 9/15/2009 0-1 ft	OC-SS-415-0.0/1.0-XXX SS-415 9/15/2009 0-1 ft	SS101XX27-RISK SWMU-27-101 11/23/1998	SS101XX27X SWMU-27-101 11/30/1998 0-2 ft
Lead	33 J	25 J	80 J	14	
Magnesium	560	110	1100	910	
Manganese	23	13	93	62	
Mercury	0.077 J	0.43 UJ	0.41 UJ	0.06 U	
Nickel	6.9	12	9.9	4.1	
Potassium	450	620 U	380 J	660	
Selenium	0.79 U	1.9	1.4 U	2 U	
Silver	0.089 J	1.5 U	1.3 J	0.7 U	
Sodium	160 U	310 U	88 J	74	
Thallium	1.6 U	3.1 U	2.8 U	2 U	
Tin	4.6 J	7.9 J	34 J		
Vanadium	30	18	14	13	
Zinc	13	82	59	19	
TCLP Metals (mg/kg)					
Chromium					
Chromium, Hexavalent					
Inorganics (mg/kg)					
Chloride	27 U	48 U	55	26.1	
Cyanide, Total					
Nitrogen, as Ammonia	200	810	670	52	
Oxidation Reduction Potential (mV)					
Percent Moisture (%)	25	59	57		
Percent Solids (%)	75	41	43		
Percent Solids, Residual (%)				80.7	
pH (units)					
Sulfate	53 U	97 U	94 U	6.8	
Specialty Compounds (mg/kg)					
Hydrazine					
Monomethylhydrazine (MMH)					
UDMH					
Dimethylformamide					
Phthalic Acid/Phthalic anhydride					

Notes:
mg/kg - milligram per kilogram
mV - millivolts
TCLP - Toxicity Characteristic Leaching Procedure
U - Not detected, value is reporting limit
J - Value is estimated.
G - The result is estimated due to duplicate precision outside of control limits
K - The result is estimated due to blank spike compound recovery outside the control limits
EB - Analyte detected in the associated equipmer
R - Value is rejected
T - The associated value is an estimated quantity and may be biased high due to the oxidation of Cr+3 to Cr+6

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-CP-TP15 CP-TP15 9/18/2001 0-2.25 ft	1010-CP-TP19 CP-TP19 9/18/2001 0-2.25 ft	1010-CP-TP8 CP-TP8 9/18/2001 0-2.25 ft	1010-SED-SDF-3S SDF-3 9/17/2001 0-0.5 ft	1010-SED-SDF-4S SDF-4 9/17/2001 0-0.5 ft	1010-SED-SDF-5S SDF-5 9/17/2001 0-0.5 ft	1010-SED-SDF-6S SDF-6 9/17/2001 0-0.5 ft	1130-OSFILL-400 OSFILL-400 11/15/2000	1130-OSFILL-460 OSFILL-460 11/15/2000	1130-OSFILL-530 OSFILL-530 11/15/2000	1130-OSFILL-550 OSFILL-550 10/13/2000	1130-OSFILL-600 OSFILL-600 11/15/2000	1140-CP-C78 CP-C78 5/9/2001 0.9-0.9 ft	1140-SD-C1 SD-C1 10/3/2000 0.5-0.5 ft	1140-SD-C10 SD-C10 10/11/2000 0.46-0.46 ft	1140-SD-C13 SD-C13 10/11/2000 0.46-0.46 ft
Volatile Organic Compounds (mg/kg)																
1,1,1,2-Tetrachloroethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,1,1-Trichloroethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,1,2,2-Tetrachloroethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,1,2-Trichloro-1,2,2-Trifluoroethane																
1,1,2-Trichloroethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,1-Dichloroethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,1-Dichloroethene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,1-Dichloropropene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2,3-Trichlorobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2,3-Trichloropropane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2,4-Trichlorobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2,4-Trimethylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2-Dibromo-3-chloropropane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2-Dibromoethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2-Dichlorobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2-Dichloroethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,2-Dichloroethene (total)																
1,2-Dichloropropane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,3,5-Trimethylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,3-Dichlorobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,3-Dichloropropane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,4-Dichlorobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
1,4-Dioxane																
2,2-Dichloropropane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
2,4,4-Trimethyl-1-pentene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
2,4,4-Trimethyl-2-pentene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
2-Butanone				14 U	16 U	5.9 U	7.9 U	2.6 U	2.5 U	2.8 U	2.5 U	2.6 U			2.8 U	
2-Chlorotoluene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
2-Hexanone				2.9 U	3.2 U	1.2 U	1.6 U	0.52 U	0.51 U	0.56 U	0.49 U	0.52 U			0.55 U	
4-Chlorotoluene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
4-iso-Propyltoluene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
4-Methyl-2-pentanone				2.9 U	3.2 U	1.2 U	1.6 U	0.52 U	0.51 U	0.56 U	0.49 U	0.52 U			0.55 U	
Acetaldehyde																
Acetic acid, methyl ester																
Acetone				14 U	16 U	5.9 U	7.9 U	2.6 U	2.5 U	2.8 U	2.5 U	2.6 U			2.8 U	
Benzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Bromobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Bromochloromethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Bromodichloromethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Bromoform				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Bromomethane				1.4 U	1.6 U	0.59 U	0.79 U	0.26 U	0.25 U	0.28 U	0.25 U	0.26 U			0.28 U	
Butane, 2-methoxy-2-methyl-																
Carbon disulfide																
Carbon tetrachloride				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Chlorobenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Chlorodibromomethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Chloroethane				1.4 U	1.6 U	0.59 U	0.79 U	0.26 U	0.25 U	0.28 U	0.25 U	0.26 U			0.28 U	
Chloroform				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Chloromethane				1.4 U	1.6 U	0.59 U	0.79 U	0.26 U	0.25 U	0.28 U	0.25 U	0.26 U			0.28 U	
Cis-1,2-Dichloroethene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
cis-1,3-Dichloropropene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Cyclohexane																
Dibromomethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-CP-TP15 CP-TP15 9/18/2001 0-2.25 ft	1010-CP-TP19 CP-TP19 9/18/2001 0-2.25 ft	1010-CP-TP8 CP-TP8 9/18/2001 0-2.25 ft	1010-SED-SDF-3S SDF-3 9/17/2001 0-0.5 ft	1010-SED-SDF-4S SDF-4 9/17/2001 0-0.5 ft	1010-SED-SDF-5S SDF-5 9/17/2001 0-0.5 ft	1010-SED-SDF-6S SDF-6 9/17/2001 0-0.5 ft	1130-OSFILL-400 OSFILL-400 11/15/2000	1130-OSFILL-460 OSFILL-460 11/15/2000	1130-OSFILL-530 OSFILL-530 11/15/2000	1130-OSFILL-550 OSFILL-550 10/13/2000	1130-OSFILL-600 OSFILL-600 11/15/2000	1140-CP-C78 CP-C78 5/9/2001 0.9-0.9 ft	1140-SD-C1 SD-C1 10/3/2000 0.5-0.5 ft	1140-SD-C10 SD-C10 10/11/2000 0.46-0.46 ft	1140-SD-C13 SD-C13 10/11/2000 0.46-0.46 ft
Dichlorodifluoromethane																
Diethyl ether																
Ethyl benzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Ethyl-t-Butyl Ether																
Formaldehyde																
Hexachlorobutadiene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Isopropyl ether																
Isopropylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Methyl cyclohexane																
Methyl Tertbutyl Ether				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Methylene chloride				1.4 U	1.6 U	0.59 U	0.79 U	0.26 U	0.25 U	0.28 U	0.12 U	0.26 U			0.14 U	
Naphthalene								1.3 U	1.3 U	1.4 U	1.2 U	1.3 U			1.4 U	
n-Butylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Propylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
sec-Butylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Styrene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
tert-Butylbenzene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Tetrachloroethene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Tetrahydrofuran																
Toluene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
trans-1,2-Dichloroethene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
trans-1,3-Dichloropropene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Trichloroethene				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Trichlorofluoromethane				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Vinyl acetate																
Vinyl chloride				1.4 U	1.6 U	0.59 U	0.79 U	0.26 U	0.25 U	0.28 U	0.25 U	0.26 U			0.28 U	
Xylene, o				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Xylenes (m&p)				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Xylenes, Total				0.72 U	0.79 U	0.3 U	0.4 U	0.13 U	0.13 U	0.14 U	0.12 U	0.13 U			0.14 U	
Semivolatile Organic Compounds (mg/kg)																
1,2,4,5-Tetrachlorobenzene																
1,2,4-Trichlorobenzene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
1,2-Dichlorobenzene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
1,2-Diphenylhydrazine				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
1,3-Dichlorobenzene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
1,4-Dichlorobenzene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
1-Methylnaphthalene																
2,2'-Dichlorodiisopropylether				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U		0.43 U	0.39 U	2.6 U
2,3,4,6-Tetrachlorophenol																
2,4,5-Trichlorophenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2,4,6-Trichlorophenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2,4-Dichlorophenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2,4-Dimethylphenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2,4-Dinitrophenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	1.8 U	0.43 U	0.39 U	2.6 U
2,4-Dinitrotoluene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2,6-Dinitrotoluene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2-Chloronaphthalene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2-Chlorophenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2-Methylnaphthalene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2-Methylphenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
2-Nitroaniline				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U	1.8 U	2.1 U	1.9 U	13 U
2-Nitrophenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
3 & 4 Methylphenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U		0.43 U	0.39 U	2.6 U
3,3'-Dichlorobenzidine				6.4 U	9.5 U	13 U	10 U	0.72 U	0.74 U	0.73 U	0.69 U	0.72 U	1.8 U	0.86 U	0.78 U	5.2 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-CP-TP15 CP-TP15 9/18/2001 0-2.25 ft	1010-CP-TP19 CP-TP19 9/18/2001 0-2.25 ft	1010-CP-TP8 CP-TP8 9/18/2001 0-2.25 ft	1010-SED-SDF-3S SDF-3 9/17/2001 0-0.5 ft	1010-SED-SDF-4S SDF-4 9/17/2001 0-0.5 ft	1010-SED-SDF-5S SDF-5 9/17/2001 0-0.5 ft	1010-SED-SDF-6S SDF-6 9/17/2001 0-0.5 ft	1130-OSFILL-400 OSFILL-400 11/15/2000	1130-OSFILL-460 OSFILL-460 11/15/2000	1130-OSFILL-530 OSFILL-530 11/15/2000	1130-OSFILL-550 OSFILL-550 10/13/2000	1130-OSFILL-600 OSFILL-600 11/15/2000	1140-CP-C78 CP-C78 5/9/2001 0.9-0.9 ft	1140-SD-C1 SD-C1 10/3/2000 0.5-0.5 ft	1140-SD-C10 SD-C10 10/11/2000 0.46-0.46 ft	1140-SD-C13 SD-C13 10/11/2000 0.46-0.46 ft
3-Nitroaniline				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U	1.8 U	2.1 U	1.9 U	13 U
4,6-Dinitro-2-methylphenol				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U	1.8 U	2.1 U	1.9 U	13 U
4-Bromophenyl phenyl ether				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
4-Chloro-3-methylphenol				6.4 U	9.5 U	13 U	10 U	0.72 U	0.74 U	0.73 U	0.69 U	0.72 U	0.37 U	0.86 U	0.78 U	5.2 U
4-Chloroaniline				6.4 U	9.5 U	13 U	10 U	0.72 U	0.74 U	0.73 U	0.69 U	0.72 U	0.37 U	0.86 U	0.78 U	5.2 U
4-Chlorophenyl phenyl ether				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
4-Methylphenol													0.37 U			
4-Nitroaniline				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U	1.8 U	2.1 U	1.9 U	13 U
4-Nitrophenol				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U	1.8 U	2.1 U	1.9 U	13 U
Acenaphthene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Acenaphthylene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Acetophenone																
Aniline				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U		2.1 U	1.9 U	13 U
Anthracene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Atrazine																
Azobenzene																
Benzaldehyde																
Benzo(a)anthracene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Benzo(a)pyrene	0.4 U	0.4 U	0.4 U	2.2	3.4	1.2	2	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	
Benzo(b)fluoranthene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Benzo(ghi)perylene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	3.9	8.4	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Benzo(k)fluoranthene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Benzoic Acid				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U		2.1 U	1.9 U	13 U
Benzyl alcohol				6.4 U	9.5 U	13 U	10 U	0.72 U	0.74 U	0.73 U	0.69 U	0.72 U	0.74 U	0.86 U	0.78 U	5.2 U
Biphenyl																
Bis(2-Chloroethoxy)methane				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Bis(2-Chloroethyl)ether				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Bis(2-Chloroisopropyl)ether													0.37 U			
Bis(2-Ethylhexyl)phthalate				2.2	20	7	6.9	0.36 U	0.37 U	0.36 U	0.39	0.36 U	0.21 J	0.43 U	0.34 J	8.8
Butylbenzylphthalate				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Caprolactam																
Carbazole													0.37 U			
Chrysene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Dibenz(a,h)anthracene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	
Dibenzofuran				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Diethylphthalate				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Dimethylphthalate				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Di-n-butylphthalate				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Di-n-octylphthalate				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Diphenyl ether																
Diphenylamine																
Diphenylmethanone																
Fluoranthene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Fluorene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Hexachlorobenzene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Hexachlorobutadiene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Hexachlorocyclopentadiene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	1.8 U	0.43 U	0.39 U	2.6 U
Hexachloroethane				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Indeno(1,2,3-cd)pyrene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Isophorone				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Naphthalene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Nitrobenzene				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
N-Nitrosodimethylamine																
N-Nitrosodi-n-propylamine				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-CP-TP15 CP-TP15 9/18/2001 0-2.25 ft	1010-CP-TP19 CP-TP19 9/18/2001 0-2.25 ft	1010-CP-TP8 CP-TP8 9/18/2001 0-2.25 ft	1010-SED-SDF-3S SDF-3 9/17/2001 0-0.5 ft	1010-SED-SDF-4S SDF-4 9/17/2001 0-0.5 ft	1010-SED-SDF-5S SDF-5 9/17/2001 0-0.5 ft	1010-SED-SDF-6S SDF-6 9/17/2001 0-0.5 ft	1130-OSFILL-400 OSFILL-400 11/15/2000	1130-OSFILL-460 OSFILL-460 11/15/2000	1130-OSFILL-530 OSFILL-530 11/15/2000	1130-OSFILL-550 OSFILL-550 10/13/2000	1130-OSFILL-600 OSFILL-600 11/15/2000	1140-CP-C78 CP-C78 5/9/2001 0.9-0.9 ft	1140-SD-C1 SD-C1 10/3/2000 0.5-0.5 ft	1140-SD-C10 SD-C10 10/11/2000 0.46-0.46 ft	1140-SD-C13 SD-C13 10/11/2000 0.46-0.46 ft
N-Nitrosodiphenylamine				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Pentachlorophenol				16 U	24 U	33 U	25 U	1.8 U	1.9 U	1.8 U	1.7 U	1.8 U	1.8 U	2.1 U	1.9 U	13 U
Phenanthrene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Phenol				3.2 U	4.8 U	6.7 U	5.1 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
Pyrene	0.4 U	0.4 U	0.4 U	0.8 U	1.2 U	1.1 U	1.3 U	0.36 U	0.37 U	0.36 U	0.35 U	0.36 U	0.37 U	0.43 U	0.39 U	2.6 U
EPH (mg/kg)																
C11-C22 Aromatics	8	20	6.8	30	81	130	92	3.6 U	3.7 U	3.6 U	8.4	3.6 U				
C11-C22 Aromatics (unadj.)	8	20	6.8	32	85	140	100	3.6 U	3.7 U	3.6 U	8.4	3.6 U				
C19-C36 Aliphatics	5.9	36	3.8 U	39	110	190	110	3.6 U	3.7 U	3.6 U	6.9	3.6 U				
C9-C18 Aliphatics	3.5 UJ	6.7 J	3.8 UJ	8.4 J	16 J	17 J	17 J	3.6 UFK	3.7 UK	3.6 UK	3.4 U	3.6 UK				
Extractable Petroleum Hydrocarbons, Total	14	63	6.8	77	200	340	210	3.6 U	3.7 U	3.6 U	15	3.6 U				
Pesticides (mg/kg)																
4,4'-DDD															0.058 U	
4,4'-DDE															0.058 U	
4,4'-DDT															0.058 U	
Aldrin															0.058 U	
Alpha-BHC															0.058 U	
Alpha-Chlordane																
Aroclor-1016	0.11 U	0.11 U	0.11 U					0.11 UF	0.11 U	0.1 U	0.1 U	0.11 U				
Aroclor-1221	0.11 U	0.11 U	0.11 U					0.11 U	0.11 U	0.1 U	0.1 U	0.11 U				
Aroclor-1232	0.11 U	0.11 U	0.11 U					0.11 U	0.11 U	0.1 U	0.1 U	0.11 U				
Aroclor-1242	0.11 U	0.11 U	0.11 U					0.11 U	0.11 U	0.1 U	0.1 U	0.11 U				
Aroclor-1248	0.11 U	0.11 U	0.11 U					0.11 U	0.11 U	0.1 U	0.1 U	0.11 U				
Aroclor-1254	0.11 U	0.11 U	0.11 U					0.11 U	0.11 U	0.1 U	0.1 U	0.11 U				
Aroclor-1260	0.11 U	0.11 U	0.11 U					0.11 U	0.11 U	0.1 U	0.1 U	0.11 U				
Beta-BHC															0.15 U	
Chlordane															0.29 U	
Chlordane (technical)																
Delta-BHC															0.058 U	
Dieldrin															0.058 U	
Endosulfan I															0.058 U	
Endosulfan II															0.058 U	
Endosulfan sulfate															0.058 U	
Endrin															0.058 U	
Endrin aldehyde															0.088 U	
Endrin ketone																
Gamma-BHC/Lindane															0.058 U	
Heptachlor															0.058 U	
Heptachlor epoxide															0.058 U	
Hexachlorobenzene																
Methoxychlor															0.29 U	
Toxaphene															2 U	
Metals (mg/kg)																
Aluminum															670	
Antimony																
Arsenic	3.9	5.1	13	12 U	18 U	18 U	21 U	12	16	11	7.2	12			1 U	
Barium	20	9.9	9.9	19	52	52	23	21	12	17	9.9	17				
Beryllium																
Cadmium	0.2 U	0.2 U	0.2 U	2 U	4 U	4 U	4 U	0.3 U	0.3 U	0.3 U	0.2 U	0.3 U			0.3 U	
Calcium																
Chromium	13	560	390	310 J	1700	300	400	14	8.7	11	8.9	11	69	300 G	1.4	46
Chromium, Hexavalent				1.1 UT	1.7 UT	1.7 UT	2.5 UT									
Cobalt																
Copper																

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-CP-TP15 CP-TP15 9/18/2001 0-2.25 ft	1010-CP-TP19 CP-TP19 9/18/2001 0-2.25 ft	1010-CP-TP8 CP-TP8 9/18/2001 0-2.25 ft	1010-SED-SDF-3S SDF-3 9/17/2001 0-0.5 ft	1010-SED-SDF-4S SDF-4 9/17/2001 0-0.5 ft	1010-SED-SDF-5S SDF-5 9/17/2001 0-0.5 ft	1010-SED-SDF-6S SDF-6 9/17/2001 0-0.5 ft	1130-OSFILL-400 OSFILL-400 11/15/2000	1130-OSFILL-460 OSFILL-460 11/15/2000	1130-OSFILL-530 OSFILL-530 11/15/2000	1130-OSFILL-550 OSFILL-550 10/13/2000	1130-OSFILL-600 OSFILL-600 11/15/2000	1140-CP-C78 CP-C78 5/9/2001 0.9-0.9 ft	1140-SD-C1 SD-C1 10/3/2000 0.5-0.5 ft	1140-SD-C10 SD-C10 10/11/2000 0.46-0.46 ft	1140-SD-C13 SD-C13 10/11/2000 0.46-0.46 ft
Iron															81	
Lead	11	3.1	3.9	62	85	52	45	5.3	3.7	4.7	3.6	4.5			1.5	
Magnesium																
Manganese																
Mercury	0.05 U	0.05 U	0.05 U	0.24	0.41	0.33	0.23	0.05 U	0.05 U	0.05 U	0.04 U	0.05 U			0.05 U	
Nickel																
Potassium																
Selenium	1 U	1 U	1 U	12 U	18 U	18 U	20 U	1 U	1 U	1 U	1 U	1 U			1 U	
Silver	1 U	1 U	1 U	12 U	18 U	18 U	21 U	1 U	1 U	1 U	1 U	1 U				
Sodium																
Thallium																
Tin																
Vanadium																
Zinc																
Inorganics (mg/kg)																
Chloride																
Cyanide, Available																
Cyanide, Total																
Nitrogen, as Ammonia																
Oxidation Reduction Potential (mV)				170	180	160	210									
Percent Moisture (%)																
Percent Solids (%)	93.6	88	88.6	19.7	21.2	37.8	40.3	92.1	89.3	91	95.7	91.8	90.1	77.3	85.5	63.8
Percent Solids, Residual (%)																
pH (units)				5.67	5.27	5.73	4.77									
Sulfate																
Total Organic Carbon																
Total Organic Carbon (%)																
Specialty Compounds (mg/kg)																
Hydrazine																
Monomethylhydrazine (MMH)																
UDMH																
Dimethylformamide																
Phthalic Acid/Phthalic anhydride																

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C14 SD-C14 10/11/2000 0.54-0.54 ft	1140-SD-C15 SD-C15 10/11/2000 0.49-0.49 ft	1140-SD-C16B SD-C16B 10/12/2000 0.21-0.21 ft	1140-SD-C17B SD-C17B 10/12/2000 0.47-0.47 ft	1140-SD-C18B SD-C18B 10/12/2000 -0.03 ft	1140-SD-C19B SD-C19B 10/12/2000 0.11 ft	1140-SD-C1B SD-C1B 10/3/2000 0.5 ft	1140-SD-C2 SD-C2 10/3/2000 0.5 ft	1140-SD-C20B SD-C20B 10/12/2000 0.51 ft	1140-SD-C21B SD-C21B 10/12/2000 0.27 ft	1140-SD-C29B SD-C29B 11/2/2000 0.48 ft	1140-SD-C30B SD-C30B 11/2/2000 0.48 ft	1140-SD-C40B SD-C40B 11/3/2000 0.48 ft	1140-SD-C42B SD-C42B 11/3/2000 0.38-0.38 ft	1140-SD-C43B SD-C43B 11/3/2000 0.65 ft
Volatile Organic Compounds (mg/kg)															
1,1,1,2-Tetrachloroethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,1,1-Trichloroethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,1,2,2-Tetrachloroethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,1-Dichloroethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,1-Dichloroethene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,1-Dichloropropene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2,3-Trichlorobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2,3-Trichloropropane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2,4-Trichlorobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 UB	0.16 UB
1,2,4-Trimethylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2-Dibromo-3-chloropropane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2-Dibromoethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2-Dichlorobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2-Dichloroethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,2-Dichloroethene (total)															
1,2-Dichloropropane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,3,5-Trimethylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,3-Dichlorobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,3-Dichloropropane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,4-Dichlorobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
1,4-Dioxane															
2,2-Dichloropropane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
2,4,4-Trimethyl-1-pentene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
2,4,4-Trimethyl-2-pentene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
2-Butanone		3.4 U		2.8 U		2.7 U				2.9 U	2.7 U			3.7 U	3.3 U
2-Chlorotoluene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
2-Hexanone		0.67 U		0.56 U		0.53 U				0.57 U	0.54 U			0.74 U	0.65 U
4-Chlorotoluene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
4-iso-Propyltoluene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
4-Methyl-2-pentanone		0.67 U		0.56 U		0.53 U				0.57 U	0.54 U			0.74 U	0.65 U
Acetaldehyde															
Acetic acid, methyl ester															
Acetone		3.4 U		2.8 U		2.7 U				2.9 U	2.7 U			3.7 U	3.3 U
Benzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Bromobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Bromochloromethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Bromodichloromethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Bromoform		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Bromomethane		0.34 U		0.28 U		0.27 U				0.29 U	0.27 U			0.37 U	0.33 U
Butane, 2-methoxy-2-methyl-															
Carbon disulfide															
Carbon tetrachloride		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Chlorobenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Chlorodibromomethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Chloroethane		0.34 U		0.28 U		0.27 U				0.29 U	0.27 U			0.37 U	0.33 U
Chloroform		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Chloromethane		0.34 U		0.28 U		0.27 U				0.29 U	0.27 U			0.37 U	0.33 U
Cis-1,2-Dichloroethene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
cis-1,3-Dichloropropene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Cyclohexane															
Dibromomethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C14 SD-C14 10/11/2000 0.54-0.54 ft	1140-SD-C15 SD-C15 10/11/2000 0.49-0.49 ft	1140-SD-C16B SD-C16B 10/12/2000 0.21-0.21 ft	1140-SD-C17B SD-C17B 10/12/2000 0.47-0.47 ft	1140-SD-C18B SD-C18B 10/12/2000 -0.03 ft	1140-SD-C19B SD-C19B 10/12/2000 0.11 ft	1140-SD-C1B SD-C1B 10/3/2000 0.5 ft	1140-SD-C2 SD-C2 10/3/2000 0.5 ft	1140-SD-C20B SD-C20B 10/12/2000 0.51 ft	1140-SD-C21B SD-C21B 10/12/2000 0.27 ft	1140-SD-C29B SD-C29B 11/2/2000 0.48 ft	1140-SD-C30B SD-C30B 11/2/2000 0.48 ft	1140-SD-C40B SD-C40B 11/3/2000 0.48 ft	1140-SD-C42B SD-C42B 11/3/2000 0.38-0.38 ft	1140-SD-C43B SD-C43B 11/3/2000 0.65 ft
Dichlorodifluoromethane															
Diethyl ether															
Ethyl benzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Isopropyl ether															
Isopropylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Methyl cyclohexane															
Methyl Tertbutyl Ether		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Methylene chloride		0.17 U		0.14 U		0.13 U				0.14 U	0.27 U			0.44 B	0.33 UB
Naphthalene		1.7 U		1.4 U		1.3 U				1.4 U	1.4 U			1.8 U	1.6 U
n-Butylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Propylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
sec-Butylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Styrene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
tert-Butylbenzene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Tetrachloroethene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Tetrahydrofuran															
Toluene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
trans-1,2-Dichloroethene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
trans-1,3-Dichloropropene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Trichloroethene		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Trichlorofluoromethane		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Vinyl acetate															
Vinyl chloride		0.34 U		0.28 U		0.27 U				0.29 U	0.27 U			0.37 U	0.33 U
Xylene, o		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Xylenes (m&p)		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Xylenes, Total		0.17 U		0.14 U		0.13 U				0.14 U	0.14 U			0.18 U	0.16 U
Semivolatile Organic Compounds (mg/kg)															
1,2,4,5-Tetrachlorobenzene															
1,2,4-Trichlorobenzene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
1,2-Dichlorobenzene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
1,2-Diphenylhydrazine	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
1,3-Dichlorobenzene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
1,4-Dichlorobenzene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
1-Methylnaphthalene															
2,2'-Dichlorodiisopropylether	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 U	0.53 U	0.53 U	5.1 U	8.3 U
2,4,6-Trichlorophenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 U	0.53 U	0.53 U	5.1 U	8.3 U
2,4-Dichlorophenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2,4-Dimethylphenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2,4-Dinitrophenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2,4-Dinitrotoluene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 U	0.53 U	0.53 U	5.1 U	8.3 U
2,6-Dinitrotoluene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2-Chloronaphthalene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2-Chlorophenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2-Methylnaphthalene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2-Methylphenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
2-Nitroaniline	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
2-Nitrophenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
3 & 4 Methylphenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
3,3'-Dichlorobenzidine	1.4 U	0.88 U	9.2 U	0.85 U	0.8 U	0.8 U	0.8 U	0.89 U	0.89 U	8 U	46 UC	1.1 UC	1.1 UC	10 UC	17 UC

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C14 SD-C14 10/11/2000 0.54-0.54 ft	1140-SD-C15 SD-C15 10/11/2000 0.49-0.49 ft	1140-SD-C16B SD-C16B 10/12/2000 0.21-0.21 ft	1140-SD-C17B SD-C17B 10/12/2000 0.47-0.47 ft	1140-SD-C18B SD-C18B 10/12/2000 -0.03 ft	1140-SD-C19B SD-C19B 10/12/2000 0.11 ft	1140-SD- C1B SD-C1B 10/3/2000 0.5 ft	1140-SD-C2 SD-C2 10/3/2000 0.5 ft	1140-SD- C20B SD-C20B 10/12/2000 0.51 ft	1140-SD- C21B SD-C21B 10/12/2000 0.27 ft	1140-SD- C29B SD-C29B 11/2/2000 0.48 ft	1140-SD- C30B SD-C30B 11/2/2000 0.48 ft	1140-SD- C40B SD-C40B 11/3/2000 0.48 ft	1140-SD-C42B SD-C42B 11/3/2000 0.38-0.38 ft	1140-SD-C43B SD-C43B 11/3/2000 0.65 ft
3-Nitroaniline	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
4,6-Dinitro-2-methylphenol	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
4-Bromophenyl phenyl ether	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
4-Chloro-3-methylphenol	1.4 U	0.88 U	9.2 U	0.85 U	0.8 U	0.8 U	0.8 U	0.89 U	0.89 U	8 U	46 UC	1.1 UC	1.1 UC	10 UC	17 UC
4-Chloroaniline	1.4 U	0.88 U	9.2 U	0.85 U	0.8 U	0.8 U	0.8 U	0.89 U	0.89 U	8 U	46 UC	1.1 UC	1.1 UC	10 UC	17 UC
4-Chlorophenyl phenyl ether	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
4-Methylphenol															
4-Nitroaniline	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
4-Nitrophenol	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
Acenaphthene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Acenaphthylene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Acetophenone															
Aniline	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
Anthracene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U		0.53 UC	0.53 UC	5.1 UC	8.3 UC
Benzo(a)pyrene	0.7 U	0.44 U		0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U			0.53 UC	0.53 UC		
Benzo(b)fluoranthene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U		0.53 UC	0.53 UC	5.1 UC	8.3 UC
Benzo(ghi)perylene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Benzo(k)fluoranthene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Benzoic Acid	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 UC	2.7 UC	2.6 UC	25 UC	41 UC
Benzyl alcohol	1.4 U	0.88 U	9.2 U	0.85 U	0.8 U	0.8 U	0.8 U	0.89 U	0.89 U	8 U	46 UC	1.1 UC	1.1 UC	10 UC	17 UC
Biphenyl															
Bis(2-Chloroethoxy)methane	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Bis(2-Chloroethyl)ether	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate	0.7 U	0.88	28	0.89	0.25 J	1.2	0.4 U	0.44 U	0.29 J	40	99 C	0.58 C	1.9 C	3.2 JC	52 C
Butylbenzylphthalate	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Caprolactam															
Carbazole															
Chrysene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Dibenz(a,h)anthracene	0.7 U	0.44 U		0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U			0.53 UC	0.53 UC		
Dibenzofuran	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Diethylphthalate	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Dimethylphthalate	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Di-n-butylphthalate	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	3 JC	8.3 UC
Di-n-octylphthalate	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Fluorene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Hexachlorobenzene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Hexachlorobutadiene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Hexachlorocyclopentadiene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Hexachloroethane	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 U	0.53 U	0.53 U	5.1 U	8.3 U
Indeno(1,2,3-cd)pyrene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U		0.53 UC	0.53 UC	5.1 UC	8.3 UC
Isophorone	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Naphthalene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Nitrobenzene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C14 SD-C14 10/11/2000 0.54-0.54 ft	1140-SD-C15 SD-C15 10/11/2000 0.49-0.49 ft	1140-SD-C16B SD-C16B 10/12/2000 0.21-0.21 ft	1140-SD-C17B SD-C17B 10/12/2000 0.47-0.47 ft	1140-SD-C18B SD-C18B 10/12/2000 -0.03 ft	1140-SD-C19B SD-C19B 10/12/2000 0.11 ft	1140-SD- C1B SD-C1B 10/3/2000 0.5 ft	1140-SD-C2 SD-C2 10/3/2000 0.5 ft	1140-SD- C20B SD-C20B 10/12/2000 0.51 ft	1140-SD- C21B SD-C21B 10/12/2000 0.27 ft	1140-SD- C29B SD-C29B 11/2/2000 0.48 ft	1140-SD- C30B SD-C30B 11/2/2000 0.48 ft	1140-SD- C40B SD-C40B 11/3/2000 0.48 ft	1140-SD-C42B SD-C42B 11/3/2000 0.38-0.38 ft	1140-SD-C43B SD-C43B 11/3/2000 0.65 ft
N-Nitrosodiphenylamine	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Pentachlorophenol	3.5 U	2.2 U	23 U	2.1 U	2 U	2 U	2 U	2.2 U	2.2 U	20 U	110 U	2.7 U	2.6 U	25 U	41 U
Phenanthrene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Phenol	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
Pyrene	0.7 U	0.44 U	4.6 U	0.42 U	0.4 U	0.4 U	0.4 U	0.44 U	0.44 U	4 U	23 UC	0.53 UC	0.53 UC	5.1 UC	8.3 UC
EPH (mg/kg)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															
Pesticides (mg/kg)															
4,4'-DDD		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
4,4'-DDE		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
4,4'-DDT		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 J	0.12 U
Aldrin		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Alpha-BHC		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Alpha-Chlordane															
Aroclor-1016															
Aroclor-1221															
Aroclor-1232															
Aroclor-1242															
Aroclor-1248															
Aroclor-1254															
Aroclor-1260															
Beta-BHC		0.17 U		0.16 U		0.14 U				0.15 U	0.065 U			0.015 U	0.12 U
Chlordane		0.34 U		0.32 U		0.28 U				0.3 U	0.32 U			0.074 U	0.59 U
Chlordane (technical)															
Delta-BHC		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Dieldrin		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Endosulfan I		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Endosulfan II		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Endosulfan sulfate		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Endrin		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Endrin aldehyde		0.1 U		0.095 U		0.085 U				0.09 U	0.065 U			0.015 U	0.12 U
Endrin ketone															
Gamma-BHC/Lindane		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Heptachlor		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Heptachlor epoxide		0.068 U		0.064 U		0.057 U				0.06 U	0.065 U			0.015 U	0.12 U
Hexachlorobenzene															
Methoxychlor		0.34 U		0.32 U		0.28 U				0.3 U	0.13 U			0.03 U	0.24 U
Toxaphene		2.4 U		2.2 U		2 U				2.1 U	0.65 U			0.15 U	1.2 U
Metals (mg/kg)															
Aluminum		3900		1500		1000				4600	2200			4100	4800
Antimony															
Arsenic		2		9.4		3 U				3	2 U			32	31
Barium															
Beryllium															
Cadmium		0.4 U		0.3 U		0.3 U				0.3 U	0.3 U			0.3 U	0.5
Calcium															
Chromium	36	33	55	170	250	180	140 G	200 G	120	300	210	49	140	1400	96
Chromium, Hexavalent															
Cobalt															
Copper															

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C14 SD-C14 10/11/2000 0.54-0.54 ft	1140-SD-C15 SD-C15 10/11/2000 0.49-0.49 ft	1140-SD-C16B SD-C16B 10/12/2000 0.21-0.21 ft	1140-SD-C17B SD-C17B 10/12/2000 0.47-0.47 ft	1140-SD-C18B SD-C18B 10/12/2000 -0.03 ft	1140-SD-C19B SD-C19B 10/12/2000 0.11 ft	1140-SD- C1B SD-C1B 10/3/2000 0.5 ft	1140-SD-C2 SD-C2 10/3/2000 0.5 ft	1140-SD- C20B SD-C20B 10/12/2000 0.51 ft	1140-SD- C21B SD-C21B 10/12/2000 0.27 ft	1140-SD- C29B SD-C29B 11/2/2000 0.48 ft	1140-SD- C30B SD-C30B 11/2/2000 0.48 ft	1140-SD- C40B SD-C40B 11/3/2000 0.48 ft	1140-SD-C42B SD-C42B 11/3/2000 0.38-0.38 ft	1140-SD-C43B SD-C43B 11/3/2000 0.65 ft
Iron		2500		4500		1800				6200	1300			13000	14000
Lead		5.1		14		3.4				4.1	3			19	9.9
Magnesium															
Manganese															
Mercury		0.06 U		0.06 U		0.05 U				0.05 U	0.06 U			0.09	0.11
Nickel															
Potassium															
Selenium		2 U		3 U		3 U				3 U	3 U			2 U	1 U
Silver															
Sodium															
Thallium															
Tin															
Vanadium															
Zinc															
Inorganics (mg/kg)															
Chloride															
Cyanide, Available															
Cyanide, Total															
Nitrogen, as Ammonia															
Oxidation Reduction Potential (mV)															
Percent Moisture (%)															
Percent Solids (%)	47.3	73.9	71.3	78.6	81.7	82.9	83	74.3	74.9	83.1	72.4	61.4	62.5	64.9	80
Percent Solids, Residual (%)															
pH (units)															
Sulfate															
Total Organic Carbon															
Total Organic Carbon (%)															
Specialty Compounds (mg/kg)															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C48N SD-C48N 5/14/2001 0.26-0.76 ft	1140-SD-C48S SD-C48S 5/14/2001 0.66-1.16 ft	1140-SD-C49N SD-C49N 5/14/2001 - 0.04-0.46 ft	1140-SD-C50N SD-C50N 5/14/2001 0.06-0.56 ft	1140-SD-C51N SD-C51N 5/14/2001 0.56-1..06 ft	1140-SD-C52N SD-C52N 5/14/2001 0.56-1.06 ft	1140-SD-C53N SD-C53N 5/15/2001 0.63-1.13 ft	1140-SD-C54S SD-C54S 5/15/2001 0.53-1.03 ft	1140-SD-C6 SD-C6 10/11/2000 0.48 ft	1140-SD-C7 SD-C7 10/11/2000 0.49-0.49 ft	1140-SD-C9 SD-C9 10/11/2000 0.5 ft	1160-A8CW-1-E A8CW-1-E 11/9/2000 0-2 ft	1160-A8CW-1-N A8CW-1-N 11/9/2000 0-2 ft	1160-A8CW-1-S A8CW-1-S 11/9/2000 0-2 ft
Volatile Organic Compounds (mg/kg)														
1,1,1,2-Tetrachloroethane						0.13 U			0.34 U					
1,1,1-Trichloroethane						0.13 U			0.34 U					
1,1,2,2-Tetrachloroethane						0.13 U			0.34 U					
1,1,2-Trichloro-1,2,2-Trifluoroethane														
1,1,2-Trichloroethane						0.13 U			0.34 U					
1,1-Dichloroethane						0.13 U			0.34 U					
1,1-Dichloroethene						0.13 U			0.34 U					
1,1-Dichloropropene						0.13 U			0.34 U					
1,2,3-Trichlorobenzene						0.13 U			0.34 U					
1,2,3-Trichloropropane						0.13 U			0.34 U					
1,2,4-Trichlorobenzene						0.13 U			0.34 U					
1,2,4-Trimethylbenzene						0.13 U			0.34 U					
1,2-Dibromo-3-chloropropane						0.13 U			0.34 U					
1,2-Dibromoethane						0.13 U			0.34 U					
1,2-Dichlorobenzene						0.13 U			0.34 U					
1,2-Dichloroethane						0.13 U			0.34 U					
1,2-Dichloroethene (total)														
1,2-Dichloropropane						0.13 U			0.34 U					
1,3,5-Trimethylbenzene						0.13 U			0.34 U					
1,3-Dichlorobenzene						0.13 U			0.34 U					
1,3-Dichloropropane						0.13 U			0.34 U					
1,4-Dichlorobenzene						0.13 U			0.34 U					
1,4-Dioxane														
2,2-Dichloropropane						0.13 U			0.34 U					
2,4,4-Trimethyl-1-pentene						0.13 U			0.34 U					
2,4,4-Trimethyl-2-pentene						0.13 U			0.34 U					
2-Butanone						2.6 U			6.7 U					
2-Chlorotoluene						0.13 U			0.34 U					
2-Hexanone						0.52 U			1.3 U					
4-Chlorotoluene						0.13 U			0.34 U					
4-iso-Propyltoluene						0.13 U			0.34 U					
4-Methyl-2-pentanone						0.52 U			1.3 U					
Acetaldehyde														
Acetic acid, methyl ester														
Acetone						2.6 U			6.7 U					
Benzene						0.13 U			0.34 U					
Bromobenzene						0.13 U			0.34 U					
Bromochloromethane						0.13 U			0.34 U					
Bromodichloromethane						0.13 U			0.34 U					
Bromoform						0.13 U			0.34 U					
Bromomethane						0.26 U			0.67 U					
Butane, 2-methoxy-2-methyl-														
Carbon disulfide														
Carbon tetrachloride						0.13 U			0.34 U					
Chlorobenzene						0.13 U			0.34 U					
Chlorodibromomethane						0.13 U			0.34 U					
Chloroethane						0.26 U			0.67 U					
Chloroform						0.13 U			0.34 U					
Chloromethane						0.26 U			0.67 U					
Cis-1,2-Dichloroethene						0.13 U			0.34 U					
cis-1,3-Dichloropropene						0.13 U			0.34 U					
Cyclohexane														
Dibromomethane						0.13 U			0.34 U					

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C48N SD-C48N 5/14/2001 0.26-0.76 ft	1140-SD-C48S SD-C48S 5/14/2001 0.66-1.16 ft	1140-SD-C49N SD-C49N 5/14/2001 - 0.04-0.46 ft	1140-SD-C50N SD-C50N 5/14/2001 0.06-0.56 ft	1140-SD-C51N SD-C51N 5/14/2001 0.56-1..06 ft	1140-SD-C52N SD-C52N 5/14/2001 0.56-1.06 ft	1140-SD-C53N SD-C53N 5/15/2001 0.63-1.13 ft	1140-SD-C54S SD-C54S 5/15/2001 0.53-1.03 ft	1140-SD-C6 SD-C6 10/11/2000 0.48 ft	1140-SD-C7 SD-C7 10/11/2000 0.49-0.49 ft	1140-SD-C9 SD-C9 10/11/2000 0.5 ft	1160-A8CW-1-E A8CW-1-E 11/9/2000 0-2 ft	1160-A8CW-1-N A8CW-1-N 11/9/2000 0-2 ft	1160-A8CW-1-S A8CW-1-S 11/9/2000 0-2 ft
Dichlorodifluoromethane														
Diethyl ether														
Ethyl benzene						0.13 U			0.34 U					
Ethyl-t-Butyl Ether														
Formaldehyde														
Hexachlorobutadiene						0.13 U			0.34 U					
Isopropyl ether														
Isopropylbenzene						0.13 U			0.34 U					
Methyl cyclohexane														
Methyl Tertbutyl Ether						0.13 U			0.34 U					
Methylene chloride						0.26 U			0.34 U					
Naphthalene						1.3 U			3.4 U					
n-Butylbenzene						0.13 U			0.34 U					
Propylbenzene						0.13 U			0.34 U					
sec-Butylbenzene						0.13 U			0.34 U					
Styrene						0.13 U			0.34 U					
tert-Butylbenzene						0.13 U			0.34 U					
Tetrachloroethene						0.13 U			0.34 U					
Tetrahydrofuran														
Toluene						0.13 U			0.34 U					
trans-1,2-Dichloroethene						0.13 U			0.34 U					
trans-1,3-Dichloropropene						0.13 U			0.34 U					
Trichloroethene						0.13 U			0.34 U					
Trichlorofluoromethane						0.13 U			0.34 U					
Vinyl acetate														
Vinyl chloride						0.26 U			0.67 U					
Xylene, o						0.13 U			0.34 U					
Xylenes (m&p)						0.13 U			0.34 U					
Xylenes, Total						0.13 U			0.34 U					
Semivolatile Organic Compounds (mg/kg)														
1,2,4,5-Tetrachlorobenzene														
1,2,4-Trichlorobenzene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
1,2-Dichlorobenzene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
1,2-Diphenylhydrazine								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
1,3-Dichlorobenzene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
1,4-Dichlorobenzene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
1-Methylnaphthalene														
2,2'-Dichlorodiisopropylether								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,3,4,6-Tetrachlorophenol														
2,4,5-Trichlorophenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,4,6-Trichlorophenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,4-Dichlorophenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,4-Dimethylphenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,4-Dinitrophenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,4-Dinitrotoluene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2,6-Dinitrotoluene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2-Chloronaphthalene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2-Chlorophenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2-Methylnaphthalene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2-Methylphenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
2-Nitroaniline								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
2-Nitrophenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
3 & 4 Methylphenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
3,3'-Dichlorobenzidine								1.6 U	18 U	1.6 U	1.2 U	1 U	0.91 U	0.83 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C48N SD-C48N 5/14/2001 0.26-0.76 ft	1140-SD-C48S SD-C48S 5/14/2001 0.66-1.16 ft	1140-SD-C49N SD-C49N 5/14/2001 - 0.04-0.46 ft	1140-SD-C50N SD-C50N 5/14/2001 0.06-0.56 ft	1140-SD-C51N SD-C51N 5/14/2001 0.56-1..06 ft	1140-SD-C52N SD-C52N 5/14/2001 0.56-1.06 ft	1140-SD-C53N SD-C53N 5/15/2001 0.63-1.13 ft	1140-SD-C54S SD-C54S 5/15/2001 0.53-1.03 ft	1140-SD-C6 SD-C6 10/11/2000 0.48 ft	1140-SD-C7 SD-C7 10/11/2000 0.49-0.49 ft	1140-SD-C9 SD-C9 10/11/2000 0.5 ft	1160-A8CW-1-E A8CW-1-E 11/9/2000 0-2 ft	1160-A8CW-1-N A8CW-1-N 11/9/2000 0-2 ft	1160-A8CW-1-S A8CW-1-S 11/9/2000 0-2 ft
3-Nitroaniline								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
4,6-Dinitro-2-methylphenol								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
4-Bromophenyl phenyl ether								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
4-Chloro-3-methylphenol								1.6 U	18 U	1.6 U	1.2 U	1 U	0.91 U	0.83 U
4-Chloroaniline								1.6 U	18 U	1.6 U	1.2 U	1 U	0.91 U	0.83 U
4-Chlorophenyl phenyl ether								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
4-Methylphenol														
4-Nitroaniline								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
4-Nitrophenol								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
Acenaphthene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Acenaphthylene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Acetophenone														
Aniline								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
Anthracene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Atrazine														
Azobenzene														
Benzaldehyde														
Benzo(a)anthracene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Benzo(a)pyrene								0.82 U		0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Benzo(b)fluoranthene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Benzo(ghi)perylene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Benzo(k)fluoranthene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Benzoic Acid								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
Benzyl alcohol								1.6 U	18 U	1.6 U	1.2 U	1 U	0.91 U	0.83 U
Biphenyl														
Bis(2-Chloroethoxy)methane								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Bis(2-Chloroethyl)ether								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Bis(2-Chloroisopropyl)ether														
Bis(2-Ethylhexyl)phthalate								1.1	110	9.5	0.42 J	0.79	0.33 J	0.29 J
Butylbenzylphthalate								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Caprolactam														
Carbazole														
Chrysene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Dibenz(a,h)anthracene								0.82 U		0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Dibenzofuran								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Diethylphthalate								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Dimethylphthalate								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Di-n-butylphthalate								0.82 U	8.8 U	0.78 U	0.6 U	0.31 J	0.3 J	0.41 U
Di-n-octylphthalate								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Diphenyl ether														
Diphenylamine														
Diphenylmethanone														
Fluoranthene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Fluorene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Hexachlorobenzene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Hexachlorobutadiene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Hexachlorocyclopentadiene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Hexachloroethane								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Indeno(1,2,3-cd)pyrene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Isophorone								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Naphthalene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Nitrobenzene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
N-Nitrosodimethylamine														
N-Nitrosodi-n-propylamine								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C48N SD-C48N 5/14/2001 0.26-0.76 ft	1140-SD-C48S SD-C48S 5/14/2001 0.66-1.16 ft	1140-SD-C49N SD-C49N 5/14/2001 - 0.04-0.46 ft	1140-SD-C50N SD-C50N 5/14/2001 0.06-0.56 ft	1140-SD-C51N SD-C51N 5/14/2001 0.56-1..06 ft	1140-SD-C52N SD-C52N 5/14/2001 0.56-1.06 ft	1140-SD-C53N SD-C53N 5/15/2001 0.63-1.13 ft	1140-SD-C54S SD-C54S 5/15/2001 0.53-1.03 ft	1140-SD-C6 SD-C6 10/11/2000 0.48 ft	1140-SD-C7 SD-C7 10/11/2000 0.49-0.49 ft	1140-SD-C9 SD-C9 10/11/2000 0.5 ft	1160-A8CW-1-E A8CW-1-E 11/9/2000 0-2 ft	1160-A8CW-1-N A8CW-1-N 11/9/2000 0-2 ft	1160-A8CW-1-S A8CW-1-S 11/9/2000 0-2 ft
N-Nitrosodiphenylamine								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Pentachlorophenol								4.1 U	44 U	3.9 U	3 U	2.6 U	2.3 U	2.1 U
Phenanthrene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Phenol								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
Pyrene								0.82 U	8.8 U	0.78 U	0.6 U	0.51 U	0.45 U	0.41 U
EPH (mg/kg)														
C11-C22 Aromatics														
C11-C22 Aromatics (unadj.)														
C19-C36 Aliphatics														
C9-C18 Aliphatics														
Extractable Petroleum Hydrocarbons, Total														
Pesticides (mg/kg)														
4,4'-DDD									0.13 U			0.015 U	0.013 U	0.012 U
4,4'-DDE									0.13 U			0.015 U	0.013 U	0.012 U
4,4'-DDT									0.13 U			0.021	0.013 U	0.012 U
Aldrin									0.13 U			0.015 U	0.013 U	0.012 U
Alpha-BHC									0.13 U			0.015 U	0.013 U	0.012 U
Alpha-Chlordane														
Aroclor-1016														
Aroclor-1221														
Aroclor-1232														
Aroclor-1242														
Aroclor-1248														
Aroclor-1254														
Aroclor-1260														
Beta-BHC									0.33 U			0.015 U	0.013 U	0.012 U
Chlordane									0.66 U			0.074 U	0.066 U	0.058 U
Chlordane (technical)														
Delta-BHC									0.13 U			0.015 U	0.013 U	0.012 U
Dieldrin									0.13 U			0.015 U	0.013 U	0.012 U
Endosulfan I									0.13 U			0.015 U	0.013 U	0.012 U
Endosulfan II									0.13 U			0.015 U	0.013 U	0.012 U
Endosulfan sulfate									0.13 U			0.015 U	0.013 U	0.012 U
Endrin									0.13 U			0.015 U	0.013 U	0.012 U
Endrin aldehyde									0.2 U			0.015 U	0.013 U	0.012 U
Endrin ketone														
Gamma-BHC/Lindane									0.13 U			0.015 U	0.013 U	0.012 U
Heptachlor									0.13 U			0.015 U	0.013 U	0.012 U
Heptachlor epoxide									0.13 U			0.015 U	0.013 U	0.012 U
Hexachlorobenzene														
Methoxychlor									0.66 U			0.03 U	0.026 U	0.023 U
Toxaphene									4.6 U			0.15 U	0.13 U	0.12 U
Metals (mg/kg)														
Aluminum									9800					
Antimony														
Arsenic									10					
Barium														
Beryllium														
Cadmium									1			0.4 U	0.3 U	0.3 U
Calcium														
Chromium	150	240	8.3	2400	5.7	74	320	72	200	19	13	250	740	170
Chromium, Hexavalent														
Cobalt														
Copper														

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1140-SD-C48N SD-C48N 5/14/2001 0.26-0.76 ft	1140-SD-C48S SD-C48S 5/14/2001 0.66-1.16 ft	1140-SD-C49N SD-C49N 5/14/2001 - 0.04-0.46 ft	1140-SD-C50N SD-C50N 5/14/2001 0.06-0.56 ft	1140-SD-C51N SD-C51N 5/14/2001 0.56-1..06 ft	1140-SD-C52N SD-C52N 5/14/2001 0.56-1.06 ft	1140-SD-C53N SD-C53N 5/15/2001 0.63-1.13 ft	1140-SD-C54S SD-C54S 5/15/2001 0.53-1.03 ft	1140-SD-C6 SD-C6 10/11/2000 0.48 ft	1140-SD-C7 SD-C7 10/11/2000 0.49-0.49 ft	1140-SD-C9 SD-C9 10/11/2000 0.5 ft	1160-A8CW-1-E A8CW-1-E 11/9/2000 0-2 ft	1160-A8CW-1-N A8CW-1-N 11/9/2000 0-2 ft	1160-A8CW-1-S A8CW-1-S 11/9/2000 0-2 ft
Iron									9100					
Lead									50			7.3	12	8.8
Magnesium														
Manganese														
Mercury									0.25					
Nickel														
Potassium														
Selenium									3 U					
Silver														
Sodium														
Thallium														
Tin														
Vanadium														
Zinc														
Inorganics (mg/kg)														
Chloride														
Cyanide, Available														
Cyanide, Total														
Nitrogen, as Ammonia														
Oxidation Reduction Potential (mV)														
Percent Moisture (%)														
Percent Solids (%)	59.4	30.8	78.5	61.9	85.2	93.3	83.4	80.4	37.7	84.9	55.4	64.3	72.3	80.5
Percent Solids, Residual (%)														
pH (units)														
Sulfate														
Total Organic Carbon														
Total Organic Carbon (%)														
Specialty Compounds (mg/kg)														
Hydrazine														
Monomethylhydrazine (MMH)														
UDMH														
Dimethylformamide														
Phthalic Acid/Phthalic anhydride														

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1160-A8CW-1-W A8CW-1-W 11/9/2000 0-2 ft	97598-DB-C1 DB-C1 8/10/2000 0.7 ft	A8CW-2 A8CW-2 12/16/1996 0-1 ft	A8CW-3 A8CW-3 12/16/1996 0-1 ft	A8CW-4 A8CW-4 12/16/1996 0-1 ft	A9CW-(COMP) A9CW-(COMP) 12/16/1996 0-1 ft	A9CW-1 A9CW-1 12/16/1996 0-1 ft	A9CW-2 A9CW-2 12/16/1996 0-1 ft	A9CW-3 A9CW-3 12/16/1996 0-1 ft	A9CW-4 A9CW-4 12/16/1996 0-1 ft	AREA 09 AREA-9 7/9/1991 0-1 ft	AREA 1-6 AREA-1-6 12/15/1996 0-1 ft	AREA8-2 AREA-8-2 12/16/1996 0-1 ft	AREA8-3 AREA-8-3 12/16/1996 0-1 ft	BS015SDX BS015 1/21/1997 0-0 ft
Volatile Organic Compounds (mg/kg)															
1,1,1,2-Tetrachloroethane		0.068 U													
1,1,1-Trichloroethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.071	0.007 U	0.006 UJ	0.012	0.016	0.006 U	
1,1,2,2-Tetrachloroethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,1-Dichloroethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,1-Dichloroethene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,1-Dichloropropene		0.068 U													
1,2,3-Trichlorobenzene		0.068 U													
1,2,3-Trichloropropane		0.068 U													
1,2,4-Trichlorobenzene		0.098													
1,2,4-Trimethylbenzene		0.21													
1,2-Dibromo-3-chloropropane		0.14 U													
1,2-Dibromoethane		0.068 U													
1,2-Dichlorobenzene		0.068 U													
1,2-Dichloroethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,2-Dichloroethene (total)			0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,2-Dichloropropane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
1,3,5-Trimethylbenzene		0.13													
1,3-Dichlorobenzene		0.068 U													
1,3-Dichloropropane		0.068 U													
1,4-Dichlorobenzene		0.068 U													
1,4-Dioxane															
2,2-Dichloropropane		0.068 U													
2,4,4-Trimethyl-1-pentene		U	0.006 UJ	0.006 UJ	0.002 J		0.01 UJ	0.007 UJ	0.007 UJ	0.007 UJ	0.012 U	0.008 U	0.006 UJ	0.006 UJ	
2,4,4-Trimethyl-2-pentene		U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.012 U	0.008 U	0.006 U	0.006 U	
2-Butanone		0.68 U	0.013 U	0.013 U	0.014 U		0.021 U	0.013 U	0.013 U	0.014 U	0.018 UJ	0.015 U	0.013 U	0.013 U	
2-Chlorotoluene		0.068 U													
2-Hexanone		0.68 U	0.013 UJ	0.013 UJ	0.014 UJ		0.021 UJ	0.013 UJ	0.013 UJ	0.014 UJ	0.018 UJ	0.015 U	0.013 UJ	0.013 UJ	
4-Chlorotoluene		0.068 U													
4-iso-Propyltoluene		0.068 U													
4-Methyl-2-pentanone		0.68 U	0.013 U	0.013 U	0.014 U		0.021 U	0.013 U	0.013 U	0.014 U	0.018 UJ	0.015 U	0.013 U	0.013 U	
Acetaldehyde															
Acetic acid, methyl ester															
Acetone		0.68 U	0.054 U	0.018 U	0.012 U		0.022 U	0.013 U	0.013 U	0.026 U	0.018 UJ	0.015 U	0.017 U	0.009 U	
Benzene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Bromobenzene		0.068 U													
Bromochloromethane		0.068 U													
Bromodichloromethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Bromoform		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Bromomethane		0.14 U	0.013 U	0.013 U	0.014 U		0.021 U	0.013 U	0.013 U	0.014 U	0.012 UJ	0.015 U	0.013 U	0.013 U	
Butane, 2-methoxy-2-methyl-															
Carbon disulfide		0.14 U	0.006 UJ	0.006 UJ	0.007 UJ		0.01 UJ	0.007 UJ	0.007 UJ	0.007 UJ	0.012 UJ	0.008 U	0.006 U	0.006 U	
Carbon tetrachloride		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Chlorobenzene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Chlorodibromomethane		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Chloroethane		0.14 U	0.013 UJ	0.013 UJ	0.014 UJ		0.021 UJ	0.013 UJ	0.013 UJ	0.014 UJ	0.012 UJ	0.015 U	0.013 UJ	0.013 UJ	
Chloroform		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Chloromethane		0.14 U	0.013 U	0.013 U	0.014 U		0.021 U	0.013 U	0.013 U	0.014 U	0.012 UJ	0.015 U	0.013 U	0.013 U	
Cis-1,2-Dichloroethene		0.068 U													
cis-1,3-Dichloropropene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Cyclohexane															
Dibromomethane		0.068 U													

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1160-A8CW-1-W A8CW-1-W 11/9/2000 0-2 ft	97598-DB-C1 DB-C1 8/10/2000 0.7 ft	A8CW-2 A8CW-2 12/16/1996 0-1 ft	A8CW-3 A8CW-3 12/16/1996 0-1 ft	A8CW-4 A8CW-4 12/16/1996 0-1 ft	A9CW-(COMP) A9CW-(COMP) 12/16/1996 0-1 ft	A9CW-1 A9CW-1 12/16/1996 0-1 ft	A9CW-2 A9CW-2 12/16/1996 0-1 ft	A9CW-3 A9CW-3 12/16/1996 0-1 ft	A9CW-4 A9CW-4 12/16/1996 0-1 ft	AREA 09 AREA-9 7/9/1991 0-1 ft	AREA 1-6 AREA-1-6 12/15/1996 0-1 ft	AREA8-2 AREA-8-2 12/16/1996 0-1 ft	AREA8-3 AREA-8-3 12/16/1996 0-1 ft	BS015SDX BS015 1/21/1997 0-0 ft
Dichlorodifluoromethane		0.14 U													
Diethyl ether															
Ethyl benzene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene		0.068 U													
Isopropyl ether															
Isopropylbenzene		0.068 U													
Methyl cyclohexane															
Methyl Tertbutyl Ether		0.068 U													
Methylene chloride		0.44 B	0.004 U	0.005 U	0.005 U		0.008 U	0.005 U	0.007 U	0.004 U	0.041 UJ	0.002 J	0.006 U	0.006 U	
Naphthalene		0.14 U													
n-Butylbenzene		0.068 U													
Propylbenzene		0.068 U													
sec-Butylbenzene		0.068 U													
Styrene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
tert-Butylbenzene		0.068 U													
Tetrachloroethene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Tetrahydrofuran															
Toluene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.004 J	0.008 U	0.006 U	0.006 U	
trans-1,2-Dichloroethene		0.068 U													
trans-1,3-Dichloropropene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Trichloroethene		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Trichlorofluoromethane		0.068 U													
Vinyl acetate			0.013 U	0.013 U	0.014 U		0.021 U	0.013 U	0.013 U	0.014 U	0.018 UJ	0.015 U	0.013 U	0.013 U	
Vinyl chloride		0.068 U	0.013 U	0.013 U	0.014 U		0.021 U	0.013 U	0.013 U	0.014 U	0.012 UJ	0.015 U	0.013 U	0.013 U	
Xylene, o		0.068 U													
Xylenes (m&p)		0.068 U													
Xylenes, Total		0.068 U	0.006 U	0.006 U	0.007 U		0.01 U	0.007 U	0.007 U	0.007 U	0.006 UJ	0.008 U	0.006 U	0.006 U	
Semivolatile Organic Compounds (mg/kg)															
1,2,4,5-Tetrachlorobenzene															
1,2,4-Trichlorobenzene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
1,2-Dichlorobenzene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
1,2-Diphenylhydrazine	0.44 U	0.31 U													
1,3-Dichlorobenzene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
1,4-Dichlorobenzene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
1-Methylnaphthalene															
2,2'-Dichlorodiisopropylether	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol	0.44 U	0.31 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
2,4,6-Trichlorophenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2,4-Dichlorophenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2,4-Dimethylphenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2,4-Dinitrophenol	0.44 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
2,4-Dinitrotoluene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2,6-Dinitrotoluene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2-Chloronaphthalene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2-Chlorophenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2-Methylnaphthalene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.038 J		0.5 U	0.5 U	32 U
2-Methylphenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
2-Nitroaniline	2.2 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
2-Nitrophenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
3 & 4 Methylphenol	0.44 U														
3,3'-Dichlorobenzidine	0.88 U	0.31 U	1.1 U	0.87 U	0.87 U	1.2 U					1.6 U		1 U	1 U	65 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1160-A8CW-1-W A8CW-1-W 11/9/2000 0-2 ft	97598-DB-C1 DB-C1 8/10/2000 0.7 ft	A8CW-2 A8CW-2 12/16/1996 0-1 ft	A8CW-3 A8CW-3 12/16/1996 0-1 ft	A8CW-4 A8CW-4 12/16/1996 0-1 ft	A9CW-(COMP) A9CW-(COMP) 12/16/1996 0-1 ft	A9CW-1 A9CW-1 12/16/1996 0-1 ft	A9CW-2 A9CW-2 12/16/1996 0-1 ft	A9CW-3 A9CW-3 12/16/1996 0-1 ft	A9CW-4 A9CW-4 12/16/1996 0-1 ft	AREA 09 AREA-9 7/9/1991 0-1 ft	AREA 1-6 AREA-1-6 12/15/1996 0-1 ft	AREA8-2 AREA-8-2 12/16/1996 0-1 ft	AREA8-3 AREA-8-3 12/16/1996 0-1 ft	BS015SDX BS015 1/21/1997 0-0 ft
3-Nitroaniline	2.2 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
4,6-Dinitro-2-methylphenol	2.2 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
4-Bromophenyl phenyl ether	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
4-Chloro-3-methylphenol	0.88 U	0.63 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
4-Chloroaniline	0.88 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
4-Chlorophenyl phenyl ether	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
4-Methylphenol		0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
4-Nitroaniline	2.2 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
4-Nitrophenol	2.2 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					3.8 U		2.4 U	2.4 U	160 U
Acenaphthene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Acenaphthylene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Acetophenone															
Aniline	2.2 U														
Anthracene	0.44 U	0.31 U	0.56 U	0.011 J	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene	0.44 U	0.31 U	0.56 U	0.015 J	0.43 U	0.58 U					0.1 J		0.5 U	0.5 U	
Benzo(a)pyrene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.094 J		0.5 U	0.5 U	
Benzo(b)fluoranthene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.17 J		0.046 J	0.5 U	
Benzo(ghi)perylene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.082 J		0.5 U	0.5 U	32 U
Benzo(k)fluoranthene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.051 J		0.036 J	0.5 U	32 U
Benzoic Acid	2.2 U	0.63 U	2.7 U	0.07 J	2.1 U	2.8 U					0.22 J		0.21 J	2.4 U	160 U
Benzyl alcohol	0.88 U	0.63 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Biphenyl															
Bis(2-Chloroethoxy)methane	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Bis(2-Chloroethyl)ether	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate	0.55	2.4 B	0.13 J	0.09 J	0.43 U	0.19 J					0.24 J		0.5 U	0.5 U	200 B
Butylbenzylphthalate	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Caprolactam															
Carbazole		0.31 U													
Chrysene	0.44 U	0.31 U	0.56 U	0.015 J	0.43 U	0.58 U					0.19 J		0.5 U	0.5 U	32 U
Dibenz(a,h)anthracene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	
Dibenzofuran	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Diethylphthalate	0.44 U	0.31 U	0.56 U	0.021 U	0.43 U	0.58 U					0.021 J		0.5 U	0.5 U	32 U
Dimethylphthalate	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Di-n-butylphthalate	0.24 J	0.31 U	0.56 U	0.04 U	0.04 U	0.065 U					0.79 U		0.046 U	0.5 U	0.4 JB
Di-n-octylphthalate	0.44 U	0.31 U	0.56 U	0.012 J	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene	0.44 U	0.31 U	0.56 U	0.027 J	0.43 U	0.58 U					0.28 J		0.056 J	0.5 U	32 U
Fluorene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Hexachlorobenzene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Hexachlorobutadiene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Hexachlorocyclopentadiene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Hexachloroethane	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Indeno(1,2,3-cd)pyrene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.11 J		0.5 U	0.5 U	
Isophorone	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Naphthalene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.027 J		0.5 U	0.5 U	32 U
Nitrobenzene	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1160-A8CW-1-W A8CW-1-W 11/9/2000 0-2 ft	97598-DB-C1 DB-C1 8/10/2000 0.7 ft	A8CW-2 A8CW-2 12/16/1996 0-1 ft	A8CW-3 A8CW-3 12/16/1996 0-1 ft	A8CW-4 A8CW-4 12/16/1996 0-1 ft	A9CW-(COMP) A9CW-(COMP) 12/16/1996 0-1 ft	A9CW-1 A9CW-1 12/16/1996 0-1 ft	A9CW-2 A9CW-2 12/16/1996 0-1 ft	A9CW-3 A9CW-3 12/16/1996 0-1 ft	A9CW-4 A9CW-4 12/16/1996 0-1 ft	AREA 09 AREA-9 7/9/1991 0-1 ft	AREA 1-6 AREA-1-6 12/15/1996 0-1 ft	AREA8-2 AREA-8-2 12/16/1996 0-1 ft	AREA8-3 AREA-8-3 12/16/1996 0-1 ft	BS015SDX BS015 1/21/1997 0-0 ft
N-Nitrosodiphenylamine	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	2.8 J
Pentachlorophenol	2.2 U	0.63 U	2.7 U	2.1 U	2.1 U	2.8 U					0.79 U		2.4 U	2.4 U	160 U
Phenanthrene	0.44 U	0.31 U	0.56 U	0.03 J	0.43 U	0.58 U					0.18 J		0.5 U	0.5 U	32 U
Phenol	0.44 U	0.31 U	0.56 U	0.43 U	0.43 U	0.58 U					0.79 U		0.5 U	0.5 U	32 U
Pyrene	0.44 U	0.31 U	0.56 U	0.024 J	0.43 U	0.58 U					0.17 J		0.048 J	0.5 U	32 U
EPH (mg/kg)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															
Pesticides (mg/kg)															
4,4'-DDD	0.013 U	0.02 U	0.0056 U	0.0042 U	0.0043 U	0.0005 J					0.038 UJ		0.005 U	0.0044 U	0.065 U
4,4'-DDE	0.013 U	0.02 U	0.00089 J	0.00069 J	0.00064 J	0.0016 J					0.038 UJ		0.0014 J	0.00053 J	0.065 U
4,4'-DDT	0.027	0.02 U	0.0017 J	0.0016 J	0.0024 J	0.003 J					0.038 UJ		0.0014 J	0.0023 J	0.065 U
Aldrin	0.013 U	0.0099 U	0.0029 U	0.0022 U	0.0022 U	0.0019 J					0.019 UJ		0.0026 U	0.0023 U	0.033 U
Alpha-BHC	0.013 U	0.0099 U	0.0011 J	0.0022 UJ	0.0022 UJ	0.003 U					0.019 UJ		0.0026 U	0.0002 J	0.0058 J
Alpha-Chlordane		0.0099 U	0.0029 U	0.0022 U	0.0022 U	0.003 U					0.19 UJ		0.0026 U	0.0023 U	0.033 U
Aroclor-1016											0.19 UJ				
Aroclor-1221											0.19 UJ				
Aroclor-1232											0.19 UJ				
Aroclor-1242											0.19 UJ				
Aroclor-1248											0.19 UJ				
Aroclor-1254											0.38 UJ				
Aroclor-1260											0.38 UJ				
Beta-BHC	0.013 U	0.0099 U	0.0029 U	0.0022 UJ	0.0022 UJ	0.003 U					0.019 UJ		0.00013 J	0.0023 U	0.033 U
Chlordane	0.064 U	0.31 U													
Chlordane (technical)		0.036	0.0029 UJ	0.0022 UJ	0.0022 UJ	0.0052 J					0.19 UJ		0.0026 UJ	0.0023 UJ	0.033 U
Delta-BHC	0.013 U	0.031 #	0.0029 U	0.0022 U	0.0022 U	0.003 U					0.019 UJ		0.0026 U	0.0023 U	0.033 U
Dieldrin	0.013 U	0.02 U	0.0056 U	0.0013 J	0.0043 U	0.0058 U					0.038 UJ		0.0017 J	0.0013 J	0.065 U
Endosulfan I	0.013 U	0.0099 U	0.0029 U	0.0022 U	0.0022 U	0.0021 J					0.019 UJ		0.0026 U	0.0023 U	0.033 U
Endosulfan II	0.013 U	0.02 U	0.0056 U	0.0042 U	0.0043 U	0.0058 U					0.038 UJ		0.005 U	0.0044 U	0.065 U
Endosulfan sulfate	0.013 U	0.02 U	0.0056 UJ	0.0042 UJ	0.0043 UJ	0.0058 UJ					0.038 UJ		0.005 UJ	0.0044 UJ	0.065 U
Endrin	0.013 U	0.02 U	0.0056 U	0.0042 U	0.0043 U	0.0058 U					0.038 UJ		0.005 U	0.0044 U	0.065 U
Endrin aldehyde	0.013 U	0.02 U	0.0056 U	0.0042 U	0.0043 U	0.0058 U					0.019 UJ		0.005 U	0.0044 U	0.065 U
Endrin ketone		0.02 U	0.0056 UJ	0.0042 UJ	0.0043 UJ	0.0058 UJ					0.038 UJ		0.005 UJ	0.0044 UJ	0.065 U
Gamma-BHC/Lindane	0.013 U	0.13 F	0.00092 J	0.0022 U	0.0022 U	0.0052					0.019 UJ		0.0026 U	0.0023 U	0.033 U
Heptachlor	0.013 U	0.0099 U	0.0029 U	0.0022 U	0.0022 U	0.003 U					0.019 UJ		0.0026 U	0.0023 U	0.033 U
Heptachlor epoxide	0.013 U	0.0099 U	0.0029 U	0.0022 U	0.0022 U	0.003 U					0.019 UJ		0.000078 J	0.0023 U	0.033 U
Hexachlorobenzene															
Methoxychlor	0.025 U	0.099 U	0.029 UJ	0.022 UJ	0.022 UJ	0.03 UJ					0.19 UJ		0.026 UJ	0.023 UJ	0.33 U
Toxaphene	0.13 U	0.31 U	0.056 U	0.042 U	0.043 U	0.058 U					0.38 UJ		0.05 U	0.044 U	0.65 U
Metals (mg/kg)															
Aluminum					2400	2400					5600				3080
Antimony					1.2 U	1.7 U					20 U				1.3 U
Arsenic					3 J	3 J					9.8				4.4
Barium					10 []	20 []					22				17.7 B
Beryllium					0.2 U	0.28 U					1.5 U				0.33 U
Cadmium	0.3 U	1.5 U			0.2 U	0.28 U					1 U				0.33 U
Calcium					340 []	470 []					910				258 B
Chromium	140	27	25	4.3	34	38					23		4.5	520	200
Chromium, Hexavalent															
Cobalt					1.1 []	1.4 []					2.1				1 B
Copper					1.1 []	6 []					22				6.2 B

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1160-A8CW-1-W A8CW-1-W 11/9/2000 0-2 ft	97598-DB-C1 DB-C1 8/10/2000 0.7 ft	A8CW-2 A8CW-2 12/16/1996 0-1 ft	A8CW-3 A8CW-3 12/16/1996 0-1 ft	A8CW-4 A8CW-4 12/16/1996 0-1 ft	A9CW-(COMP) A9CW-(COMP) 12/16/1996 0-1 ft	A9CW-1 A9CW-1 12/16/1996 0-1 ft	A9CW-2 A9CW-2 12/16/1996 0-1 ft	A9CW-3 A9CW-3 12/16/1996 0-1 ft	A9CW-4 A9CW-4 12/16/1996 0-1 ft	AREA 09 AREA-9 7/9/1991 0-1 ft	AREA 1-6 AREA-1-6 12/15/1996 0-1 ft	AREA8-2 AREA-8-2 12/16/1996 0-1 ft	AREA8-3 AREA-8-3 12/16/1996 0-1 ft	BS015SDX BS015 1/21/1997 0-0 ft
Iron					2900	2400					9500				3240 *
Lead	7.5	7.6 U			6.3	17					210				24.2
Magnesium					510 []	130 []					1200				200 B
Manganese					18	6.8					76				9.3
Mercury					0.089 UN	0.18 UN					0.12				0.15
Nickel					2.3 []	3.9 []					7.6				5.1 B
Potassium					120 []	87 []					350				148 BE
Selenium					0.99 UN	1.4 UN					0.5 U				1.5 B
Silver					R	R					1.5 U				1.3 U
Sodium					73 []	120 []					34				197 BE
Thallium					1.6 UJ	2.2 UJ					0.8				2.3 U
Tin															
Vanadium					7.1 []	6.4 []					34				9.8 B
Zinc					11	15					72				8.3 E
Inorganics (mg/kg)															
Chloride											56 J				
Cyanide, Available															
Cyanide, Total											2 UJ				
Nitrogen, as Ammonia			301	94.9	73.1	168					27		215	154	
Oxidation Reduction Potential (mV)															
Percent Moisture (%)		22.6													
Percent Solids (%)	73.7														
Percent Solids, Residual (%)											83 J	79			
pH (units)															
Sulfate			290	150	290	400					83 J		290	320	
Total Organic Carbon															
Total Organic Carbon (%)															
Specialty Compounds (mg/kg)															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS016SMD BS016 1/21/1997 0-0 ft	BS018PND BS018 1/21/1997 0-0 ft	BS019WMD BS019 1/21/1997 0-0 ft	BS020WMD BS020 1/21/1997 0-0 ft	BS041LSD BS041 8/22/2005 0-0.5 ft	BS042LSD BS042 8/22/2005 0-0.5 ft	BS043LSD BS043 8/22/2005 0-0.5 ft	BS044LSD BS044 8/23/2005 0-0.5 ft	BS045LSD BS045 8/23/2005 0-0.5 ft	CPDA-5 CPDA-5 12/16/1996 0-1 ft	CPDA-8 CPDA-8 12/16/1996 0-1 ft	OC-SB-473-0.0/1.0-XXX SB-473 9/18/2009 0-1 ft	OC-SS-414-0.0/1.0-XXX SS-414 9/15/2009 0-1 ft	OC-SS-418-0.0/1.0-XXX SS-418 9/15/2009 0-1 ft	OC-SS-427-0.0/1.0-XXX SS-427 9/16/2009 0-1 ft
Volatile Organic Compounds (mg/kg)															
1,1,1,2-Tetrachloroethane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,1,1-Trichloroethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,1,2,2-Tetrachloroethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,1,2-Trichloro-1,2,2-Trifluoroethane												0.018 U	0.013 U	0.014 U	0.017 U
1,1,2-Trichloroethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,1-Dichloroethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,1-Dichloroethene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,1-Dichloropropene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2,3-Trichlorobenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2,3-Trichloropropane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2,4-Trichlorobenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2,4-Trimethylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2-Dibromo-3-chloropropane												0.036 U	0.026 U	0.028 U	0.034 U
1,2-Dibromoethane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2-Dichlorobenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2-Dichloroethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,2-Dichloroethene (total)										0.007 U	0.007 U				
1,2-Dichloropropane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,3,5-Trimethylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,3-Dichlorobenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,3-Dichloropropane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,4-Dichlorobenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
1,4-Dioxane												0.36 UJ	0.26 UJ	0.28 UJ	0.34 UJ
2,2-Dichloropropane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
2,4,4-Trimethyl-1-pentene										0.007 UJ	0.007 UJ	0.0073 U	0.0052 U	0.0055 U	0.0069 U
2,4,4-Trimethyl-2-pentene										0.007 U	0.007 U	0.0073 U	0.0052 U	0.0055 U	0.0069 U
2-Butanone										0.013 U	0.014 U	0.036 U	0.026 U	0.028 U	0.034 U
2-Chlorotoluene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
2-Hexanone										0.013 UJ	0.014 UJ	0.036 U	0.026 U	0.028 U	0.034 U
4-Chlorotoluene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
4-iso-Propyltoluene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
4-Methyl-2-pentanone										0.013 U	0.014 U	0.036 U	0.026 U	0.028 U	0.034 U
Acetaldehyde												0.24 U			0.24 U
Acetic acid, methyl ester												0.073 U	0.052 U	0.055 U	0.069 U
Acetone										0.006 U	0.007 U	0.36 UJ	0.26 UJ	0.28 UJ	0.34 UJ
Benzene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Bromobenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Bromochloromethane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Bromodichloromethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Bromoform										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Bromomethane										0.013 U	0.014 U	0.0073 U	0.0052 U	0.0055 U	0.0069 U
Butane, 2-methoxy-2-methyl-												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Carbon disulfide										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Carbon tetrachloride										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Chlorobenzene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Chlorodibromomethane										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Chloroethane										0.013 UJ	0.014 UJ	0.0073 U	0.0052 U	0.0055 U	0.0069 U
Chloroform										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Chloromethane										0.013 U	0.014 U	0.0073 U	0.0052 U	0.0055 U	0.0069 U
Cis-1,2-Dichloroethene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
cis-1,3-Dichloropropene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Cyclohexane												0.036 U	0.026 U	0.028 U	0.034 U
Dibromomethane												0.0036 U	0.0026 U	0.0028 U	0.0034 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS016SMD BS016 1/21/1997 0-0 ft	BS018PND BS018 1/21/1997 0-0 ft	BS019WMD BS019 1/21/1997 0-0 ft	BS020WMD BS020 1/21/1997 0-0 ft	BS041LSD BS041 8/22/2005 0-0.5 ft	BS042LSD BS042 8/22/2005 0-0.5 ft	BS043LSD BS043 8/22/2005 0-0.5 ft	BS044LSD BS044 8/23/2005 0-0.5 ft	BS045LSD BS045 8/23/2005 0-0.5 ft	CPDA-5 CPDA-5 12/16/1996 0-1 ft	CPDA-8 CPDA-8 12/16/1996 0-1 ft	OC-SB-473-0.0/1.0-XXX SB-473 9/18/2009 0-1 ft	OC-SS-414-0.0/1.0-XXX SS-414 9/15/2009 0-1 ft	OC-SS-418-0.0/1.0-XXX SS-418 9/15/2009 0-1 ft	OC-SS-427-0.0/1.0-XXX SS-427 9/16/2009 0-1 ft
Dichlorodifluoromethane												0.0073 UJ	0.0052 UJ	0.0055 UJ	0.0069 UJ
Diethyl ether												0.0036 UJ	0.0026 U	0.0028 U	0.0034 U
Ethyl benzene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Ethyl-t-Butyl Ether												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Formaldehyde												0.22 J			0.18
Hexachlorobutadiene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Isopropyl ether												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Isopropylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Methyl cyclohexane												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Methyl Tertbutyl Ether												0.0036 UJ	0.0026 U	0.0028 U	0.0034 U
Methylene chloride										0.007 U	0.007 U	0.015 U	0.01 U	0.011 U	0.014 U
Naphthalene												0.036 U	0.026 U	0.028 U	0.034 U
n-Butylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Propylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
sec-Butylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Styrene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
tert-Butylbenzene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Tetrachloroethene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Tetrahydrofuran												0.036 U	0.026 U	0.028 U	0.034 U
Toluene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
trans-1,2-Dichloroethene												0.0036 U	0.0026 U	0.0028 U	0.0034 U
trans-1,3-Dichloropropene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Trichloroethene										0.007 U	0.007 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Trichlorofluoromethane												0.0073 U	0.0052 U	0.0055 U	0.0069 U
Vinyl acetate										0.013 U	0.014 U				
Vinyl chloride										0.013 U	0.014 U	0.0036 U	0.0026 U	0.0028 U	0.0034 U
Xylene, o												0.0036 U	0.0026 U	0.0028 U	0.0034 U
Xylenes (m&p)												0.0073 U	0.0052 U	0.0055 U	0.0069 U
Xylenes, Total										0.007 U	0.007 U	0.0073 U	0.0052 U	0.0055 U	0.0069 U
Semivolatile Organic Compounds (mg/kg)															
1,2,4,5-Tetrachlorobenzene												0.41 U	0.35 U	0.036 U	0.039 U
1,2,4-Trichlorobenzene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
1,2-Dichlorobenzene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
1,2-Diphenylhydrazine															
1,3-Dichlorobenzene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
1,4-Dichlorobenzene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
1-Methylnaphthalene												0.41 U	0.35 U	0.036 U	0.039 U
2,2'-Dichlorodiisopropylether	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U				
2,3,4,6-Tetrachlorophenol												0.41 U	0.35 U	0.036 U	0.039 U
2,4,5-Trichlorophenol	24 U	2.1 U	2.4 U	2.3 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	3 U	2 U	0.41 U	0.35 U	0.036 U	0.039 U
2,4,6-Trichlorophenol	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2,4-Dichlorophenol	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2,4-Dimethylphenol	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2,4-Dinitrophenol	24 U	2.1 U	2.4 U	2.3 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	3 U	2 U	0.41 U	0.35 U	0.036 U	0.039 U
2,4-Dinitrotoluene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2,6-Dinitrotoluene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2-Chloronaphthalene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2-Chlorophenol	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2-Methylnaphthalene	5 U	0.007 J	0.49 U	0.48 U	0.4 UJ	0.49 U	0.63 U	0.75 UJ	0.75 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2-Methylphenol	5 U	0.02 J	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
2-Nitroaniline	24 U	2.1 U	2.4 U	2.3 U	4 UJ	4.9 U	6.3 U	7.5 UJ	7.5 UJ	3 U	2 U	2 U	1.8 U	0.18 U	0.2 U
2-Nitrophenol	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
3 & 4 Methylphenol					0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ			0.41 U	0.35 U	0.036 U	0.039 U
3,3'-Dichlorobenzidine	10 U	0.88 U	0.98 U	0.96 U	1.6 UJ	2 U	2.5 UJ	3 UJ	3 UJ	1.2 U	0.84 U	0.81 U	0.71 U	0.073 U	0.079 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS016SMD BS016 1/21/1997 0-0 ft	BS018PND BS018 1/21/1997 0-0 ft	BS019WMD BS019 1/21/1997 0-0 ft	BS020WMD BS020 1/21/1997 0-0 ft	BS041LSD BS041 8/22/2005 0-0.5 ft	BS042LSD BS042 8/22/2005 0-0.5 ft	BS043LSD BS043 8/22/2005 0-0.5 ft	BS044LSD BS044 8/23/2005 0-0.5 ft	BS045LSD BS045 8/23/2005 0-0.5 ft	CPDA-5 CPDA-5 12/16/1996 0-1 ft	CPDA-8 CPDA-8 12/16/1996 0-1 ft	OC-SB-473-0.0/1.0-XXX SB-473 9/18/2009 0-1 ft	OC-SS-414-0.0/1.0-XXX SS-414 9/15/2009 0-1 ft	OC-SS-418-0.0/1.0-XXX SS-418 9/15/2009 0-1 ft	OC-SS-427-0.0/1.0-XXX SS-427 9/16/2009 0-1 ft
3-Nitroaniline	24 U	2.1 U	2.4 U	2.3 U	4 UJ	4.9 U	6.3 U	7.5 UJ	7.5 UJ	3 U	2 U	2 U	1.8 U	0.18 U	0.2 U
4,6-Dinitro-2-methylphenol	24 U	2.1 U	2.4 U	2.3 U	4 UJ	4.9 UJ	6.3 U	7.5 UJ	7.5 UJ	3 U	2 U	2 U	1.8 U	0.18 U	0.2 U
4-Bromophenyl phenyl ether	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
4-Chloro-3-methylphenol	5 U	0.44 U	0.49 U	0.48 U	1.6 UJ	2 UJ	2.5 U	3 UJ	3 UJ	0.61 U	0.42 U	0.81 U	0.71 U	0.073 U	0.079 U
4-Chloroaniline	5 U	0.44 U	0.49 U	0.48 U	1.6 UJ	2 U	2.5 U	3 UJ	3 UJ	0.61 U	0.42 U	0.81 U	0.71 U	0.073 U	0.079 U
4-Chlorophenyl phenyl ether	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
4-Methylphenol	5 U	0.44 U	0.49 U	0.48 U						0.61 U	0.42 U				
4-Nitroaniline	24 U	2.1 U	2.4 U	2.3 U	4 UJ	4.9 U	6.3 U	7.5 UJ	7.5 UJ	3 U	2 U	2 U	1.8 U	0.18 U	0.2 U
4-Nitrophenol	24 U	2.1 U	2.4 U	2.3 U	4 UJ	4.9 UJ	6.3 U	7.5 UJ	7.5 UJ	3 U	2 U	2 U	1.8 U	0.18 U	0.2 U
Acenaphthene	5 U	0.44 U	0.49 U	0.48 U	0.4 UJ	0.49 U	0.63 U	0.75 UJ	0.75 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Acenaphthylene	5 U	0.02 J	0.008 J	0.48 U	0.65 J	3.9	2.3	0.75 UJ	0.75 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Acetophenone					0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ			0.41 U	0.35 U	0.036 U	0.039 U
Aniline					4 UJ	4.9 U	6.3 U	7.5 UJ	7.5 UJ			0.41 UJ	0.35 UJ	0.036 UJ	0.039 UJ
Anthracene	0.035 J	0.013 J	0.005 J	0.48 U	0.063	0.054	0.045	0.048	0.073	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Atrazine												0.41 U	0.35 U	0.036 U	0.039 U
Azobenzene					0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ			0.41 U	0.35 U	0.036 U	0.039 U
Benzaldehyde												0.41 U	0.35 U	0.023 J	0.085
Benzo(a)anthracene	5 U	0.031 J	0.012 J	0.48 U	0.39	0.32	0.33	0.43	1.1	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Benzo(a)pyrene		0.034 J	0.011 J	0.48 U	0.71	0.31	0.38	0.39	0.58	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Benzo(b)fluoranthene	5 U	0.044 J	0.013 J	0.48 U	1.2	0.55	0.51	0.49	0.71	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Benzo(ghi)perylene	5 U	0.03 J	0.49 U	0.48 U	0.79	0.37	0.36	0.37	0.66	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Benzo(k)fluoranthene	5 U	0.025 J	0.012 J	0.48 U	0.31	0.26	0.24	0.23	0.34	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Benzoic Acid	24 U	0.59 J	0.36 J	0.24 J	4 UJ	4.9 UJ	1.2 J	7.5 UJ	7.5 UJ	0.29 J	2 U	2 U	1.8 U	0.24 U	0.3 U
Benzyl alcohol	5 U	0.44 U	0.49 U	0.48 U	1.6 UJ	2 U	2.5 U	3 UJ	3 UJ	0.61 U	0.42 U	0.81 U	0.71 U	0.073 U	0.079 U
Biphenyl												0.41 U	0.35 U	0.036 U	0.039 U
Bis(2-Chloroethoxy)methane	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Bis(2-Chloroethyl)ether	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Bis(2-Chloroisopropyl)ether												0.41 U	0.35 U	0.036 U	0.039 U
Bis(2-Ethylhexyl)phthalate	20 B	1.7 B	0.32 JB	0.35 JB	0.43 J	0.98 U	2.1 J	6.2 J	9.9	0.22 J	0.72	0.41 U	2.1 EB	0.02 JEB	0.014 JEB
Butylbenzylphthalate	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 UJ	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Caprolactam												0.41 U	0.35 U	0.036 U	0.039 U
Carbazole												0.41 U	0.35 U	0.036 U	0.039 U
Chrysene	5 U	0.049 J	0.016 J	0.48 U	0.97	0.62	0.54	0.55	0.86	0.61 U	0.42 U	0.41 U	0.35 U	0.013 J	0.015 J
Dibenz(a,h)anthracene		0.44 U	0.49 U	0.48 U	0.3 U	0.3 U	0.066 J	0.41 U	0.14 J	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Dibenzofuran	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Diethylphthalate	0.085 JB	0.015 JB	0.013 JB	0.013 JB	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Dimethylphthalate	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Di-n-butylphthalate	0.074 JB	0.013 JB	0.02 JB	0.013 JB	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.044 U	0.41 U	0.35 U	0.036 U	0.039 U
Di-n-octylphthalate	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	R	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Diphenyl ether												0.41 U	0.35 U	0.036 U	0.039 U
Diphenylamine												0.41 U			0.039 U
Diphenylmethanone												0.41 U	0.35 U	0.036 U	0.039 U
Fluoranthene	0.081 J	0.067 J	0.026 J	0.011 J	2	1.4	1.2	1.3	1.9	0.61 U	0.42 U	0.41 U	0.12 J	0.016 J	0.018 J
Fluorene	5 U	0.008 J	0.49 U	0.48 U	0.15 U	0.15 U	0.14 U	0.2 U	0.19 U	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Hexachlorobenzene	5 U	0.44 U	0.49 U	0.48 U						0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Hexachlorobutadiene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Hexachlorocyclopentadiene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.81 U	0.71 U	0.073 U	0.079 U
Hexachloroethane	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Indeno(1,2,3-cd)pyrene	5 U	0.031 J	0.49 U	0.48 U	0.8	0.4	0.35	0.33	0.43	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Isophorone	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Naphthalene	5 U	0.008 J	0.49 U	0.48 U	0.4 UJ	0.49 U	0.63 U	0.75 UJ	0.75 UJ	0.61 U	0.42 U	0.98 U	0.85 U	0.088 U	0.094 U
Nitrobenzene	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
N-Nitrosodimethylamine												0.0061 U	0.35 U	0.036 U	0.006 U
N-Nitrosodi-n-propylamine	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS016SMD BS016 1/21/1997 0-0 ft	BS018PND BS018 1/21/1997 0-0 ft	BS019WMD BS019 1/21/1997 0-0 ft	BS020WMD BS020 1/21/1997 0-0 ft	BS041LSD BS041 8/22/2005 0-0.5 ft	BS042LSD BS042 8/22/2005 0-0.5 ft	BS043LSD BS043 8/22/2005 0-0.5 ft	BS044LSD BS044 8/23/2005 0-0.5 ft	BS045LSD BS045 8/23/2005 0-0.5 ft	CPDA-5 CPDA-5 12/16/1996 0-1 ft	CPDA-8 CPDA-8 12/16/1996 0-1 ft	OC-SB-473-0.0/1.0-XXX SB-473 9/18/2009 0-1 ft	OC-SS-414-0.0/1.0-XXX SS-414 9/15/2009 0-1 ft	OC-SS-418-0.0/1.0-XXX SS-418 9/15/2009 0-1 ft	OC-SS-427-0.0/1.0-XXX SS-427 9/16/2009 0-1 ft
N-Nitrosodiphenylamine	0.55 J	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 U	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Pentachlorophenol	24 U	2.1 U	2.4 U	2.3 U	4 UJ	4.9 U	6.3 U	7.5 UJ	7.5 UJ	3 U	2 U	0.41 U	0.35 U	0.036 U	0.039 U
Phenanthrene	0.14 J	0.06 J	0.019 J	0.012 J	0.67	0.57	0.49	0.43	0.69	0.61 U	0.42 U	0.49 U	0.42 U	0.044 U	0.047 U
Phenol	5 U	0.44 U	0.49 U	0.48 U	0.79 UJ	0.98 UJ	1.3 U	1.5 UJ	1.5 UJ	0.61 U	0.42 U	0.41 U	0.35 U	0.036 U	0.039 U
Pyrene	0.085 J	0.061 J	0.02 J	0.013 J	1.5	1	0.9	0.91	1.3	0.61 U	0.42 U	0.41 U	0.14 J	0.017 J	0.018 J
EPH (mg/kg)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															
Pesticides (mg/kg)															
4,4'-DDD	0.005 U	0.0068	0.00012 J	0.00035 J	0.024 U	0.029 U	0.037 U	0.039 J	0.16	0.0062 U	0.0042 U				
4,4'-DDE	0.0037 J	0.011	0.0026 J	0.0021 J	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0012 J	0.0042 U				
4,4'-DDT	0.0016 J	0.027	0.0014 J	0.0073	0.024 U	0.054	0.037 U	0.069	0.15	0.0029 J	0.0049 J				
Aldrin	0.000098 J	0.0023 U	0.0024 U	0.0025 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0032 U	0.0022 U				
Alpha-BHC	0.0026 U	0.0023 U	0.0024 U	0.0025 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0032 U	0.0022 U				
Alpha-Chlordane	0.0026 U	0.00079 J	0.0024 U	0.00034 J						0.0032 U	0.0022 U				
Aroclor-1016															
Aroclor-1221															
Aroclor-1232															
Aroclor-1242															
Aroclor-1248															
Aroclor-1254															
Aroclor-1260															
Beta-BHC	0.0026 U	0.0023 U	0.0024 U	0.0025 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0032 U	0.0022 U				
Chlordane					0.12 U	0.15 U	0.18 U	0.22 U	0.22 U						
Chlordane (technical)	0.0026 U	0.00028 J	0.0024 U	0.0025 U						0.0032 UJ	0.0022 UJ				
Delta-BHC	0.0026 U	0.0023 U	0.0024 U	0.0025 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0015 J	0.0022 U				
Dieldrin	0.00055 J	0.0025 J	0.00098 J	0.00087 J	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.002 J	0.0042 U				
Endosulfan I	0.0026 U	0.0023 U	0.0024 U	0.0025 U	0.024 U	0.034	0.037 U	0.032 J	0.044 U	0.0032 U	0.0022 U				
Endosulfan II	0.005 U	0.0044 U	0.0046 U	0.0048 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0062 U	0.0042 U				
Endosulfan sulfate	0.005 U	0.0044 U	0.0046 U	0.0048 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0062 UJ	0.0042 UJ				
Endrin	0.005 U	0.0044 U	0.0046 U	0.0048 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0062 U	0.0042 U				
Endrin aldehyde	0.005 U	0.0044 U	0.0046 U	0.0048 U						0.0062 U	0.0042 U				
Endrin ketone	0.005 U	0.0044 U	0.0014 J	0.0048 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0062 UJ	0.0042 UJ				
Gamma-BHC/Lindane	0.0026 U	0.00011 J	0.0024 U	0.0025 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0032 U	0.0061 J				
Heptachlor	0.0026 U	0.0023 U	0.0024 U	0.0025 U	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0032 U	0.0022 U				
Heptachlor epoxide	0.0026 U	0.0023 U	0.0024 U	0.00041 J	0.024 U	0.029 U	0.037 U	0.044 U	0.044 U	0.0032 U	0.0022 U				
Hexachlorobenzene					0.024 U	0.029 U	0.037 U	0.044 U	0.044 U						
Methoxychlor	0.026 U	0.023 U	0.024 U	0.025 U	0.047 U	0.058 U	0.073 U	0.088 U	0.088 U	0.032 UJ	0.022 UJ				
Toxaphene	0.05 U	0.044 U	0.046 U	0.048 U						0.062 U	0.042 U				
Metals (mg/kg)															
Aluminum	9290	2690	4930	5780	20000	6800	6200	7100	8700		2100	1700	6400	640	13000
Antimony	1 U	0.97 U	1 U	0.97 U	5.3 U	6.4 U	7.8 U	10 U	11 U		1.1 U	0.61 UJ	0.64 UJ	0.64 UJ	0.75 UJ
Arsenic	4.7	7.5	5.8	4.4	13	6.4	3.9 U	5.1 U	5.4 U		0.9 U	2.1	7.8	1.3 U	3.7
Barium	5.4 B	18.3 B	5.3 B	5.4 B	53	20	13	22	120		4.6 []	9.6	17 J	3.4	9.2
Beryllium	0.25 U	0.24 U	0.26 U	0.24 U	2.2	0.64 U	0.78 U	1 U	1.1 U		0.18 U	0.06 J	0.22 J	0.26 U	0.3 J
Cadmium	0.25 U	0.24 U	0.26 U	0.24 U	0.73	0.64 U	0.78 U	1 U	1.1 U		0.18 U	0.099 J	0.19 J	0.026 J	0.14 J
Calcium	77.4 B	302 B	85.7 B	97.4 B	8300	6800	5100	2600	2200		21000	270	2000	68	310
Chromium	6.1	5.2	4.2	3.5	1600	82	240	580	1500	210	47	2.6	14	1.1	6.3
Chromium, Hexavalent					49 U	54 U	80 U	63 U	95 U			2.4 U			
Cobalt	0.8 B	0.55 B	0.43 B	0.24 U	44	7.3	6.6	5.5	5.4 U		0.42 []	0.41 J	5.9	0.16 J	1.3
Copper	1.7 B	3.7 B	2.5 B	2.1 B	79	23	37	43	55		1.6 []	1.9	22	0.94 JEB	2.4 EB

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS016SMD BS016 1/21/1997 0-0 ft	BS018PND BS018 1/21/1997 0-0 ft	BS019WMD BS019 1/21/1997 0-0 ft	BS020WMD BS020 1/21/1997 0-0 ft	BS041LSD BS041 8/22/2005 0-0.5 ft	BS042LSD BS042 8/22/2005 0-0.5 ft	BS043LSD BS043 8/22/2005 0-0.5 ft	BS044LSD BS044 8/23/2005 0-0.5 ft	BS045LSD BS045 8/23/2005 0-0.5 ft	CPDA-5 CPDA-5 12/16/1996 0-1 ft	CPDA-8 CPDA-8 12/16/1996 0-1 ft	OC-SB-473-0.0/1.0-XXX SB-473 9/18/2009 0-1 ft	OC-SS-414-0.0/1.0-XXX SS-414 9/15/2009 0-1 ft	OC-SS-418-0.0/1.0-XXX SS-418 9/15/2009 0-1 ft	OC-SS-427-0.0/1.0-XXX SS-427 9/16/2009 0-1 ft
Iron	6420 *	2850 *	7800 *	4150 *	26000	4900	5200	3000	2000		1200	1900	12000	300	6200
Lead	7.5	18.6	13.7	15.9	40	110	44	46	53		4.8	8	8.1 J	3.7	8.4
Magnesium	197 B	168 B	112 B	84 B	1100	740	540	220	340		290 []	39	2700	24	280
Manganese	9.4	7.2	10.7	3.7	970	130	97	15	17		7.8	5.1	130	2.8	19
Mercury	0.1 U	0.093 U	0.12 U	0.11 U	0.26	0.35	0.49	0.46	0.36		0.11 UN	0.16 U	0.2 UJ	0.034 J	0.042 J
Nickel	2.5 B	2.3 B	1.5 B	1.8 B	50	17	15	24	24		1.5 []	2.3	11	0.66 J	3.6
Potassium	57.4 BE	128 BE	67 BE	46.3 BE	1100 U	1300 U	1700	2000 U	2100 U		80 []	290	930	250 J	340
Selenium	1 U	0.97 U	1 U	0.97 U	2.7 U	3.2 U	3.9 U	5.1 U	5.4 U		0.9 UN	0.61 U	0.64 U	0.64 U	0.75 U
Silver	1 U	0.97 U	1 U	0.97 U	2.7 U	3.2 U	3.9 U	5.1 U	5.4 U		R	0.61 U	0.64 U	0.64 U	0.75 U
Sodium	49.9 BE	110 BE	70.6 BE	53.2 BE	2300	1000	780 U	1000 U	1100 U		82 []	23 J	75 J	32 J	150 U
Thallium	1.8 U	1.7 U	1.8 U	1.7 U	2.7 U	3.2 U	3.9 U	5.1 U	5.4 U		1.4 UJ	1.2 U	1.3 U	1.3 U	1.5 U
Tin												1 J	4.5 J	6.4 UJ	2.3 J
Vanadium	11 B	8.8 B	15	11.3 B	28	39	23	24	34		5.3 []	10	18	4.1	11
Zinc	5.6 E	4.8 BE	5.9 E	5.1 E	96	18	20 U	26 U	27 U		6	3.5	21	1.2 J	9.3
Inorganics (mg/kg)															
Chloride												19 U	21 U	16 U	19 U
Cyanide, Available					3.8	2 U	2.9 U	2.4 U	4.1 U						
Cyanide, Total					9.7	3.7	5.3	7.5	8.8						
Nitrogen, as Ammonia					400	580	720	1800	920	343	77.7	94	50	58	120
Oxidation Reduction Potential (mV)												550			
Percent Moisture (%)												17.9	6.9	9.5	17.2
Percent Solids (%)					42.1	33.2	26.4	22.2	22.1			82	93	90	82
Percent Solids, Residual (%)															
pH (units)												4.01			
Sulfate										680	23900	39 U	43 U	31 U	37 U
Total Organic Carbon												35000			
Total Organic Carbon (%)					11 >	11 >	11 >	11 >	11 >						
Specialty Compounds (mg/kg)															
Hydrazine												0.0024 U			0.0024 U
Monomethylhydrazine (MMH)												0.006 U			0.006 U
UDMH												0.006 U			0.006 U
Dimethylformamide												0.66 U			0.73 U
Phthalic Acid/Phthalic anhydride												0.12 UJ			0.12 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-432-0.0/1.0-XXX SS-432 9/16/2009 0-1 ft	OC-SS-436-0.0/1.0-XXX SS-436 9/16/2009 0-1 ft	OC-SS-437-0.0/1.0-XXX SS-437 9/16/2009 0-1 ft	OC-SS-440-0.0/1.0-XXX SS-440 9/16/2009 0-1 ft	OC-SS-442-0.0/1.0-XXX SS-442 9/16/2009 0-1 ft	OC-SS-456-0.0/1.0-XXX SS-456 9/18/2009 0-1 ft	OC-SS-457-0.0/1.0-XXX SS-457 9/17/2009 0-1 ft	OC-SS-458-0.0/1.0-XXX SS-458 9/18/2009 0-1 ft	OC-SS-459-0.0/1.0-XXX SS-459 9/18/2009 0-1 ft	OC-SS-461-0.0/1.0-XXX SS-461 9/18/2009 0-1 ft	OC-SS-510-0.0/1.0-XXX SS-510 12/4/2012 0-1 ft	OC-SS-511-0.0/1.0-XXX SS-511 12/4/2012 0-1 ft	OC-SS-512-0.0/1.0-XXX SS-512 12/4/2012 0-1 ft	OC-SS-513-0.0/1.0-XXX SS-513 12/4/2012 0-1 ft	OC-SS-514-0.0/1.0-XXX SS-514 12/4/2012 0-1 ft
Volatile Organic Compounds (mg/kg)															
1,1,1,2-Tetrachloroethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,1,1-Trichloroethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,1,2,2-Tetrachloroethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.016 U	0.016 U	0.017 U	0.021 U	0.03 U	0.016 U	0.013 U	0.018 U	0.017 U	0.018 U					
1,1,2-Trichloroethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,1-Dichloroethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,1-Dichloroethene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,1-Dichloropropene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2,3-Trichlorobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2,3-Trichloropropane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2,4-Trichlorobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2,4-Trimethylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2-Dibromo-3-chloropropane	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
1,2-Dibromoethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2-Dichlorobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2-Dichloroethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,2-Dichloroethene (total)															
1,2-Dichloropropane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,3,5-Trimethylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,3-Dichlorobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,3-Dichloropropane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,4-Dichlorobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
1,4-Dioxane	0.31 UJ	0.32 UJ	0.34 UJ	0.42 UJ	0.6 UJ	0.32 UJ	0.26 UJ	0.36 UJ	0.34 UJ	0.36 UJ					
2,2-Dichloropropane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
2,4,4-Trimethyl-1-pentene	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
2,4,4-Trimethyl-2-pentene	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
2-Butanone	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
2-Chlorotoluene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
2-Hexanone	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
4-Chlorotoluene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
4-iso-Propyltoluene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
4-Methyl-2-pentanone	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
Acetaldehyde				0.36 U		0.24 U	0.046 J		0.23 U						
Acetic acid, methyl ester	0.063 U	0.063 U	0.068 U	0.085 U	0.12 U	0.064 U	0.052 U	0.072 U	0.067 U	0.071 U					
Acetone	0.31 UJ	0.32 UJ	0.34 UJ	0.42 UJ	0.6 UJ	0.32 UJ	0.021 J	0.36 UJ	0.34 UJ	0.081 J					
Benzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Bromobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Bromochloromethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Bromodichloromethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Bromoform	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Bromomethane	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
Butane, 2-methoxy-2-methyl-	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Carbon disulfide	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Carbon tetrachloride	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Chlorobenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Chlorodibromomethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Chloroethane	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
Chloroform	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Chloromethane	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
Cis-1,2-Dichloroethene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
cis-1,3-Dichloropropene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Cyclohexane	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
Dibromomethane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-432-0.0/1.0-XXX SS-432 9/16/2009 0-1 ft	OC-SS-436-0.0/1.0-XXX SS-436 9/16/2009 0-1 ft	OC-SS-437-0.0/1.0-XXX SS-437 9/16/2009 0-1 ft	OC-SS-440-0.0/1.0-XXX SS-440 9/16/2009 0-1 ft	OC-SS-442-0.0/1.0-XXX SS-442 9/16/2009 0-1 ft	OC-SS-456-0.0/1.0-XXX SS-456 9/18/2009 0-1 ft	OC-SS-457-0.0/1.0-XXX SS-457 9/17/2009 0-1 ft	OC-SS-458-0.0/1.0-XXX SS-458 9/18/2009 0-1 ft	OC-SS-459-0.0/1.0-XXX SS-459 9/18/2009 0-1 ft	OC-SS-461-0.0/1.0-XXX SS-461 9/18/2009 0-1 ft	OC-SS-510-0.0/1.0-XXX SS-510 12/4/2012 0-1 ft	OC-SS-511-0.0/1.0-XXX SS-511 12/4/2012 0-1 ft	OC-SS-512-0.0/1.0-XXX SS-512 12/4/2012 0-1 ft	OC-SS-513-0.0/1.0-XXX SS-513 12/4/2012 0-1 ft	OC-SS-514-0.0/1.0-XXX SS-514 12/4/2012 0-1 ft
Dichlorodifluoromethane	0.0063 UJ	0.0063 UJ	0.0068 UJ	0.0085 UJ	0.012 UJ	0.0064 UJ	0.0052 UJ	0.0072 UJ	0.0067 UJ	0.0071 UJ					
Diethyl ether	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 UJ	0.0036 U	0.0034 U	0.0036 U					
Ethyl benzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Ethyl-t-Butyl Ether	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Formaldehyde				0.57		0.22	0.27		0.23						
Hexachlorobutadiene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Isopropyl ether	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Isopropylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Methyl cyclohexane	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Methyl Tertbutyl Ether	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 UJ	0.0036 U	0.0034 U	0.0036 U					
Methylene chloride	0.013 U	0.013 U	0.014 U	0.017 U	0.024 U	0.013 U	0.01 U	0.014 U	0.013 U	0.014 U					
Naphthalene	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
n-Butylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Propylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
sec-Butylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Styrene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
tert-Butylbenzene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Tetrachloroethene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Tetrahydrofuran	0.031 U	0.032 U	0.034 U	0.042 U	0.06 U	0.032 U	0.026 U	0.036 U	0.034 U	0.036 U					
Toluene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
trans-1,2-Dichloroethene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
trans-1,3-Dichloropropene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Trichloroethene	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Trichlorofluoromethane	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
Vinyl acetate															
Vinyl chloride	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Xylene, o	0.0031 U	0.0032 U	0.0034 U	0.0042 U	0.006 U	0.0032 U	0.0026 U	0.0036 U	0.0034 U	0.0036 U					
Xylenes (m&p)	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
Xylenes, Total	0.0063 U	0.0063 U	0.0068 U	0.0085 U	0.012 U	0.0064 U	0.0052 U	0.0072 U	0.0067 U	0.0071 U					
Semivolatile Organic Compounds (mg/kg)															
1,2,4,5-Tetrachlorobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
1,2,4-Trichlorobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
1,2-Dichlorobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
1,2-Diphenylhydrazine															
1,3-Dichlorobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
1,4-Dichlorobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
1-Methylnaphthalene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,2'-Dichlorodiisopropylether															
2,3,4,6-Tetrachlorophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,4,5-Trichlorophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,4,6-Trichlorophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,4-Dichlorophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,4-Dimethylphenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,4-Dinitrophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,4-Dinitrotoluene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2,6-Dinitrotoluene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2-Chloronaphthalene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2-Chlorophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2-Methylnaphthalene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2-Methylphenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
2-Nitroaniline	0.2 U	0.22 U	0.23 U	0.3 U	0.31 U	0.2 U	0.18 U	1.9 U	1.9 U	2 U					
2-Nitrophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
3 & 4 Methylphenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
3,3'-Dichlorobenzidine	0.078 U	0.086 U	0.091 U	0.12 U	0.12 U	0.078 U	0.073 U	0.75 U	0.76 U	0.78 U					

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-432-0.0/1.0-XXX SS-432 9/16/2009 0-1 ft	OC-SS-436-0.0/1.0-XXX SS-436 9/16/2009 0-1 ft	OC-SS-437-0.0/1.0-XXX SS-437 9/16/2009 0-1 ft	OC-SS-440-0.0/1.0-XXX SS-440 9/16/2009 0-1 ft	OC-SS-442-0.0/1.0-XXX SS-442 9/16/2009 0-1 ft	OC-SS-456-0.0/1.0-XXX SS-456 9/18/2009 0-1 ft	OC-SS-457-0.0/1.0-XXX SS-457 9/17/2009 0-1 ft	OC-SS-458-0.0/1.0-XXX SS-458 9/18/2009 0-1 ft	OC-SS-459-0.0/1.0-XXX SS-459 9/18/2009 0-1 ft	OC-SS-461-0.0/1.0-XXX SS-461 9/18/2009 0-1 ft	OC-SS-510-0.0/1.0-XXX SS-510 12/4/2012 0-1 ft	OC-SS-511-0.0/1.0-XXX SS-511 12/4/2012 0-1 ft	OC-SS-512-0.0/1.0-XXX SS-512 12/4/2012 0-1 ft	OC-SS-513-0.0/1.0-XXX SS-513 12/4/2012 0-1 ft	OC-SS-514-0.0/1.0-XXX SS-514 12/4/2012 0-1 ft
3-Nitroaniline	0.2 U	0.22 U	0.23 U	0.3 U	0.31 U	0.2 U	0.18 U	1.9 U	1.9 U	2 U					
4,6-Dinitro-2-methylphenol	0.2 U	0.22 U	0.23 U	0.3 U	0.31 U	0.2 U	0.18 U	1.9 U	1.9 U	2 U					
4-Bromophenyl phenyl ether	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
4-Chloro-3-methylphenol	0.078 U	0.086 U	0.091 U	0.12 U	0.12 U	0.078 U	0.073 U	0.75 U	0.76 U	0.78 U					
4-Chloroaniline	0.078 U	0.086 U	0.091 U	0.12 U	0.12 U	0.078 U	0.073 U	0.75 U	0.76 U	0.78 U					
4-Chlorophenyl phenyl ether	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
4-Methylphenol															
4-Nitroaniline	0.2 U	0.22 U	0.23 U	0.3 U	0.31 U	0.2 U	0.18 U	1.9 U	1.9 U	2 U					
4-Nitrophenol	0.2 U	0.22 U	0.23 U	0.3 U	0.31 U	0.2 U	0.18 U	1.9 U	1.9 U	2 U					
Acenaphthene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Acenaphthylene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Acetophenone	0.013 JEB	0.043 U	0.045 U	0.061 U	0.021 JEB	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Aniline	0.039 UJ	0.043 UJ	0.045 UJ	0.061 UJ	0.062 UJ	0.039 UJ	0.037 UJ	0.37 UJ	0.38 UJ	0.39 UJ					
Anthracene	0.02 JEB	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Atrazine	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Azobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Benzaldehyde	0.18	0.075	0.05	0.061	0.17	1.2	0.012 J	0.69	0.24 J	0.16 J					
Benzo(a)anthracene	0.14	0.043 U	0.045 U	0.061 U	0.022 J	0.017 J	0.021 J	0.37 U	0.4	0.39 U					
Benzo(a)pyrene	0.15	0.043 U	0.016 J	0.061 U	0.026 J	0.018 J	0.022 J	0.37 UJ	0.38 J	0.39 U					
Benzo(b)fluoranthene	0.24	0.043 U	0.018 J	0.061 U	0.04 J	0.025 J	0.034 J	0.13 J	0.46	0.39 U					
Benzo(ghi)perylene	0.074	0.043 U	0.018 J	0.061 U	0.023 J	0.039 U	0.015 J	0.37 UJ	0.26 J	0.39 U					
Benzo(k)fluoranthene	0.089	0.043 U	0.045 U	0.061 U	0.062 U	0.013 J	0.037 U	0.37 UJ	0.23 J	0.39 U					
Benzoic Acid	0.39 U	0.22 UJ	0.23 UJ	0.3 UJ	0.44 UJ	2.2 U	0.18 U	1.9 U	1.9 U	2 U					
Benzyl alcohol	0.078 U	0.086 U	0.091 U	0.12 U	0.12 U	0.078 U	0.073 U	0.75 U	0.76 U	0.78 U					
Biphenyl	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Bis(2-Chloroethoxy)methane	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Bis(2-Chloroethyl)ether	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Bis(2-Chloroisopropyl)ether	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Bis(2-Ethylhexyl)phthalate	0.18 EB	0.043 U	0.027 JEB	0.022 JEB	0.031 JEB	0.019 JEB	0.037 EB	0.12 JEB	0.38 U	0.39 U					
Butylbenzylphthalate	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Caprolactam	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Carbazole	0.02 J	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Chrysene	0.18	0.043 U	0.019 J	0.061 U	0.038 J	0.029 J	0.023 J	0.14 J	0.36 J	0.39 U					
Dibenz(a,h)anthracene	0.028 J	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.021 J	0.37 UJ	0.25 J	0.39 U					
Dibenzofuran	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Diethylphthalate	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Dimethylphthalate	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Di-n-butylphthalate	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Di-n-octylphthalate	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 UJ	0.38 U	0.39 U					
Diphenyl ether	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Diphenylamine				0.061 U		0.039 U	0.037 U		0.38 U						
Diphenylmethanone	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Fluoranthene	0.46	0.014 J	0.032 J	0.061 U	0.055 J	0.035 J	0.041	0.2 J	0.69	0.12 J					
Fluorene	0.028 J	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Hexachlorobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Hexachlorobutadiene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Hexachlorocyclopentadiene	0.078 U	0.086 U	0.091 U	0.12 U	0.12 U	0.078 U	0.073 U	0.75 U	0.76 U	0.78 U					
Hexachloroethane	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Indeno(1,2,3-cd)pyrene	0.079	0.043 U	0.022 J	0.061 U	0.036 J	0.027 J	0.029 J	0.37 UJ	0.38 J	0.22 J					
Isophorone	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Naphthalene	0.094 U	0.1 U	0.11 U	0.15 U	0.02 J	0.094 U	0.088 U	0.21 J	0.91 U	0.94 U					
Nitrobenzene	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
N-Nitrosodimethylamine	0.039 U	0.043 U	0.045 U	0.0091 U	0.062 U	0.006 U	0.0055 U	0.37 U	0.0057 U	0.39 U					
N-Nitrosodi-n-propylamine	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-432-0.0/1.0-XXX SS-432 9/16/2009 0-1 ft	OC-SS-436-0.0/1.0-XXX SS-436 9/16/2009 0-1 ft	OC-SS-437-0.0/1.0-XXX SS-437 9/16/2009 0-1 ft	OC-SS-440-0.0/1.0-XXX SS-440 9/16/2009 0-1 ft	OC-SS-442-0.0/1.0-XXX SS-442 9/16/2009 0-1 ft	OC-SS-456-0.0/1.0-XXX SS-456 9/18/2009 0-1 ft	OC-SS-457-0.0/1.0-XXX SS-457 9/17/2009 0-1 ft	OC-SS-458-0.0/1.0-XXX SS-458 9/18/2009 0-1 ft	OC-SS-459-0.0/1.0-XXX SS-459 9/18/2009 0-1 ft	OC-SS-461-0.0/1.0-XXX SS-461 9/18/2009 0-1 ft	OC-SS-510-0.0/1.0-XXX SS-510 12/4/2012 0-1 ft	OC-SS-511-0.0/1.0-XXX SS-511 12/4/2012 0-1 ft	OC-SS-512-0.0/1.0-XXX SS-512 12/4/2012 0-1 ft	OC-SS-513-0.0/1.0-XXX SS-513 12/4/2012 0-1 ft	OC-SS-514-0.0/1.0-XXX SS-514 12/4/2012 0-1 ft
N-Nitrosodiphenylamine	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Pentachlorophenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Phenanthrene	0.16	0.052 U	0.019 J	0.073 U	0.042 J	0.023 J	0.015 J	0.17 J	0.17 J	0.47 U					
Phenol	0.039 U	0.043 U	0.045 U	0.061 U	0.062 U	0.039 U	0.037 U	0.37 U	0.38 U	0.39 U					
Pyrene	0.33	0.013 J	0.032 J	0.061 U	0.064	0.036 J	0.04	0.19 J	0.8	0.12 J					
EPH (mg/kg)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															
Pesticides (mg/kg)															
4,4'-DDD															
4,4'-DDE															
4,4'-DDT															
Aldrin															
Alpha-BHC															
Alpha-Chlordane															
Aroclor-1016															
Aroclor-1221															
Aroclor-1232															
Aroclor-1242															
Aroclor-1248															
Aroclor-1254															
Aroclor-1260															
Beta-BHC															
Chlordane															
Chlordane (technical)															
Delta-BHC															
Dieldrin															
Endosulfan I															
Endosulfan II															
Endosulfan sulfate															
Endrin															
Endrin aldehyde															
Endrin ketone															
Gamma-BHC/Lindane															
Heptachlor															
Heptachlor epoxide															
Hexachlorobenzene															
Methoxychlor															
Toxaphene															
Metals (mg/kg)															
Aluminum	6800	3100	3800	3900	3600	6800	9400	4800	8400	5600					
Antimony	0.66 UJ	0.76 UJ	0.73 UJ	1.1 UJ	0.97 UJ	0.67 UJ	0.66 UJ	0.67 UJ	0.7 UJ	0.74 UJ					
Arsenic	8.3	2.4	2.6	14	7.5	4.1	18	9.5	8	5.7					
Barium	26	5.9	15	12	23	9.3	32	19	23	19					
Beryllium	0.27	0.067 J	0.21 J	0.16 J	0.13 J	0.2 J	0.33	0.24 J	0.29	0.27 J					
Cadmium	0.3	0.073 J	0.11 J	0.17 J	0.16 J	0.16 J	0.3	0.24 J	0.36	0.24 J					
Calcium	2400	130	330	670	610	620	2100	800	1800	1500					
Chromium	30	2.9	70	81	8.8	6.8	39	6.8	14	6.4					
Chromium, Hexavalent		3 U	8.9								2.6 U	3.8 U	2.9 U	3.5 U	2.2 U
Cobalt	3.8	0.38 J	3.9	1.4	1.9	1.3	7	1.8	3.4	1.5					
Copper	13	2	6.3	4.5	6.2	4.4	13	15	20	9.8					

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-432-0.0/1.0-XXX SS-432 9/16/2009 0-1 ft	OC-SS-436-0.0/1.0-XXX SS-436 9/16/2009 0-1 ft	OC-SS-437-0.0/1.0-XXX SS-437 9/16/2009 0-1 ft	OC-SS-440-0.0/1.0-XXX SS-440 9/16/2009 0-1 ft	OC-SS-442-0.0/1.0-XXX SS-442 9/16/2009 0-1 ft	OC-SS-456-0.0/1.0-XXX SS-456 9/18/2009 0-1 ft	OC-SS-457-0.0/1.0-XXX SS-457 9/17/2009 0-1 ft	OC-SS-458-0.0/1.0-XXX SS-458 9/18/2009 0-1 ft	OC-SS-459-0.0/1.0-XXX SS-459 9/18/2009 0-1 ft	OC-SS-461-0.0/1.0-XXX SS-461 9/18/2009 0-1 ft	OC-SS-510-0.0/1.0-XXX SS-510 12/4/2012 0-1 ft	OC-SS-511-0.0/1.0-XXX SS-511 12/4/2012 0-1 ft	OC-SS-512-0.0/1.0-XXX SS-512 12/4/2012 0-1 ft	OC-SS-513-0.0/1.0-XXX SS-513 12/4/2012 0-1 ft	OC-SS-514-0.0/1.0-XXX SS-514 12/4/2012 0-1 ft
Iron	9500	2300	3200	8000	4200	6300	14000	8100	9400	6500					
Lead	15	8.4	15	24	41	8.2	12	31	33	24					
Magnesium	2000	68	230	510	170	490	3500	580	1300	520					
Manganese	250	4.1	21	20	11	61	210	59	160	71					
Mercury	0.099 J	0.18 U	0.2 U	0.32 U	0.067 J	0.2 U	0.19 U	0.066 J	0.14 J	0.038 J					
Nickel	7.7	1.4 J	7.5	4.2	3.7	4	21	5.3	8.2	6					
Potassium	980	200 J	580	650	380 J	330	2000	290	720	310					
Selenium	0.66 U	0.76 U	0.73 U	1.1 U	0.97 U	0.67 U	0.66 U	0.67 U	0.7 U	0.74 U					
Silver	0.21 J	0.76 U	0.98	0.99 J	0.97 U	0.67 U	0.18 J	0.67 U	0.7 U	0.74 U					
Sodium	130 U	23 J	36 J	220 U	42 J	130 U	29 J	130 U	140 U	150 U					
Thallium	1.3 U	1.5 U	1.5 U	2.2 U	1.9 U	1.3 U	1.3 U	1.3 U	1.4 U	1.5 U					
Tin	12 J	1.1 J	31 J	35 J	3.8 J	2.5 J	15	2.5 J	5.9 J	2.5 J					
Vanadium	14	8.5	6.7	23	15	9.1	24	14	15	12					
Zinc	30	2.4 J	5.9	6	5.5	18	29	20	49	39					
Inorganics (mg/kg)															
Chloride	23 U	21 U	24 U	26 U	33 U	21 U	22 U	19 U	19 U	18 U					
Cyanide, Available															
Cyanide, Total															
Nitrogen, as Ammonia	61	100	120	250	350	130	65	140	190	200					
Oxidation Reduction Potential (mV)		560	530								120	25	100	20	61
Percent Moisture (%)	15	25	27	43.3	47	16.7	10.2	11	13.6	15	24	46	30	42	8.7
Percent Solids (%)	85	75	73	55	53	83	90	89	87	85	76	54	70	58	91
Percent Solids, Residual (%)															
pH (units)		3.95	4.41								4.24	6.49	4.21	6.28	4.59
Sulfate	46 U	43 U	52	58	66 U	43 U	43 U	39 U	38 U	37 U					
Total Organic Carbon							12000								
Total Organic Carbon (%)															
Specialty Compounds (mg/kg)															
Hydrazine				0.0035 U		0.0024 U	0.0022 U		0.0023 U						
Monomethylhydrazine (MMH)				0.0088 U		0.006 U	0.0055 U		0.0058 U						
UDMH				0.0088 U		0.006 U	0.0055 U		0.0058 U						
Dimethylformamide				0.74 U		0.8 U	0.74 U		0.77 U						
Phthalic Acid/Phthalic anhydride				0.18 U		0.11 U	0.11 U		0.11 U						

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-515-0.0/1.0-XXX SS-515 12/4/2012 0-1 ft	OC-SS-516-0.0/1.0-XXX SS-516 12/4/2012 0-1 ft	OC-SS-517-0.0/1.0-XXX SS-517 12/4/2012 0-1 ft	OC-SS-518-0.0/1.0-XXX SS-518 12/4/2012 0-1 ft	OC-SS-519-0.0/1.0-XXX SS-519 12/4/2012 0-1 ft	OC-SS-520-0.0/1.0-XXX SS-520 12/4/2012 0-1 ft	OC-SS-521-0.0/1.0-XXX SS-521 12/4/2012 0-1 ft	OC-SS-522-0.0/1.0-XXX SS-522 12/4/2012 0-1 ft	OC-SS-523-0.0/1.0-XXX SS-523 12/4/2012 0-1 ft	OC-SS-524-0.0/1.0-XXX SS-524 12/5/2012 0-1 ft	OC-SS-525-0.0/1.0-XXX SS-525 12/5/2012 0-1 ft	SS101XX33X SWMU-33-101 11/23/1998 0-2 ft	SS101XX33X SWMU-33-101 11/30/1998 0-2 ft	SS102XX33X SWMU-33-102 11/23/1998 0-2 ft	SS102XX33X SWMU-33-102 11/30/1998 0-2 ft
Volatile Organic Compounds (mg/kg)															
1,1,1,2-Tetrachloroethane												0.013 U	1 U	0.009 U	0.76 U
1,1,1-Trichloroethane												0.013 U	1 U	0.009 U	0.76 U
1,1,2,2-Tetrachloroethane												0.013 U	1 U	0.009 U	0.76 U
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane												0.013 U	1 U	0.009 U	0.76 U
1,1-Dichloroethane												0.013 U	1 U	0.009 U	0.76 U
1,1-Dichloroethene												0.013 U	1 U	0.009 U	0.76 U
1,1-Dichloropropene												0.013 U	1 U	0.009 U	0.76 U
1,2,3-Trichlorobenzene												0.013 U	1 U	0.009 U	0.76 U
1,2,3-Trichloropropane												0.013 U	1 U	0.009 U	0.76 U
1,2,4-Trichlorobenzene												0.013 U	1 U	0.009 U	0.76 U
1,2,4-Trimethylbenzene												0.013 U	1 U	0.009 U	0.76 U
1,2-Dibromo-3-chloropropane												0.013 U	1 U	0.009 U	0.76 U
1,2-Dibromoethane												0.013 U	1 U	0.009 U	0.76 U
1,2-Dichlorobenzene												0.013 U	1 U	0.009 U	0.76 U
1,2-Dichloroethane												0.013 U	1 U	0.009 U	0.76 U
1,2-Dichloroethene (total)															
1,2-Dichloropropane												0.013 U	1 U	0.009 U	0.76 U
1,3,5-Trimethylbenzene												0.013 U	1 U	0.009 U	0.76 U
1,3-Dichlorobenzene												0.013 U	1 U	0.009 U	0.76 U
1,3-Dichloropropane												0.013 U	1 U	0.009 U	0.76 U
1,4-Dichlorobenzene												0.013 U	1 U	0.009 U	0.76 U
1,4-Dioxane															
2,2-Dichloropropane												0.013 U	1 U	0.009 U	0.76 U
2,4,4-Trimethyl-1-pentene												0.013 U		0.009 U	
2,4,4-Trimethyl-2-pentene												0.013 U		0.009 U	
2-Butanone												0.26 U	20 U	0.18 U	15 U
2-Chlorotoluene												0.013 U	1 U	0.009 U	0.76 U
2-Hexanone												0.052 U	4 U	0.036 U	3 U
4-Chlorotoluene												0.013 U	1 U	0.009 U	0.76 U
4-iso-Propyltoluene												0.013 U	1 U	0.009 U	0.76 U
4-Methyl-2-pentanone												0.052 U	4 U	0.036 U	3 U
Acetaldehyde															
Acetic acid, methyl ester															
Acetone												0.26 U	20 U	0.18 U	15 U
Benzene												0.013 U	1 U	0.009 U	0.76 U
Bromobenzene												0.013 U	1 U	0.009 U	0.76 U
Bromochloromethane												0.013 U	1 U	0.009 U	0.76 U
Bromodichloromethane												0.013 U	1 U	0.009 U	0.76 U
Bromoform												0.013 U	1 U	0.009 U	0.76 U
Bromomethane												0.026 U	2 U	0.018 U	1.5 U
Butane, 2-methoxy-2-methyl-															
Carbon disulfide															
Carbon tetrachloride												0.013 U	1 U	0.009 U	0.76 U
Chlorobenzene												0.013 U	1 U	0.009 U	0.76 U
Chlorodibromomethane												0.013 U	1 U	0.009 U	0.76 U
Chloroethane												0.026 U	2 U	0.018 U	1.5 U
Chloroform												0.013 U	1 U	0.009 U	0.76 U
Chloromethane												0.026 U	2 U	0.018 U	1.5 U
Cis-1,2-Dichloroethene												0.013 U	1 U	0.009 U	0.76 U
cis-1,3-Dichloropropene												0.013 U	1 U	0.009 U	0.76 U
Cyclohexane															
Dibromomethane												0.013 U	1 U	0.009 U	0.76 U

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-515-0.0/1.0-XXX SS-515 12/4/2012 0-1 ft	OC-SS-516-0.0/1.0-XXX SS-516 12/4/2012 0-1 ft	OC-SS-517-0.0/1.0-XXX SS-517 12/4/2012 0-1 ft	OC-SS-518-0.0/1.0-XXX SS-518 12/4/2012 0-1 ft	OC-SS-519-0.0/1.0-XXX SS-519 12/4/2012 0-1 ft	OC-SS-520-0.0/1.0-XXX SS-520 12/4/2012 0-1 ft	OC-SS-521-0.0/1.0-XXX SS-521 12/4/2012 0-1 ft	OC-SS-522-0.0/1.0-XXX SS-522 12/4/2012 0-1 ft	OC-SS-523-0.0/1.0-XXX SS-523 12/4/2012 0-1 ft	OC-SS-524-0.0/1.0-XXX SS-524 12/5/2012 0-1 ft	OC-SS-525-0.0/1.0-XXX SS-525 12/5/2012 0-1 ft	SS101XX33X SWMU-33-101 11/23/1998 0-2 ft	SS101XX33X SWMU-33-101 11/30/1998 0-2 ft	SS102XX33X SWMU-33-102 11/23/1998 0-2 ft	SS102XX33X SWMU-33-102 11/30/1998 0-2 ft
Dichlorodifluoromethane												0.013 U	1 U	0.009 U	0.76 U
Diethyl ether															
Ethyl benzene												0.013 U	1 U	0.009 U	0.76 U
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene												0.013 U	1 U	0.009 U	0.76 U
Isopropyl ether															
Isopropylbenzene												0.013 U	1 U	0.009 U	0.76 U
Methyl cyclohexane															
Methyl Tertbutyl Ether															
Methylene chloride												0.013 U	1 U	0.009 U	0.76 U
Naphthalene												0.13 U	10 U	0.09 U	7.6 U
n-Butylbenzene												0.013 U	1 U	0.009 U	0.76 U
Propylbenzene												0.013 U	1 U	0.009 U	0.76 U
sec-Butylbenzene												0.013 U	1 U	0.009 U	0.76 U
Styrene												0.013 U	1 U	0.009 U	0.76 U
tert-Butylbenzene												0.013 U	1 U	0.009 U	0.76 U
Tetrachloroethene												0.013 U	1 U	0.015	0.76 U
Tetrahydrofuran															
Toluene												0.013 U	1 U	0.038	0.76 U
trans-1,2-Dichloroethene												0.013 U	1 U	0.009 U	0.76 U
trans-1,3-Dichloropropene												0.013 U	1 U	0.009 U	0.76 U
Trichloroethene												0.013 U	1 U	0.009 U	0.76 U
Trichlorofluoromethane												0.013 U	1 U	0.009 U	0.76 U
Vinyl acetate															
Vinyl chloride												0.026 U	2 U	0.018 U	1.5 U
Xylene, o												0.013 U	1 U	0.009 U	0.76 U
Xylenes (m&p)												0.013 U	1 U	0.011	0.76 U
Xylenes, Total												0.013 U	1 U	0.011	0.76 U
Semivolatile Organic Compounds (mg/kg)															
1,2,4,5-Tetrachlorobenzene															
1,2,4-Trichlorobenzene												0.6 U		0.48 U	
1,2-Dichlorobenzene												0.6 U		0.48 U	
1,2-Diphenylhydrazine												0.6 U		0.48 U	
1,3-Dichlorobenzene												0.6 U		0.48 U	
1,4-Dichlorobenzene												0.6 U		0.48 U	
1-Methylnaphthalene															
2,2'-Dichlorodiisopropylether												0.6 U		0.48 U	
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol												0.6 U		0.48 U	
2,4,6-Trichlorophenol												0.6 U		0.48 U	
2,4-Dichlorophenol												0.6 U		0.48 U	
2,4-Dimethylphenol												0.6 U		0.48 U	
2,4-Dinitrophenol												3 U		2.4 U	
2,4-Dinitrotoluene												0.6 U		0.48 U	
2,6-Dinitrotoluene												0.6 U		0.48 U	
2-Chloronaphthalene												0.6 U		0.45 U	
2-Chlorophenol												0.6 U		0.48 U	
2-Methylnaphthalene												0.6 U		0.48 U	
2-Methylphenol												0.6 U		0.48 U	
2-Nitroaniline												3 U		2.4 U	
2-Nitrophenol												0.6 U		0.48 U	
3 & 4 Methylphenol															
3,3'-Dichlorobenzidine												1.2 U		0.95 U	

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-515-0.0/1.0-XXX SS-515 12/4/2012 0-1 ft	OC-SS-516-0.0/1.0-XXX SS-516 12/4/2012 0-1 ft	OC-SS-517-0.0/1.0-XXX SS-517 12/4/2012 0-1 ft	OC-SS-518-0.0/1.0-XXX SS-518 12/4/2012 0-1 ft	OC-SS-519-0.0/1.0-XXX SS-519 12/4/2012 0-1 ft	OC-SS-520-0.0/1.0-XXX SS-520 12/4/2012 0-1 ft	OC-SS-521-0.0/1.0-XXX SS-521 12/4/2012 0-1 ft	OC-SS-522-0.0/1.0-XXX SS-522 12/4/2012 0-1 ft	OC-SS-523-0.0/1.0-XXX SS-523 12/4/2012 0-1 ft	OC-SS-524-0.0/1.0-XXX SS-524 12/5/2012 0-1 ft	OC-SS-525-0.0/1.0-XXX SS-525 12/5/2012 0-1 ft	SS101XX33X SWMU-33-101 11/23/1998 0-2 ft	SS101XX33X SWMU-33-101 11/30/1998 0-2 ft	SS102XX33X SWMU-33-102 11/23/1998 0-2 ft	SS102XX33X SWMU-33-102 11/30/1998 0-2 ft
3-Nitroaniline												3 U		2.4 U	
4,6-Dinitro-2-methylphenol												3 U		2.4 U	
4-Bromophenyl phenyl ether												0.6 U		0.48 U	
4-Chloro-3-methylphenol												1.2 U		0.95 U	
4-Chloroaniline												1.2 U		0.95 U	
4-Chlorophenyl phenyl ether												0.6 U		0.48 U	
4-Methylphenol												0.6 U		0.48 U	
4-Nitroaniline												3 U		2.4 U	
4-Nitrophenol												3 U		2.4 U	
Acenaphthene												0.6 U		0.48 U	
Acenaphthylene												0.6 U		0.48 U	
Acetophenone															
Aniline												3 U		2.4 U	
Anthracene												0.6 U		0.48 U	
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene												0.6 U		0.48 U	
Benzo(a)pyrene												0.6 U		0.48 U	
Benzo(b)fluoranthene												0.6 U		0.48 U	
Benzo(ghi)perylene												0.6 U		0.48 U	
Benzo(k)fluoranthene												0.6 U		0.48 U	
Benzoic Acid												3 U		2.4 U	
Benzyl alcohol												1.2 U		0.95 U	
Biphenyl															
Bis(2-Chloroethoxy)methane												0.6 U		0.48 U	
Bis(2-Chloroethyl)ether												0.6 U		0.48 U	
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate												0.6 U		0.48 U	
Butylbenzylphthalate												0.6 U		0.48 U	
Caprolactam															
Carbazole															
Chrysene												0.6 U		0.48 U	
Dibenz(a,h)anthracene												0.6 U		0.48 U	
Dibenzofuran												0.6 U		0.48 U	
Diethylphthalate												0.6 U		0.48 U	
Dimethylphthalate												0.6 U		0.48 U	
Di-n-butylphthalate												0.6 U		0.48 U	
Di-n-octylphthalate												0.6 U		0.48 U	
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene												0.6 U		0.48 U	
Fluorene												0.6 U		0.48 U	
Hexachlorobenzene												0.6 U		0.48 U	
Hexachlorobutadiene												0.6 U		0.48 U	
Hexachlorocyclopentadiene												0.6 U		0.48 U	
Hexachloroethane												0.6 U		0.48 U	
Indeno(1,2,3-cd)pyrene												0.6 U		0.48 U	
Isophorone												0.6 U		0.48 U	
Naphthalene												0.6 U		0.48 U	
Nitrobenzene												0.6 U		0.48 U	
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine												0.6 U		0.48 U	

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-515-0.0/1.0-XXX SS-515 12/4/2012 0-1 ft	OC-SS-516-0.0/1.0-XXX SS-516 12/4/2012 0-1 ft	OC-SS-517-0.0/1.0-XXX SS-517 12/4/2012 0-1 ft	OC-SS-518-0.0/1.0-XXX SS-518 12/4/2012 0-1 ft	OC-SS-519-0.0/1.0-XXX SS-519 12/4/2012 0-1 ft	OC-SS-520-0.0/1.0-XXX SS-520 12/4/2012 0-1 ft	OC-SS-521-0.0/1.0-XXX SS-521 12/4/2012 0-1 ft	OC-SS-522-0.0/1.0-XXX SS-522 12/4/2012 0-1 ft	OC-SS-523-0.0/1.0-XXX SS-523 12/4/2012 0-1 ft	OC-SS-524-0.0/1.0-XXX SS-524 12/5/2012 0-1 ft	OC-SS-525-0.0/1.0-XXX SS-525 12/5/2012 0-1 ft	SS101XX33X SWMU-33-101 11/23/1998 0-2 ft	SS101XX33X SWMU-33-101 11/30/1998 0-2 ft	SS102XX33X SWMU-33-102 11/23/1998 0-2 ft	SS102XX33X SWMU-33-102 11/30/1998 0-2 ft
N-Nitrosodiphenylamine												0.6 U		0.48 U	
Pentachlorophenol												3 U		2.4 U	
Phenanthrene												0.6 U		0.48 U	
Phenol												0.6 U		0.48 U	
Pyrene												0.6 U		0.48 U	
EPH (mg/kg)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															
Pesticides (mg/kg)															
4,4'-DDD															
4,4'-DDE															
4,4'-DDT															
Aldrin															
Alpha-BHC															
Alpha-Chlordane															
Aroclor-1016															
Aroclor-1221															
Aroclor-1232															
Aroclor-1242															
Aroclor-1248															
Aroclor-1254															
Aroclor-1260															
Beta-BHC															
Chlordane															
Chlordane (technical)															
Delta-BHC															
Dieldrin															
Endosulfan I															
Endosulfan II															
Endosulfan sulfate															
Endrin															
Endrin aldehyde															
Endrin ketone															
Gamma-BHC/Lindane															
Heptachlor															
Heptachlor epoxide															
Hexachlorobenzene															
Methoxychlor															
Toxaphene															
Metals (mg/kg)															
Aluminum												8600		12000	
Antimony												5 U		3 U	
Arsenic												5 U		8.3	
Barium												14		23	
Beryllium												0.5 U		0.3 U	
Cadmium												0.5 U		0.3 U	
Calcium												290		2600	
Chromium												6.4		10	
Chromium, Hexavalent	2.5 U	2.4 U	2.4 U	3.9 U	4 U	4.7 U	4.9 U	3.2 U	3.5 U	4.4 U	3 U				
Cobalt												2 U		4.8	
Copper												8.2		12	

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SS-515-0.0/1.0-XXX SS-515 12/4/2012 0-1 ft	OC-SS-516-0.0/1.0-XXX SS-516 12/4/2012 0-1 ft	OC-SS-517-0.0/1.0-XXX SS-517 12/4/2012 0-1 ft	OC-SS-518-0.0/1.0-XXX SS-518 12/4/2012 0-1 ft	OC-SS-519-0.0/1.0-XXX SS-519 12/4/2012 0-1 ft	OC-SS-520-0.0/1.0-XXX SS-520 12/4/2012 0-1 ft	OC-SS-521-0.0/1.0-XXX SS-521 12/4/2012 0-1 ft	OC-SS-522-0.0/1.0-XXX SS-522 12/4/2012 0-1 ft	OC-SS-523-0.0/1.0-XXX SS-523 12/4/2012 0-1 ft	OC-SS-524-0.0/1.0-XXX SS-524 12/5/2012 0-1 ft	OC-SS-525-0.0/1.0-XXX SS-525 12/5/2012 0-1 ft	SS101XX33X SWMU-33-101 11/23/1998 0-2 ft	SS101XX33X SWMU-33-101 11/30/1998 0-2 ft	SS102XX33X SWMU-33-102 11/23/1998 0-2 ft	SS102XX33X SWMU-33-102 11/30/1998 0-2 ft
Iron												3200		15000	
Lead												17		49	
Magnesium												260		1600	
Manganese												31		130	
Mercury												0.08 U		0.11	
Nickel												5 U		6.1	
Potassium												240		390	
Selenium												2 U		2 U	
Silver												1 U		0.8 U	
Sodium												140		94	
Thallium												2 U		2 U	
Tin															
Vanadium												9		54	
Zinc												12 U		24	
Inorganics (mg/kg)															
Chloride												55.1		26.3	
Cyanide, Available															
Cyanide, Total															
Nitrogen, as Ammonia												70		61	
Oxidation Reduction Potential (mV)	57	68	64	68	97	98	67	67	82	110	99				
Percent Moisture (%)	18	17	18	50	52	59	59	36	42	55	34				
Percent Solids (%)	82	83	82	50	48	41	41	64	58	45	66				
Percent Solids, Residual (%)												50.9		69.9	
pH (units)	4.55	3.59	3.82	3.64	3.58	3.99	3.87	3.9	3.71	3.36	4.07				
Sulfate												165		13.4	
Total Organic Carbon															
Total Organic Carbon (%)															
Specialty Compounds (mg/kg)															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SS103XX33X SWMU-33-103 11/23/1998 0-2 ft	SS103XX33X SWMU-33-103 11/30/1998 0-2 ft	SWMU-33 SWMU-33 7/30/1991 0-1 ft
Volatile Organic Compounds (mg/kg)			
1,1,1,2-Tetrachloroethane	0.012 U	0.86 U	
1,1,1-Trichloroethane	0.012 U	0.86 U	0.016 UJ
1,1,2,2-Tetrachloroethane	0.012 U	0.86 U	0.016 UJ
1,1,2-Trichloro-1,2,2-Trifluoroethane			
1,1,2-Trichloroethane	0.012 U	0.86 U	0.016 UJ
1,1-Dichloroethane	0.012 U	0.86 U	0.016 UJ
1,1-Dichloroethene	0.012 U	0.86 U	0.016 UJ
1,1-Dichloropropene	0.012 U	0.86 U	
1,2,3-Trichlorobenzene	0.012 U	0.86 U	
1,2,3-Trichloropropane	0.012 U	0.86 U	
1,2,4-Trichlorobenzene	0.012 U	0.86 U	
1,2,4-Trimethylbenzene	0.012 U	0.86 U	
1,2-Dibromo-3-chloropropane	0.012 U	0.86 U	
1,2-Dibromoethane	0.012 U	0.86 U	
1,2-Dichlorobenzene	0.012 U	0.86 U	
1,2-Dichloroethane	0.012 U	0.86 U	0.016 UJ
1,2-Dichloroethene (total)			0.016 UJ
1,2-Dichloropropane	0.012 U	0.86 U	0.016 UJ
1,3,5-Trimethylbenzene	0.012 U	0.86 U	
1,3-Dichlorobenzene	0.012 U	0.86 U	
1,3-Dichloropropane	0.012 U	0.86 U	
1,4-Dichlorobenzene	0.012 U	0.86 U	
1,4-Dioxane			
2,2-Dichloropropane	0.012 U	0.86 U	
2,4,4-Trimethyl-1-pentene	0.012 U		0.033 U
2,4,4-Trimethyl-2-pentene	0.012 U		0.033 U
2-Butanone	0.23 U	17 U	0.05 U
2-Chlorotoluene	0.012 U	0.86 U	
2-Hexanone	0.046 U	3.4 U	0.05 UJ
4-Chlorotoluene	0.012 U	0.86 U	
4-iso-Propyltoluene	0.012 U	0.86 U	
4-Methyl-2-pentanone	0.046 U	3.4 U	0.05 UJ
Acetaldehyde			
Acetic acid, methyl ester			
Acetone	0.23 U	17 U	0.014 U
Benzene	0.012 U	0.86 U	0.016 UJ
Bromobenzene	0.012 U	0.86 U	
Bromochloromethane	0.012 U	0.86 U	
Bromodichloromethane	0.012 U	0.86 U	0.016 UJ
Bromoform	0.012 U	0.86 U	0.016 UJ
Bromomethane	0.023 U	1.7 U	0.033 UJ
Butane, 2-methoxy-2-methyl-			
Carbon disulfide			0.033 UJ
Carbon tetrachloride	0.012 U	0.86 U	0.016 UJ
Chlorobenzene	0.012 U	0.86 U	0.016 UJ
Chlorodibromomethane	0.012 U	0.86 U	0.016 UJ
Chloroethane	0.023 U	1.7 U	0.033 UJ
Chloroform	0.012 U	0.86 U	0.016 UJ
Chloromethane	0.023 U	1.7 U	0.033 UJ
Cis-1,2-Dichloroethene	0.012 U	0.86 U	
cis-1,3-Dichloropropene	0.012 U	0.86 U	0.016 UJ
Cyclohexane			
Dibromomethane	0.012 U	0.86 U	

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SS103XX33X SWMU-33-103 11/23/1998 0-2 ft	SS103XX33X SWMU-33-103 11/30/1998 0-2 ft	SWMU-33 SWMU-33 7/30/1991 0-1 ft
Dichlorodifluoromethane	0.012 U	0.86 U	
Diethyl ether			
Ethyl benzene	0.012 U	0.86 U	0.016 UJ
Ethyl-t-Butyl Ether			
Formaldehyde			
Hexachlorobutadiene	0.012 U	0.86 U	
Isopropyl ether			
Isopropylbenzene	0.012 U	0.86 U	
Methyl cyclohexane			
Methyl Tertbutyl Ether			
Methylene chloride	0.012 U	0.86 U	0.032 U
Naphthalene	0.12 U	8.6 U	
n-Butylbenzene	0.012 U	0.86 U	
Propylbenzene	0.012 U	0.86 U	
sec-Butylbenzene	0.012 U	0.86 U	
Styrene	0.012 U	0.86 U	0.016 UJ
tert-Butylbenzene	0.012 U	0.86 U	
Tetrachloroethene	0.012 U	0.86 U	0.001 J
Tetrahydrofuran			
Toluene	0.012 U	0.86 U	0.001 J
trans-1,2-Dichloroethene	0.012 U	0.86 U	
trans-1,3-Dichloropropene	0.012 U	0.86 U	0.016 UJ
Trichloroethene	0.012 U	0.86 U	0.016 UJ
Trichlorofluoromethane	0.012 U	0.86 U	
Vinyl acetate			0.05 UJ
Vinyl chloride	0.023 U	1.7 U	0.033 UJ
Xylene, o	0.012 U	0.86 U	
Xylenes (m&p)	0.012 U	0.86 U	
Xylenes, Total	0.012 U	0.86 U	0.016 UJ
Semivolatile Organic Compounds (mg/kg)			
1,2,4,5-Tetrachlorobenzene			
1,2,4-Trichlorobenzene	0.62 U		2.2 UJ
1,2-Dichlorobenzene	0.62 U		2.2 UJ
1,2-Diphenylhydrazine	0.62 U		
1,3-Dichlorobenzene	0.62 U		2.2 UJ
1,4-Dichlorobenzene	0.62 U		2.2 UJ
1-Methylnaphthalene			
2,2'-Dichlorodiisopropylether	0.62 U		2.2 UJ
2,3,4,6-Tetrachlorophenol			
2,4,5-Trichlorophenol	0.62 U		11 UJ
2,4,6-Trichlorophenol	0.62 U		2.2 UJ
2,4-Dichlorophenol	0.62 U		2.2 UJ
2,4-Dimethylphenol	0.62 U		2.2 UJ
2,4-Dinitrophenol	3.1 U		11 UJ
2,4-Dinitrotoluene	0.62 U		2.2 UJ
2,6-Dinitrotoluene	0.62 U		2.2 UJ
2-Chloronaphthalene	0.62 U		2.2 UJ
2-Chlorophenol	0.62 U		2.2 UJ
2-Methylnaphthalene	0.62 U		2.2 UJ
2-Methylphenol	0.62 U		2.2 UJ
2-Nitroaniline	3.1 U		11 UJ
2-Nitrophenol	0.62 U		2.2 UJ
3 & 4 Methylphenol			
3,3'-Dichlorobenzidine	1.2 U		4.4 UJ

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SS103XX33X SWMU-33-103 11/23/1998 0-2 ft	SS103XX33X SWMU-33-103 11/30/1998 0-2 ft	SWMU-33 SWMU-33 7/30/1991 0-1 ft
3-Nitroaniline	3.1 U		11 UJ
4,6-Dinitro-2-methylphenol	3.1 U		11 UJ
4-Bromophenyl phenyl ether	0.62 U		2.2 UJ
4-Chloro-3-methylphenol	1.2 U		2.2 UJ
4-Chloroaniline	1.2 U		2.2 UJ
4-Chlorophenyl phenyl ether	0.62 U		2.2 UJ
4-Methylphenol	0.62 U		2.2 UJ
4-Nitroaniline	3.1 U		11 UJ
4-Nitrophenol	3.1 U		11 UJ
Acenaphthene	0.62 U		2.2 UJ
Acenaphthylene	0.62 U		2.2 UJ
Acetophenone			
Aniline	3.1 U		
Anthracene	0.62 U		2.2 UJ
Atrazine			
Azobenzene			
Benzaldehyde			
Benzo(a)anthracene	0.62 U		2.2 UJ
Benzo(a)pyrene	0.62 U		
Benzo(b)fluoranthene	0.62 U		2.2 UJ
Benzo(ghi)perylene	0.62 U		2.2 UJ
Benzo(k)fluoranthene	0.62 U		2.2 UJ
Benzoic Acid	3.1 U		11 UJ
Benzyl alcohol	1.2 U		2.2 UJ
Biphenyl			
Bis(2-Chloroethoxy)methane	0.62 U		2.2 UJ
Bis(2-Chloroethyl)ether	0.62 U		2.2 UJ
Bis(2-Chloroisopropyl)ether			
Bis(2-Ethylhexyl)phthalate	0.62 U		34 J
Butylbenzylphthalate	0.62 U		2.2 UJ
Caprolactam			
Carbazole			
Chrysene	0.62 U		2.2 UJ
Dibenz(a,h)anthracene	0.62 U		
Dibenzofuran	0.62 U		2.2 UJ
Diethylphthalate	0.62 U		2.2 UJ
Dimethylphthalate	0.62 U		2.2 UJ
Di-n-butylphthalate	0.62 U		0.27 J
Di-n-octylphthalate	0.62 U		2.2 UJ
Diphenyl ether			
Diphenylamine			
Diphenylmethanone			
Fluoranthene	0.62 U		2.2 UJ
Fluorene	0.62 U		2.2 UJ
Hexachlorobenzene	0.62 U		2.2 UJ
Hexachlorobutadiene	0.62 U		2.2 UJ
Hexachlorocyclopentadiene	0.62 U		2.2 UJ
Hexachloroethane	0.62 U		2.2 UJ
Indeno(1,2,3-cd)pyrene	0.62 U		2.2 UJ
Isophorone	0.62 U		2.2 UJ
Naphthalene	0.62 U		2.2 UJ
Nitrobenzene	0.62 U		2.2 UJ
N-Nitrosodimethylamine			
N-Nitrosodi-n-propylamine	0.62 U		2.2 UJ

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SS103XX33X SWMU-33-103 11/23/1998 0-2 ft	SS103XX33X SWMU-33-103 11/30/1998 0-2 ft	SWMU-33 SWMU-33 7/30/1991 0-1 ft
N-Nitrosodiphenylamine	0.62 U		2.2 UJ
Pentachlorophenol	3.1 U		2.2 UJ
Phenanthrene	0.62 U		2.2 UJ
Phenol	0.62 U		2.2 UJ
Pyrene	0.62 U		R
EPH (mg/kg)			
C11-C22 Aromatics			
C11-C22 Aromatics (unadj.)			
C19-C36 Aliphatics			
C9-C18 Aliphatics			
Extractable Petroleum Hydrocarbons, Total			
Pesticides (mg/kg)			
4,4'-DDD			0.1 UJ
4,4'-DDE			0.1 UJ
4,4'-DDT			0.1 UJ
Aldrin			0.052 UJ
Alpha-BHC			0.052 UJ
Alpha-Chlordane			0.052 UJ
Aroclor-1016			0.98 J
Aroclor-1221			0.52 UJ
Aroclor-1232			0.52 UJ
Aroclor-1242			0.52 UJ
Aroclor-1248			0.52 UJ
Aroclor-1254			1 UJ
Aroclor-1260			1 UJ
Beta-BHC			0.052 UJ
Chlordane			
Chlordane (technical)			0.052 UJ
Delta-BHC			0.052 UJ
Dieldrin			0.1 UJ
Endosulfan I			0.052 UJ
Endosulfan II			0.1 UJ
Endosulfan sulfate			0.1 UJ
Endrin			0.1 UJ
Endrin aldehyde			0.1 UJ
Endrin ketone			0.052 UJ
Gamma-BHC/Lindane			0.1 UJ
Heptachlor			0.52 UJ
Heptachlor epoxide			0.052 UJ
Hexachlorobenzene			
Methoxychlor			0.052 UJ
Toxaphene			1 UJ
Metals (mg/kg)			
Aluminum	7600		59000
Antimony	4 U		79
Arsenic	6		18
Barium	13		21
Beryllium	0.4 U		4
Cadmium	0.4 U		5.8
Calcium	630		1400
Chromium	11		5000
Chromium, Hexavalent			
Cobalt	2.8		45
Copper	5.7		33

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SS103XX33X SWMU-33-103 11/23/1998 0-2 ft	SS103XX33X SWMU-33-103 11/30/1998 0-2 ft	SWMU-33 SWMU-33 7/30/1991 0-1 ft
Iron	5600		100000
Lead	18		62
Magnesium	900		550
Manganese	55		140
Mercury	0.07 U		0.4
Nickel	6.2		67
Potassium	290		160
Selenium	2 U		5.1 U
Silver	1 U		3 U
Sodium	150		680
Thallium	2 U		1 U
Tin			
Vanadium	13		37
Zinc	11 U		180
Inorganics (mg/kg)			
Chloride	176		560 J
Cyanide, Available			
Cyanide, Total			5.2 J
Nitrogen, as Ammonia	80		300
Oxidation Reduction Potential (mV)			
Percent Moisture (%)			
Percent Solids (%)			
Percent Solids, Residual (%)	51.3		30
pH (units)			
Sulfate	221		2400 J
Total Organic Carbon			
Total Organic Carbon (%)			
Specialty Compounds (mg/kg)			
Hydrazine			
Monomethylhydrazine (MMH)			
UDMH			
Dimethylformamide			
Phthalic Acid/Phthalic anhydride			

Attachment 1-3
Surface Soil Data Summary - Exposure Area 4
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-CP-TP15 CP-TP15 9/18/2001 0-2.25 ft	1010-CP-TP19 CP-TP19 9/18/2001 0-2.25 ft	1010-CP-TP8 CP-TP8 9/18/2001 0-2.25 ft	1010-SED-SDF-3S SDF-3 9/17/2001 0-0.5 ft	1010-SED-SDF-4S SDF-4 9/17/2001 0-0.5 ft	1010-SED-SDF-5S SDF-5 9/17/2001 0-0.5 ft	1010-SED-SDF-6S SDF-6 9/17/2001 0-0.5 ft	1130-OSFILL-400 OSFILL-400 11/15/2000	1130-OSFILL-460 OSFILL-460 11/15/2000

Notes:
mg/kg - milligram per kilogram
mV - millivolts
U - Not detected, value is reporting limit
J - Value is estimated.
EB - Analyte detected in the associated equipment blank
T - The associated value is an estimated quantity and may be biased high due to the oxidation of Cr+3 to Cr+6
F - The result is estimated due to matrix spike recovery outside of control limits
K - The result is estimated due to blank spike compound recovery outside the control limits
G - The result is estimated due to duplicate precision outside of control limits
C - The result is estimated due to surrogate recovery outside of control limits
B - Parameter found in both the associated blank and the sample
N - Presumptive evidence of presence of material
E - The reporting limit is elevated due to a matrix effect
R - Value is rejected
- CCV (continuing calibration verification) exceeded the limit
[] - Value is above instrument detection limit but below the CRDL (Contract-Required Detection Limit)
* - Duplicate analysis is not within control limits
> - Exceeded the maximum reportable value of the instrument

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-SED-SDF-1S SDF-1 9/17/2001 0-0.5 ft	1010-SED-SDF-2S SDF-2 9/17/2001 0-0.5 ft	BS040LSD BS040 8/22/2005 0-0.5 ft	OC-SB-526-0.0/1.0-XXX SB-526 12/5/2012 0-1 ft	OC-SB-527-0.0/1.0-XXX SB-527 12/5/2012 0-1 ft	OC-SB-528-0.0/1.0-XXX SB-528 12/5/2012 0-1 ft	OC-SB-529-0.0/1.0-XXX SB-529 12/5/2012 0-1 ft	OC-SS-438-0.0/1.0-XXX SS-438 6/3/2010 0-1 ft	OC-SS-439-0.0/1.0-XXX SS-439 6/3/2010 0-1 ft	OC-SS-441-0.0/1.0-XXX SS-441 6/3/2010 0-1 ft	OC-SS-443-0.0/1.0-XXX SS-443 6/3/2010 0-1 ft	OC-SS-444-0.0/1.0-XXX SS-444 6/3/2010 0-1 ft	OC-SS-445-0.0/1.0-XXX SS-445 6/3/2010 0-1 ft	OC-SS-446-0.0/1.0-XXX SS-446 6/3/2010 0-1 ft	OC-SS-447-0.0/1.0-XXX SS-447 6/3/2010 0-1 ft	SOLSD-10-0-6 SOLSD10 9/21/2005 0-0.5 ft	SOLSD-1-0-6 SOLSD01 9/21/2005 0-0.5 ft
Volatile Organic Compounds (mg/kg)																	
1,1,1,2-Tetrachloroethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,1,1-Trichloroethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,1,2,2-Tetrachloroethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,1,2-Trichloro-1,2,2-Trifluoroethane								0.026 U	0.024 U	0.024 U	0.022 U	0.024 U	R	0.02 U	R		
1,1,2-Trichloroethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,1-Dichloroethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,1-Dichloroethene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,1-Dichloropropene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,2,3-Trichlorobenzene	0.47 U	0.56 U						0.0052 UJ	0.0048 UJ	0.0048 UJ	0.0043 UJ	0.0047 UJ	R	0.004 UJ	R		
1,2,3-Trichloropropane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,2,4-Trichlorobenzene	0.47 U	0.56 U						0.0052 UJ	0.0048 UJ	0.0048 UJ	0.0043 UJ	0.0047 UJ	R	0.004 UJ	R		
1,2,4-Trimethylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,2-Dibromo-3-chloropropane	0.47 U	0.56 U						0.052 U	0.048 U	0.048 U	0.043 U	0.047 U	R	0.04 U	R		
1,2-Dibromoethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,2-Dichlorobenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,2-Dichloroethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,2-Dichloropropane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,3,5-Trimethylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,3-Dichlorobenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,3-Dichloropropane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,4-Dichlorobenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
1,4-Dioxane								0.52 UJ	0.48 UJ	0.48 UJ	0.43 UJ	0.47 UJ	R	0.4 UJ	R		
2,2-Dichloropropane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
2,4,4-Trimethyl-1-pentene	0.47 U	0.56 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
2,4,4-Trimethyl-2-pentene	0.47 U	0.56 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	0.0056 J	0.008 U	R		
2-Butanone	9.4 U	11 U						0.052 U	0.048 U	0.048 U	0.043 U	0.047 U	R	0.04 U	R		
2-Chlorotoluene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
2-Hexanone	1.9 U	2.2 U						0.052 U	0.048 U	0.048 U	0.043 U	0.047 U	R	0.04 U	R		
4-Chlorotoluene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
4-iso-Propyltoluene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
4-Methyl-2-pentanone	1.9 U	2.2 U						0.052 UJ	0.048 UJ	0.048 UJ	0.043 UJ	0.047 UJ	R	0.04 UJ	R		
Acetaldehyde										0.048 J	0.067 J				0.13 J		
Acetic acid, methyl ester								0.1 U	0.095 U	0.096 U	0.086 U	0.095 U	R	0.08 U	R		
Acetone	9.4 U	11 U						0.52 UJ	0.48 UJ	0.48 UJ	0.43 UJ	0.47 UJ	R	0.4 UJ	R		
Benzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Bromobenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Bromochloromethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Bromodichloromethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Bromoform	0.47 U	0.56 U						0.0052 UJ	0.0048 UJ	0.0048 UJ	0.0043 UJ	0.0047 UJ	R	0.004 UJ	R		
Bromomethane	0.94 U	1.1 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Butane, 2-methoxy-2-methyl-								0.0052 UJ	0.0048 UJ	0.0048 UJ	0.0043 UJ	0.0047 UJ	R	0.004 UJ	R		
Carbon disulfide								0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Carbon tetrachloride	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Chlorobenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Chlorodibromomethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Chloroethane	0.94 U	1.1 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Chloroform	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Chloromethane	0.94 U	1.1 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Cis-1,2-Dichloroethene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
cis-1,3-Dichloropropene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Cyclohexane								0.052 U	0.048 U	0.048 U	0.043 U	0.047 U	R	0.04 U	R		
Dibromomethane	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Dichlorodifluoromethane								0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Diethyl ether								0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-SED-SDF-1S SDF-1 9/17/2001 0-0.5 ft	1010-SED-SDF-2S SDF-2 9/17/2001 0-0.5 ft	BS040LSD BS040 8/22/2005 0-0.5 ft	OC-SB-526-0.0/1.0-XXX SB-526 12/5/2012 0-1 ft	OC-SB-527-0.0/1.0-XXX SB-527 12/5/2012 0-1 ft	OC-SB-528-0.0/1.0-XXX SB-528 12/5/2012 0-1 ft	OC-SB-529-0.0/1.0-XXX SB-529 12/5/2012 0-1 ft	OC-SS-438-0.0/1.0-XXX SS-438 6/3/2010 0-1 ft	OC-SS-439-0.0/1.0-XXX SS-439 6/3/2010 0-1 ft	OC-SS-441-0.0/1.0-XXX SS-441 6/3/2010 0-1 ft	OC-SS-443-0.0/1.0-XXX SS-443 6/3/2010 0-1 ft	OC-SS-444-0.0/1.0-XXX SS-444 6/3/2010 0-1 ft	OC-SS-445-0.0/1.0-XXX SS-445 6/3/2010 0-1 ft	OC-SS-446-0.0/1.0-XXX SS-446 6/3/2010 0-1 ft	OC-SS-447-0.0/1.0-XXX SS-447 6/3/2010 0-1 ft	SOLSD-10-0-6 SOLSD10 9/21/2005 0-0.5 ft	SOLSD-1-0-6 SOLSD01 9/21/2005 0-0.5 ft
Ethyl benzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Ethyl-t-Butyl Ether								0.0052 UJ	0.0048 UJ	0.0048 UJ	0.0043 UJ	0.0047 UJ	R	0.004 UJ	R		
Formaldehyde										0.47	0.5				1.1		
Hexachlorobutadiene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Isopropyl ether								0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Isopropylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Methyl cyclohexane								0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Methyl Tertbutyl Ether	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Methylene chloride	0.94 U	1.1 U						0.021 U	0.019 U	0.019 U	0.017 U	0.019 U	R	0.016 U	R		
Naphthalene								0.052 U	0.048 U	0.048 U	0.043 U	0.047 U	R	0.04 U	R		
n-Butylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Propylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
sec-Butylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Styrene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
tert-Butylbenzene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Tetrachloroethene	0.47 U	0.56 U						0.0052 UJ	0.0048 UJ	0.0048 UJ	0.0043 UJ	0.0047 UJ	R	0.004 UJ	R		
Tetrahydrofuran								0.052 UJ	0.048 UJ	0.048 UJ	0.043 UJ	0.047 UJ	R	0.04 UJ	R		
Toluene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
trans-1,2-Dichloroethene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
trans-1,3-Dichloropropene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Trichloroethene	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Trichlorofluoromethane	0.47 U	0.56 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Vinyl chloride	0.94 U	1.1 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Xylene, o	0.47 U	0.56 U						0.0052 U	0.0048 U	0.0048 U	0.0043 U	0.0047 U	R	0.004 U	R		
Xylenes (m&p)	0.47 U	0.56 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Xylenes, Total	0.47 U	0.56 U						0.01 U	0.0095 U	0.0096 U	0.0086 U	0.0095 U	R	0.008 U	R		
Semivolatile Organic Compounds (mg/kg)																	
1,2,4,5-Tetrachlorobenzene				0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
1,2,4-Trichlorobenzene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
1,2-Dichlorobenzene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.21 J	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
1,2-Diphenylhydrazine	26 U	33 U															
1,3-Dichlorobenzene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
1,4-Dichlorobenzene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.053 J	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
1-Methylnaphthalene				0.056 U		R	0.056 U	0.063 U	0.023 J	0.037 J	0.059 U	0.057 U	0.045 J	0.046 U	0.062 J		
2,2'-Dichlorodiisopropylether	26 U	33 U	0.99 U														
2,3,4,6-Tetrachlorophenol				0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,4,5-Trichlorophenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,4,6-Trichlorophenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,4-Dichlorophenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,4-Dimethylphenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,4-Dinitrophenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,4-Dinitrotoluene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2,6-Dinitrotoluene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2-Chloronaphthalene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2-Chlorophenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2-Methylnaphthalene	2.6 U	2.2 U	0.5 U	0.056 U		R	0.056 U	0.063 U	0.026 J	0.041 J	0.059 U	0.057 U	0.051 J	0.046 U	0.075 J		
2-Methylphenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
2-Nitroaniline	130 U	170 U	5 U	0.28 U		R	0.28 U	0.31 U	0.35 U	0.28 U	0.3 U	0.28 U	R	0.23 U	R		
2-Nitrophenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
3 & 4 Methylphenol	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
3,3'-Dichlorobenzidine	51 U	67 U	2 UJ	0.11 U		R	0.11 U	0.13 U	R	0.11 U	0.12 U	0.11 U	R	0.092 U	R		
3-Nitroaniline	130 U	170 U	5 U	0.28 U		R	0.28 U	0.31 U	R	0.28 U	0.3 U	0.28 U	R	0.073 J	R		
4,6-Dinitro-2-methylphenol	130 U	170 U	5 U	0.28 U		R	0.28 U	0.31 U	0.35 U	0.28 U	0.3 U	0.28 U	R	0.23 U	R		
4-Bromophenyl phenyl ether	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
4-Chloro-3-methylphenol	51 U	67 U	2 U	0.11 U		R	0.11 U	0.13 U	0.14 U	0.11 U	0.12 U	0.11 U	R	0.092 U	R		

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-SED-SDF-1S SDF-1 9/17/2001 0-0.5 ft	1010-SED-SDF-2S SDF-2 9/17/2001 0-0.5 ft	BS040LSD BS040 8/22/2005 0-0.5 ft	OC-SB-526-0.0/1.0-XXX SB-526 12/5/2012 0-1 ft	OC-SB-527-0.0/1.0-XXX SB-527 12/5/2012 0-1 ft	OC-SB-528-0.0/1.0-XXX SB-528 12/5/2012 0-1 ft	OC-SB-529-0.0/1.0-XXX SB-529 12/5/2012 0-1 ft	OC-SS-438-0.0/1.0-XXX SS-438 6/3/2010 0-1 ft	OC-SS-439-0.0/1.0-XXX SS-439 6/3/2010 0-1 ft	OC-SS-441-0.0/1.0-XXX SS-441 6/3/2010 0-1 ft	OC-SS-443-0.0/1.0-XXX SS-443 6/3/2010 0-1 ft	OC-SS-444-0.0/1.0-XXX SS-444 6/3/2010 0-1 ft	OC-SS-445-0.0/1.0-XXX SS-445 6/3/2010 0-1 ft	OC-SS-446-0.0/1.0-XXX SS-446 6/3/2010 0-1 ft	OC-SS-447-0.0/1.0-XXX SS-447 6/3/2010 0-1 ft	SOLSD-10-0-6 SOLSD10 9/21/2005 0-0.5 ft	SOLSD-1-0-6 SOLSD01 9/21/2005 0-0.5 ft
4-Chloroaniline	51 U	67 U	2 U	0.11 U		R	0.11 U	0.13 UJ	R	0.11 UJ	0.12 UJ	0.11 UJ	R	0.092 UJ	R		
4-Chlorophenyl phenyl ether	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
4-Methylphenol				0.056 U		R	0.056 U										
4-Nitroaniline	130 U	170 U	5 U	0.28 U		R	0.28 U	0.31 U	R	0.28 U	0.3 U	0.28 U	R	0.23 U	R		
4-Nitrophenol	130 U	170 U	5 U	R		R	R	0.31 U	0.35 U	0.28 U	0.3 U	0.28 U	R	0.23 U	R		
Acenaphthene	2.6 U	2.2 U	0.5 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Acenaphthylene	2.6 U	2.2 U	0.5 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	0.063 J	0.046 U	0.058 J		
Acetophenone			0.99 U	0.056 U		R	0.018 J	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	0.17 J	0.046 U	R		
Aniline	130 U	170 U	5 U	0.056 U		R	0.056 U	0.063 UJ	0.07 UJ	0.055 UJ	0.059 UJ	0.057 UJ	0.12 J	0.046 UJ	R		
Anthracene	2.6 U	2.2 U	0.05 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	0.044 J	0.046 U	R		
Atrazine				0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Azobenzene			0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Benzaldehyde				0.056		R	0.097	0.045 J	0.029 J	0.065	0.032 J	0.055 J	0.33 J	0.16	0.32 J		
Benzo(a)anthracene	2.6 U	2.2 U	2.3	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	0.069 J		
Benzo(a)pyrene			0.44	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.027 J	0.059 U	0.057 U	R	0.014 J	0.062 J		
Benzo(b)fluoranthene	2.6 U	2.2 U	0.6	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.025 J	0.059 U	0.057 U	R	0.046 U	0.051 J		
Benzo(ghi)perylene	2.6 U	2.3	0.51	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.023 J	0.059 U	0.057 U	R	0.046 U	0.041 J		
Benzo(k)fluoranthene	2.6 U	2.2 U	0.24	0.056 U		R	0.056 U	0.022 J	0.07 UJ	0.041 J	0.059 U	0.057 U	R	0.046 U	0.15 J		
Benzoic Acid	130 U	170 U	5 U	R		R	R	0.31 UJ	0.35 UJ	0.3 UJ	0.3 UJ	0.28 UJ	R	0.32 UJ	R		
Benzyl alcohol	51 U	67 U	2 U	R		R	R	0.13 U	0.14 U	0.11 U	0.12 U	0.11 U	R	0.092 U	R		
Biphenyl				0.056 U		0.93 J	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	0.86 J	0.046 U	R		
Bis(2-Chloroethoxy)methane	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Bis(2-Chloroethyl)ether	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Bis(2-Chloroisopropyl)ether				0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Bis(2-Ethylhexyl)phthalate	216	106	46	0.28 U		41 J	0.28 U	0.026 J	0.028 J	0.05 J	0.027 J	0.057 U	28 J	0.1 J	0.37 J		
Butylbenzylphthalate	26 U	33 U	0.99 UJ	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Caprolactam				0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Carbazole				0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	0.086 J	0.046 U	0.039 J		
Chrysene	2.6 U	2.2 U	0.56	0.056 U		R	0.056 U	0.063 U	0.07 U	0.029 J	0.059 U	0.057 U	R	0.046 U	0.15 J		
Dibenz(a,h)anthracene			0.49 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Dibenzofuran	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.08	0.07 U	0.068	0.022 J	0.024 J	R	0.037 J	1.2 J		
Diethylphthalate	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 UJ	0.07 UJ	0.055 UJ	0.059 UJ	0.057 UJ	R	0.046 UJ	R		
Dimethylphthalate	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Di-n-butylphthalate	26 U	33 U	0.99 U	0.28 U		R	0.28 U	0.063 UJ	0.07 UJ	0.055 UJ	0.059 UJ	0.057 UJ	0.98 J	0.046 UJ	R		
Di-n-octylphthalate	26 U	33 U	0.99 UJ	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Diphenyl ether				0.056 U		1.9 J	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	1.6 J	0.046 U	R		
Diphenylamine										0.055 U	0.059 U				R		
Diphenylmethanone				0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Fluoranthene	2.6	2.2 U	1.3	0.056 U		R	0.018 J	0.028 J	0.036 J	0.066	0.059 U	0.039 J	0.11 J	0.055	0.34 J		
Fluorene	2.6 U	2.2 U	0.25 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Hexachlorobenzene	26 U	33 U		0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Hexachlorobutadiene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Hexachlorocyclopentadiene	26 U	33 U	0.99 U	0.11 U		R	0.11 U	0.13 UJ	R	0.11 UJ	0.12 UJ	0.11 UJ	R	0.092 UJ	R		
Hexachloroethane	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Indeno(1,2,3-cd)pyrene	13	2.2 U	0.12 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.027 J	0.059 U	0.057 U	R	0.046 U	R		
Isophorone	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Naphthalene	2.6 U	2.2 U	0.5 U	0.056 U		R	0.026 J	0.15 U	0.021 J	0.037 J	0.14 U	0.14 U	0.06 J	0.11 U	0.082 J		
Nitrobenzene	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
N-Nitrosodimethylamine				0.056 U		R	0.056 U	0.063 U	0.07 U	0.0084 UJ	0.009 UJ	0.057 U	R	0.046 U	R		
N-Nitrosodi-n-propylamine	26 U	33 U	0.99 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	0.26 J	0.046 U	R		
N-Nitrosodiphenylamine	26 U	33 U	0.63 J	0.056 U		1.3 J	0.056 U	0.063 U	0.07 UJ	0.055 U	0.059 U	0.057 U	0.8 J	0.046 U	R		
Pentachlorophenol	130 U	170 U	5 U	0.056 U		R	0.056 U	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	R	0.046 U	R		
Phenanthrene	2.6 U	2.2 U	0.41	0.056 U		R	0.023 J	0.025 J	0.034 J	0.054 J	0.071 U	0.028 J	0.084 J	0.026 J	0.19 J		
Phenol	26 U	33 U	0.99 U	0.056 U		R	0.024 J	0.063 U	0.07 U	0.055 U	0.059 U	0.057 U	0.24 J	0.046 U	R		
Pyrene	2.6 U	2.2 U	0.79 J	0.056 U		R	0.056 U	0.063 U	0.024 J	0.046 J	0.059 U	0.034 J	0.06 J	0.033 J	0.2 J		

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-SED-SDF-1S SDF-1 9/17/2001 0-0.5 ft	1010-SED-SDF-2S SDF-2 9/17/2001 0-0.5 ft	BS040LSD BS040 8/22/2005 0-0.5 ft	OC-SB-526-0.0/1.0-XXX SB-526 12/5/2012 0-1 ft	OC-SB-527-0.0/1.0-XXX SB-527 12/5/2012 0-1 ft	OC-SB-528-0.0/1.0-XXX SB-528 12/5/2012 0-1 ft	OC-SB-529-0.0/1.0-XXX SB-529 12/5/2012 0-1 ft	OC-SS-438-0.0/1.0-XXX SS-438 6/3/2010 0-1 ft	OC-SS-439-0.0/1.0-XXX SS-439 6/3/2010 0-1 ft	OC-SS-441-0.0/1.0-XXX SS-441 6/3/2010 0-1 ft	OC-SS-443-0.0/1.0-XXX SS-443 6/3/2010 0-1 ft	OC-SS-444-0.0/1.0-XXX SS-444 6/3/2010 0-1 ft	OC-SS-445-0.0/1.0-XXX SS-445 6/3/2010 0-1 ft	OC-SS-446-0.0/1.0-XXX SS-446 6/3/2010 0-1 ft	OC-SS-447-0.0/1.0-XXX SS-447 6/3/2010 0-1 ft	SOLSD-10-0-6 SOLSD10 9/21/2005 0-0.5 ft	SOLSD-1-0-6 SOLSD01 9/21/2005 0-0.5 ft
EPH (mg/kg)																	
C11-C22 Aromatics	7500	1400															
C11-C22 Aromatics (unadj.)	7500	1400															
C19-C36 Aliphatics	4900	1800															
C9-C18 Aliphatics	780 J	200 J															
Extractable Petroleum Hydrocarbons, Total	13000	3400															
Pesticides (mg/kg)																	
4,4'-DDD			0.028 U														
4,4'-DDE			0.028 U														
4,4'-DDT			0.045														
Aldrin			0.028 U														
Alpha-BHC			0.028 U														
Beta-BHC			0.028 U														
Chlordane			0.14 U														
Delta-BHC			0.028 U														
Dieldrin			0.028 U														
Endosulfan I			0.028 U														
Endosulfan II			0.028 U														
Endosulfan sulfate			0.028 U														
Endrin			0.028 U														
Endrin ketone			0.028 U														
Gamma-BHC/Lindane			0.028 U														
Heptachlor			0.028 U														
Heptachlor epoxide			0.028 U														
Hexachlorobenzene			0.029														
Methoxychlor			0.056 U														
Metals (mg/kg)																	
Aluminum			43000					2500	5700	3600	6700	5800	13000 J	7000	9800 J		
Antimony			6.9 U					1 U	1.3 U	0.34 J	0.94 U	0.92 U	R	0.29 J	R		
Arsenic	37 U	40	14					4.6	25	4.5	29	8.2	42 J	10	18 J		
Barium	65	23	16					5.5	16	11	9.8	14	130 J	9.3	37 J		
Beryllium			2.8					0.061 J	0.27 J	0.093 J	0.42	0.2 J	R	0.15 J	0.74 J		
Cadmium	4 U	4 U	0.69 U					0.093 J	0.42 J	0.36 U	0.38 J	0.52 J	R	0.19 J	0.39 J		
Calcium			740					260	530	320	350	190	1100 J	260	710 J		
Chromium	21000	12000	5000					15	20	46	14	9	52000 J	7.2	540 J	32	15
Chromium, Hexavalent	28 T	26 T	30 U	3.4 U	2.9 U	19 J	3.3 U	3.7 U	4.2 U	3.3 U	3.5 U	3.3 U	1100	2.8 U	7.2 U		
Cobalt			10					0.91 J	3.3	1.7	2.4	1.5	3.7 J	1.2	4.5 J		
Copper			69					5.5	11	12	3.8	21	190 J	4.4	28 J		
Iron			31000					3700	27000	5900	20000	8400	10000 J	6600	14000 J		
Lead	120	85	41					27	28	59	32	88	150 J	48	100 J		
Magnesium			1000					82	880	390	540	140	750 J	470	590 J		
Manganese			170					10	83	21	53	9	37 J	26	28 J		
Mercury	1.4	1.5	0.28					0.11 J	0.16 U	0.064 J	0.047 J	0.11 J	3.1 J	0.068 J	0.32 J		
Nickel			16					2.1	7.1 J	3.4 J	6.6 J	9.2	15 J	4.3 J	12 J		
Potassium			1400 U					300 J	640 J	380 J	450 J	240 J	2200 J	300 J	810 J		
Selenium	18 U	18 U	3.5 U					1 U	1.3 U	0.55 U	0.94 U	0.92 U	R	0.75 U	R		
Silver	19 U	18 U	3.5 U					1 U	1.3 U	0.9 U	0.94 U	0.92 U	1100 J	0.75 U	10 J		
Sodium			690 U					200 U	260 U	180 U	190 U	180 U	R	150 U	R		
Thallium			3.5 U					2 U	2.6 U	1.8 U	1.9 U	1.8 U	7.4 J	1.5 U	R		
Tin						7.5 J		7.4 J	8.1 J	22	5.4 J	4.5 J	26000 J	7.5 UJ	260 J		
Vanadium			32					12	25	17	28	29	150 J	15	43 J		
Zinc			47					3.4 J	11	5.3	7.2	15	39 J	7.9	17 J		
Inorganics (mg/kg)																	
Chloride								38 U	43 U	34 U	36 U	34 U	81 U	28 U	74 U		
Cyanide, Available			2.4 U														

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1010-SED-SDF-1S SDF-1 9/17/2001 0-0.5 ft	1010-SED-SDF-2S SDF-2 9/17/2001 0-0.5 ft	BS040LSD BS040 8/22/2005 0-0.5 ft	OC-SB-526-0.0/1.0-XXX SB-526 12/5/2012 0-1 ft	OC-SB-527-0.0/1.0-XXX SB-527 12/5/2012 0-1 ft	OC-SB-528-0.0/1.0-XXX SB-528 12/5/2012 0-1 ft	OC-SB-529-0.0/1.0-XXX SB-529 12/5/2012 0-1 ft	OC-SS-438-0.0/1.0-XXX SS-438 6/3/2010 0-1 ft	OC-SS-439-0.0/1.0-XXX SS-439 6/3/2010 0-1 ft	OC-SS-441-0.0/1.0-XXX SS-441 6/3/2010 0-1 ft	OC-SS-443-0.0/1.0-XXX SS-443 6/3/2010 0-1 ft	OC-SS-444-0.0/1.0-XXX SS-444 6/3/2010 0-1 ft	OC-SS-445-0.0/1.0-XXX SS-445 6/3/2010 0-1 ft	OC-SS-446-0.0/1.0-XXX SS-446 6/3/2010 0-1 ft	OC-SS-447-0.0/1.0-XXX SS-447 6/3/2010 0-1 ft	SOLSD-10-0-6 SOLSD10 9/21/2005 0-0.5 ft	SOLSD-1-0-6 SOLSD01 9/21/2005 0-0.5 ft
Cyanide, Total			6.5														
Nitrate as N								9.4 U	11 U	8.4 U	8.9 U	8.5 U	20 U	7 U	19 U		
Nitrite as N								1.9 U	2.1 U	1.7 U	1.8 U	1.7 U	4 U	1.4 U	3.7 U		
Nitrogen, as Ammonia			340					220	220	150	310	240	1100	200	870		
Oxidation Reduction Potential (mV)	220	220		75	79	0.01 U	49	540	570	540	480	470	540	530	540		
Percent Moisture (%)				42	30	73	41	47	53	31.1	41.8	41	75	28	66.6		
Percent Solids (%)	24.5	22.4	33.3	58	70	27	59	53	47	59	56	59	25	72	27	48.7	62.5
pH (units)	4.74	4.58		4.04	3.73	6.02	3.88	4.11	3.74	3.91	4.3	3.94	5.52	4.55	4.05		
Sulfate								76 U	120	67 U	72 U	68 U	230	56 U	150 U		
Sulfide	730 U	450 U															
Total Organic Carbon										55000							
Total Organic Carbon (%)			11 >														
Specialty Compounds (mg/kg)																	
Hydrazine										0.0029 U	0.0034 U				0.006 U		
Monomethylhydrazine (MMH)										0.0073 U	0.0086 U				0.015 U		
UDMH										0.0073 U	0.0086 U				0.015 U		
Dimethylformamide										0.84 U	0.55 U				1.3 U		
Phthalic Acid/Phthalic anhydride										0.17 UJ	0.18 U				0.37 U		
TRIBUTYLTIN HYDRIDE						R											

Notes:
mg/kg - milligram per kilogram
mV - millivolts
U - Not detected, value is reporting limit
J - Value is estimated.
T - The associated value is an estimated quantity and may be biased high due to the oxidation of Cr+3 to Cr+6
R - Value is rejected
> - Exceeded the maximum reportable value of the instrument

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-11-0-6 SOLSD11 9/21/2005 0-0.5 ft	SOLSD-11-6-12-RISK SOLSD11 9/21/2005 0.5-1 ft	SOLSD-12-0-6-RISK SOLSD12 9/21/2005 0-0.5 ft	SOLSD-13-0-6 SOLSD13 9/21/2005 0-0.5 ft	SOLSD-13-6-12 SOLSD13 9/21/2005 0.5-1 ft	SOLSD-14-0-6 SOLSD14 9/21/2005 0-0.5 ft	SOLSD-14-6-12 SOLSD14 9/21/2005 0.5-1 ft	SOLSD-15-0-6 SOLSD15 9/21/2005 0-0.5 ft	SOLSD-16-0-6 SOLSD16 9/21/2005 0-0.5 ft	SOLSD-17-0-6 SOLSD17 9/20/2005 0-0.5 ft	SOLSD-17-6-12 SOLSD17 9/20/2005 0.5-1 ft	SOLSD-18-0-6 SOLSD18 9/20/2005 0-0.5 ft	SOLSD-18-6-12 SOLSD18 9/20/2005 0.5-1 ft	SOLSD-19-0-6 SOLSD19 9/20/2005 0-0.5 ft	SOLSD-19-6-12 SOLSD19 9/20/2005 0.5-1 ft	SOLSD-20-0-6 SOLSD20 9/20/2005 0-0.5 ft	SOLSD-2-0-6 SOLSD02 9/21/2005 0-0.5 ft
Volatile Organic Compounds (mg/kg)																	
1,1,1,2-Tetrachloroethane																	
1,1,1-Trichloroethane																	
1,1,2,2-Tetrachloroethane																	
1,1,2-Trichloro-1,2,2-Trifluoroethane																	
1,1,2-Trichloroethane																	
1,1-Dichloroethane																	
1,1-Dichloroethene																	
1,1-Dichloropropene																	
1,2,3-Trichlorobenzene																	
1,2,3-Trichloropropane																	
1,2,4-Trichlorobenzene																	
1,2,4-Trimethylbenzene																	
1,2-Dibromo-3-chloropropane																	
1,2-Dibromoethane																	
1,2-Dichlorobenzene																	
1,2-Dichloroethane																	
1,2-Dichloropropane																	
1,3,5-Trimethylbenzene																	
1,3-Dichlorobenzene																	
1,3-Dichloropropane																	
1,4-Dichlorobenzene																	
1,4-Dioxane																	
2,2-Dichloropropane																	
2,4,4-Trimethyl-1-pentene																	
2,4,4-Trimethyl-2-pentene																	
2-Butanone																	
2-Chlorotoluene																	
2-Hexanone																	
4-Chlorotoluene																	
4-iso-Propyltoluene																	
4-Methyl-2-pentanone																	
Acetaldehyde																	
Acetic acid, methyl ester																	
Acetone																	
Benzene																	
Bromobenzene																	
Bromochloromethane																	
Bromodichloromethane																	
Bromoform																	
Bromomethane																	
Butane, 2-methoxy-2-methyl-																	
Carbon disulfide																	
Carbon tetrachloride																	
Chlorobenzene																	
Chlorodibromomethane																	
Chloroethane																	
Chloroform																	
Chloromethane																	
Cis-1,2-Dichloroethene																	
cis-1,3-Dichloropropene																	
Cyclohexane																	
Dibromomethane																	
Dichlorodifluoromethane																	
Diethyl ether																	

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-11-0-6 SOLSD11 9/21/2005 0-0.5 ft	SOLSD-11-6-12-RISK SOLSD11 9/21/2005 0.5-1 ft	SOLSD-12-0-6-RISK SOLSD12 9/21/2005 0-0.5 ft	SOLSD-13-0-6 SOLSD13 9/21/2005 0-0.5 ft	SOLSD-13-6-12 SOLSD13 9/21/2005 0.5-1 ft	SOLSD-14-0-6 SOLSD14 9/21/2005 0-0.5 ft	SOLSD-14-6-12 SOLSD14 9/21/2005 0.5-1 ft	SOLSD-15-0-6 SOLSD15 9/21/2005 0-0.5 ft	SOLSD-16-0-6 SOLSD16 9/21/2005 0-0.5 ft	SOLSD-17-0-6 SOLSD17 9/20/2005 0-0.5 ft	SOLSD-17-6-12 SOLSD17 9/20/2005 0.5-1 ft	SOLSD-18-0-6 SOLSD18 9/20/2005 0-0.5 ft	SOLSD-18-6-12 SOLSD18 9/20/2005 0.5-1 ft	SOLSD-19-0-6 SOLSD19 9/20/2005 0-0.5 ft	SOLSD-19-6-12 SOLSD19 9/20/2005 0.5-1 ft	SOLSD-20-0-6 SOLSD20 9/20/2005 0-0.5 ft	SOLSD-2-0-6 SOLSD02 9/21/2005 0-0.5 ft
Ethyl benzene																	
Ethyl-t-Butyl Ether																	
Formaldehyde																	
Hexachlorobutadiene																	
Isopropyl ether																	
Isopropylbenzene																	
Methyl cyclohexane																	
Methyl Tertbutyl Ether																	
Methylene chloride																	
Naphthalene																	
n-Butylbenzene																	
Propylbenzene																	
sec-Butylbenzene																	
Styrene																	
tert-Butylbenzene																	
Tetrachloroethene																	
Tetrahydrofuran																	
Toluene																	
trans-1,2-Dichloroethene																	
trans-1,3-Dichloropropene																	
Trichloroethene																	
Trichlorofluoromethane																	
Vinyl chloride																	
Xylene, o																	
Xylenes (m&p)																	
Xylenes, Total																	
Semivolatile Organic Compounds (mg/kg)																	
1,2,4,5-Tetrachlorobenzene																	
1,2,4-Trichlorobenzene																	
1,2-Dichlorobenzene																	
1,2-Diphenylhydrazine																	
1,3-Dichlorobenzene																	
1,4-Dichlorobenzene																	
1-Methylnaphthalene																	
2,2'-Dichlorodiisopropylether																	
2,3,4,6-Tetrachlorophenol																	
2,4,5-Trichlorophenol																	
2,4,6-Trichlorophenol																	
2,4-Dichlorophenol																	
2,4-Dimethylphenol																	
2,4-Dinitrophenol																	
2,4-Dinitrotoluene																	
2,6-Dinitrotoluene																	
2-Chloronaphthalene																	
2-Chlorophenol																	
2-Methylnaphthalene																	
2-Methylphenol																	
2-Nitroaniline																	
2-Nitrophenol																	
3 & 4 Methylphenol																	
3,3'-Dichlorobenzidine																	
3-Nitroaniline																	
4,6-Dinitro-2-methylphenol																	
4-Bromophenyl phenyl ether																	
4-Chloro-3-methylphenol																	

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-11-0-6 SOLSD11 9/21/2005 0-0.5 ft	SOLSD-11-6-12-RISK SOLSD11 9/21/2005 0.5-1 ft	SOLSD-12-0-6-RISK SOLSD12 9/21/2005 0-0.5 ft	SOLSD-13-0-6 SOLSD13 9/21/2005 0-0.5 ft	SOLSD-13-6-12 SOLSD13 9/21/2005 0.5-1 ft	SOLSD-14-0-6 SOLSD14 9/21/2005 0-0.5 ft	SOLSD-14-6-12 SOLSD14 9/21/2005 0.5-1 ft	SOLSD-15-0-6 SOLSD15 9/21/2005 0-0.5 ft	SOLSD-16-0-6 SOLSD16 9/21/2005 0-0.5 ft	SOLSD-17-0-6 SOLSD17 9/20/2005 0-0.5 ft	SOLSD-17-6-12 SOLSD17 9/20/2005 0.5-1 ft	SOLSD-18-0-6 SOLSD18 9/20/2005 0-0.5 ft	SOLSD-18-6-12 SOLSD18 9/20/2005 0.5-1 ft	SOLSD-19-0-6 SOLSD19 9/20/2005 0-0.5 ft	SOLSD-19-6-12 SOLSD19 9/20/2005 0.5-1 ft	SOLSD-20-0-6 SOLSD20 9/20/2005 0-0.5 ft	SOLSD-2-0-6 SOLSD02 9/21/2005 0-0.5 ft
4-Chloroaniline																	
4-Chlorophenyl phenyl ether																	
4-Methylphenol																	
4-Nitroaniline																	
4-Nitrophenol																	
Acenaphthene																	
Acenaphthylene																	
Acetophenone																	
Aniline																	
Anthracene																	
Atrazine																	
Azobenzene																	
Benzaldehyde																	
Benzo(a)anthracene																	
Benzo(a)pyrene																	
Benzo(b)fluoranthene																	
Benzo(ghi)perylene																	
Benzo(k)fluoranthene																	
Benzoic Acid																	
Benzyl alcohol																	
Biphenyl																	
Bis(2-Chloroethoxy)methane																	
Bis(2-Chloroethyl)ether																	
Bis(2-Chloroisopropyl)ether																	
Bis(2-Ethylhexyl)phthalate																	
Butylbenzylphthalate																	
Caprolactam																	
Carbazole																	
Chrysene																	
Dibenz(a,h)anthracene																	
Dibenzofuran																	
Diethylphthalate																	
Dimethylphthalate																	
Di-n-butylphthalate																	
Di-n-octylphthalate																	
Diphenyl ether																	
Diphenylamine																	
Diphenylmethanone																	
Fluoranthene																	
Fluorene																	
Hexachlorobenzene																	
Hexachlorobutadiene																	
Hexachlorocyclopentadiene																	
Hexachloroethane																	
Indeno(1,2,3-cd)pyrene																	
Isophorone																	
Naphthalene																	
Nitrobenzene																	
N-Nitrosodimethylamine																	
N-Nitrosodi-n-propylamine																	
N-Nitrosodiphenylamine																	
Pentachlorophenol																	
Phenanthrene																	
Phenol																	
Pyrene																	

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-11-0-6 SOLSD11 9/21/2005 0-0.5 ft	SOLSD-11-6-12-RISK SOLSD11 9/21/2005 0.5-1 ft	SOLSD-12-0-6-RISK SOLSD12 9/21/2005 0-0.5 ft	SOLSD-13-0-6 SOLSD13 9/21/2005 0-0.5 ft	SOLSD-13-6-12 SOLSD13 9/21/2005 0.5-1 ft	SOLSD-14-0-6 SOLSD14 9/21/2005 0-0.5 ft	SOLSD-14-6-12 SOLSD14 9/21/2005 0.5-1 ft	SOLSD-15-0-6 SOLSD15 9/21/2005 0-0.5 ft	SOLSD-16-0-6 SOLSD16 9/21/2005 0-0.5 ft	SOLSD-17-0-6 SOLSD17 9/20/2005 0-0.5 ft	SOLSD-17-6-12 SOLSD17 9/20/2005 0.5-1 ft	SOLSD-18-0-6 SOLSD18 9/20/2005 0-0.5 ft	SOLSD-18-6-12 SOLSD18 9/20/2005 0.5-1 ft	SOLSD-19-0-6 SOLSD19 9/20/2005 0-0.5 ft	SOLSD-19-6-12 SOLSD19 9/20/2005 0.5-1 ft	SOLSD-20-0-6 SOLSD20 9/20/2005 0-0.5 ft	SOLSD-2-0-6 SOLSD02 9/21/2005 0-0.5 ft
EPH (mg/kg)																	
C11-C22 Aromatics																	
C11-C22 Aromatics (unadj.)																	
C19-C36 Aliphatics																	
C9-C18 Aliphatics																	
Extractable Petroleum Hydrocarbons, Total																	
Pesticides (mg/kg)																	
4,4'-DDD																	
4,4'-DDE																	
4,4'-DDT																	
Aldrin																	
Alpha-BHC																	
Beta-BHC																	
Chlordane																	
Delta-BHC																	
Dieldrin																	
Endosulfan I																	
Endosulfan II																	
Endosulfan sulfate																	
Endrin																	
Endrin ketone																	
Gamma-BHC/Lindane																	
Heptachlor																	
Heptachlor epoxide																	
Hexachlorobenzene																	
Methoxychlor																	
Metals (mg/kg)																	
Aluminum																	
Antimony																	
Arsenic																	
Barium																	
Beryllium																	
Cadmium																	
Calcium																	
Chromium	13000	3850	86.5	17000	2400	7200	11000	12	150	530	97	16000	14000	22000	9800	1500	180
Chromium, Hexavalent						110 U											
Cobalt																	
Copper																	
Iron																	
Lead																	
Magnesium																	
Manganese																	
Mercury																	
Nickel																	
Potassium																	
Selenium																	
Silver																	
Sodium																	
Thallium																	
Tin																	
Vanadium																	
Zinc																	
Inorganics (mg/kg)																	
Chloride																	
Cyanide, Available																	

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-11-0-6 SOLSD11 9/21/2005 0-0.5 ft	SOLSD-11-6-12-RISK SOLSD11 9/21/2005 0.5-1 ft	SOLSD-12-0-6-RISK SOLSD12 9/21/2005 0-0.5 ft	SOLSD-13-0-6 SOLSD13 9/21/2005 0-0.5 ft	SOLSD-13-6-12 SOLSD13 9/21/2005 0.5-1 ft	SOLSD-14-0-6 SOLSD14 9/21/2005 0-0.5 ft	SOLSD-14-6-12 SOLSD14 9/21/2005 0.5-1 ft	SOLSD-15-0-6 SOLSD15 9/21/2005 0-0.5 ft	SOLSD-16-0-6 SOLSD16 9/21/2005 0-0.5 ft	SOLSD-17-0-6 SOLSD17 9/20/2005 0-0.5 ft	SOLSD-17-6-12 SOLSD17 9/20/2005 0.5-1 ft	SOLSD-18-0-6 SOLSD18 9/20/2005 0-0.5 ft	SOLSD-18-6-12 SOLSD18 9/20/2005 0.5-1 ft	SOLSD-19-0-6 SOLSD19 9/20/2005 0-0.5 ft	SOLSD-19-6-12 SOLSD19 9/20/2005 0.5-1 ft	SOLSD-20-0-6 SOLSD20 9/20/2005 0-0.5 ft	SOLSD-2-0-6 SOLSD02 9/21/2005 0-0.5 ft
Cyanide, Total																	
Nitrate as N																	
Nitrite as N																	
Nitrogen, as Ammonia																	
Oxidation Reduction Potential (mV)																	
Percent Moisture (%)																	
Percent Solids (%)	23.3	44.55	36.9	20.4	39.2	23.3	35.4	90.3	35.3	23.8	41.6	21.5	39.1	29.1	45.6	25.1	27.5
pH (units)																	
Sulfate																	
Sulfide																	
Total Organic Carbon																	
Total Organic Carbon (%)																	
Specialty Compounds (mg/kg)																	
Hydrazine																	
Monomethylhydrazine (MMH)																	
UDMH																	
Dimethylformamide																	
Phthalic Acid/Phthalic anhydride																	
TRIBUTYLTIN HYDRIDE																	

Notes:
mg/kg - milligram per kilogram
mV - millivolts
U - Not detected, value is reporting limit
J - Value is estimated.
T - The associated value is an estimated quantity and may be biased high due to the oxidation of Cr+3 to Cr+6
R - Value is rejected
> - Exceeded the maximum reportable value of the instrument

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-20-6-12 SOLSD20 9/20/2005 0.5-1 ft	SOLSD-21-0-6 SOLSD21 9/20/2005 0-0.5 ft	SOLSD-22-0-6 SOLSD22 9/20/2005 0-0.5 ft	SOLSD-23-0-6 SOLSD23 9/20/2005 0-0.5 ft	SOLSD-3-0-6 SOLSD03 9/21/2005 0-0.5 ft	SOLSD-4-0-6 SOLSD04 9/21/2005 0-0.5 ft	SOLSD-5-0-6 SOLSD05 9/21/2005 0-0.5 ft	SOLSD-6-0-6 SOLSD06 9/21/2005 0-0.5 ft	SOLSD-6-6-12 SOLSD06 9/21/2005 0.5-1 ft	SOLSD-7-0-6 SOLSD07 9/21/2005 0-0.5 ft	SOLSD-7-6-12 SOLSD07 9/21/2005 0.5-1 ft	SOLSD-8-0-6 SOLSD08 9/21/2005 0-0.5 ft	SOLSD-9-0-6 SOLSD09 9/21/2005 0-0.5 ft
Volatile Organic Compounds (mg/kg)													
1,1,1,2-Tetrachloroethane													
1,1,1-Trichloroethane													
1,1,2,2-Tetrachloroethane													
1,1,2-Trichloro-1,2,2-Trifluoroethane													
1,1,2-Trichloroethane													
1,1-Dichloroethane													
1,1-Dichloroethene													
1,1-Dichloropropene													
1,2,3-Trichlorobenzene													
1,2,3-Trichloropropane													
1,2,4-Trichlorobenzene													
1,2,4-Trimethylbenzene													
1,2-Dibromo-3-chloropropane													
1,2-Dibromoethane													
1,2-Dichlorobenzene													
1,2-Dichloroethane													
1,2-Dichloropropane													
1,3,5-Trimethylbenzene													
1,3-Dichlorobenzene													
1,3-Dichloropropane													
1,4-Dichlorobenzene													
1,4-Dioxane													
2,2-Dichloropropane													
2,4,4-Trimethyl-1-pentene													
2,4,4-Trimethyl-2-pentene													
2-Butanone													
2-Chlorotoluene													
2-Hexanone													
4-Chlorotoluene													
4-iso-Propyltoluene													
4-Methyl-2-pentanone													
Acetaldehyde													
Acetic acid, methyl ester													
Acetone													
Benzene													
Bromobenzene													
Bromochloromethane													
Bromodichloromethane													
Bromoform													
Bromomethane													
Butane, 2-methoxy-2-methyl-													
Carbon disulfide													
Carbon tetrachloride													
Chlorobenzene													
Chlorodibromomethane													
Chloroethane													
Chloroform													
Chloromethane													
Cis-1,2-Dichloroethene													
cis-1,3-Dichloropropene													
Cyclohexane													
Dibromomethane													
Dichlorodifluoromethane													
Diethyl ether													

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-20-6-12 SOLSD20 9/20/2005 0.5-1 ft	SOLSD-21-0-6 SOLSD21 9/20/2005 0-0.5 ft	SOLSD-22-0-6 SOLSD22 9/20/2005 0-0.5 ft	SOLSD-23-0-6 SOLSD23 9/20/2005 0-0.5 ft	SOLSD-3-0-6 SOLSD03 9/21/2005 0-0.5 ft	SOLSD-4-0-6 SOLSD04 9/21/2005 0-0.5 ft	SOLSD-5-0-6 SOLSD05 9/21/2005 0-0.5 ft	SOLSD-6-0-6 SOLSD06 9/21/2005 0-0.5 ft	SOLSD-6-6-12 SOLSD06 9/21/2005 0.5-1 ft	SOLSD-7-0-6 SOLSD07 9/21/2005 0-0.5 ft	SOLSD-7-6-12 SOLSD07 9/21/2005 0.5-1 ft	SOLSD-8-0-6 SOLSD08 9/21/2005 0-0.5 ft	SOLSD-9-0-6 SOLSD09 9/21/2005 0-0.5 ft
Ethyl benzene													
Ethyl-t-Butyl Ether													
Formaldehyde													
Hexachlorobutadiene													
Isopropyl ether													
Isopropylbenzene													
Methyl cyclohexane													
Methyl Tertbutyl Ether													
Methylene chloride													
Naphthalene													
n-Butylbenzene													
Propylbenzene													
sec-Butylbenzene													
Styrene													
tert-Butylbenzene													
Tetrachloroethene													
Tetrahydrofuran													
Toluene													
trans-1,2-Dichloroethene													
trans-1,3-Dichloropropene													
Trichloroethene													
Trichlorofluoromethane													
Vinyl chloride													
Xylene, o													
Xylenes (m&p)													
Xylenes, Total													
Semivolatile Organic Compounds (mg/kg)													
1,2,4,5-Tetrachlorobenzene													
1,2,4-Trichlorobenzene													
1,2-Dichlorobenzene													
1,2-Diphenylhydrazine													
1,3-Dichlorobenzene													
1,4-Dichlorobenzene													
1-Methylnaphthalene													
2,2'-Dichlorodiisopropylether													
2,3,4,6-Tetrachlorophenol													
2,4,5-Trichlorophenol													
2,4,6-Trichlorophenol													
2,4-Dichlorophenol													
2,4-Dimethylphenol													
2,4-Dinitrophenol													
2,4-Dinitrotoluene													
2,6-Dinitrotoluene													
2-Chloronaphthalene													
2-Chlorophenol													
2-Methylnaphthalene													
2-Methylphenol													
2-Nitroaniline													
2-Nitrophenol													
3 & 4 Methylphenol													
3,3'-Dichlorobenzidine													
3-Nitroaniline													
4,6-Dinitro-2-methylphenol													
4-Bromophenyl phenyl ether													
4-Chloro-3-methylphenol													

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-20-6-12 SOLSD20 9/20/2005 0.5-1 ft	SOLSD-21-0-6 SOLSD21 9/20/2005 0-0.5 ft	SOLSD-22-0-6 SOLSD22 9/20/2005 0-0.5 ft	SOLSD-23-0-6 SOLSD23 9/20/2005 0-0.5 ft	SOLSD-3-0-6 SOLSD03 9/21/2005 0-0.5 ft	SOLSD-4-0-6 SOLSD04 9/21/2005 0-0.5 ft	SOLSD-5-0-6 SOLSD05 9/21/2005 0-0.5 ft	SOLSD-6-0-6 SOLSD06 9/21/2005 0-0.5 ft	SOLSD-6-6-12 SOLSD06 9/21/2005 0.5-1 ft	SOLSD-7-0-6 SOLSD07 9/21/2005 0-0.5 ft	SOLSD-7-6-12 SOLSD07 9/21/2005 0.5-1 ft	SOLSD-8-0-6 SOLSD08 9/21/2005 0-0.5 ft	SOLSD-9-0-6 SOLSD09 9/21/2005 0-0.5 ft
4-Chloroaniline													
4-Chlorophenyl phenyl ether													
4-Methylphenol													
4-Nitroaniline													
4-Nitrophenol													
Acenaphthene													
Acenaphthylene													
Acetophenone													
Aniline													
Anthracene													
Atrazine													
Azobenzene													
Benzaldehyde													
Benzo(a)anthracene													
Benzo(a)pyrene													
Benzo(b)fluoranthene													
Benzo(ghi)perylene													
Benzo(k)fluoranthene													
Benzoic Acid													
Benzyl alcohol													
Biphenyl													
Bis(2-Chloroethoxy)methane													
Bis(2-Chloroethyl)ether													
Bis(2-Chloroisopropyl)ether													
Bis(2-Ethylhexyl)phthalate													
Butylbenzylphthalate													
Caprolactam													
Carbazole													
Chrysene													
Dibenz(a,h)anthracene													
Dibenzofuran													
Diethylphthalate													
Dimethylphthalate													
Di-n-butylphthalate													
Di-n-octylphthalate													
Diphenyl ether													
Diphenylamine													
Diphenylmethanone													
Fluoranthene													
Fluorene													
Hexachlorobenzene													
Hexachlorobutadiene													
Hexachlorocyclopentadiene													
Hexachloroethane													
Indeno(1,2,3-cd)pyrene													
Isophorone													
Naphthalene													
Nitrobenzene													
N-Nitrosodimethylamine													
N-Nitrosodi-n-propylamine													
N-Nitrosodiphenylamine													
Pentachlorophenol													
Phenanthrene													
Phenol													
Pyrene													

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-20-6-12 SOLSD20 9/20/2005 0.5-1 ft	SOLSD-21-0-6 SOLSD21 9/20/2005 0-0.5 ft	SOLSD-22-0-6 SOLSD22 9/20/2005 0-0.5 ft	SOLSD-23-0-6 SOLSD23 9/20/2005 0-0.5 ft	SOLSD-3-0-6 SOLSD03 9/21/2005 0-0.5 ft	SOLSD-4-0-6 SOLSD04 9/21/2005 0-0.5 ft	SOLSD-5-0-6 SOLSD05 9/21/2005 0-0.5 ft	SOLSD-6-0-6 SOLSD06 9/21/2005 0-0.5 ft	SOLSD-6-6-12 SOLSD06 9/21/2005 0.5-1 ft	SOLSD-7-0-6 SOLSD07 9/21/2005 0-0.5 ft	SOLSD-7-6-12 SOLSD07 9/21/2005 0.5-1 ft	SOLSD-8-0-6 SOLSD08 9/21/2005 0-0.5 ft	SOLSD-9-0-6 SOLSD09 9/21/2005 0-0.5 ft
EPH (mg/kg)													
C11-C22 Aromatics													
C11-C22 Aromatics (unadj.)													
C19-C36 Aliphatics													
C9-C18 Aliphatics													
Extractable Petroleum Hydrocarbons, Total													
Pesticides (mg/kg)													
4,4'-DDD													
4,4'-DDE													
4,4'-DDT													
Aldrin													
Alpha-BHC													
Beta-BHC													
Chlordane													
Delta-BHC													
Dieldrin													
Endosulfan I													
Endosulfan II													
Endosulfan sulfate													
Endrin													
Endrin ketone													
Gamma-BHC/Lindane													
Heptachlor													
Heptachlor epoxide													
Hexachlorobenzene													
Methoxychlor													
Metals (mg/kg)													
Aluminum													
Antimony													
Arsenic													
Barium													
Beryllium													
Cadmium													
Calcium													
Chromium	140	10	20	26	15	10 U	47	11000	62000	2800	180	64	56
Chromium, Hexavalent													
Cobalt													
Copper													
Iron													
Lead													
Magnesium													
Manganese													
Mercury													
Nickel													
Potassium													
Selenium													
Silver													
Sodium													
Thallium													
Tin													
Vanadium													
Zinc													
Inorganics (mg/kg)													
Chloride													
Cyanide, Available													

Attachment 1-4
Surface Soil Data Summary - Exposure Area 5
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	SOLSD-20-6-12 SOLSD20 9/20/2005 0.5-1 ft	SOLSD-21-0-6 SOLSD21 9/20/2005 0-0.5 ft	SOLSD-22-0-6 SOLSD22 9/20/2005 0-0.5 ft	SOLSD-23-0-6 SOLSD23 9/20/2005 0-0.5 ft	SOLSD-3-0-6 SOLSD03 9/21/2005 0-0.5 ft	SOLSD-4-0-6 SOLSD04 9/21/2005 0-0.5 ft	SOLSD-5-0-6 SOLSD05 9/21/2005 0-0.5 ft	SOLSD-6-0-6 SOLSD06 9/21/2005 0-0.5 ft	SOLSD-6-6-12 SOLSD06 9/21/2005 0.5-1 ft	SOLSD-7-0-6 SOLSD07 9/21/2005 0-0.5 ft	SOLSD-7-6-12 SOLSD07 9/21/2005 0.5-1 ft	SOLSD-8-0-6 SOLSD08 9/21/2005 0-0.5 ft	SOLSD-9-0-6 SOLSD09 9/21/2005 0-0.5 ft
Cyanide, Total													
Nitrate as N													
Nitrite as N													
Nitrogen, as Ammonia													
Oxidation Reduction Potential (mV)													
Percent Moisture (%)													
Percent Solids (%)	44.2	65.7	47.6	38.8	84.1	59.1	45.5	23.4	34.1	45	57.6	37.3	37.1
pH (units)													
Sulfate													
Sulfide													
Total Organic Carbon													
Total Organic Carbon (%)													
Specialty Compounds (mg/kg)													
Hydrazine													
Monomethylhydrazine (MMH)													
UDMH													
Dimethylformamide													
Phthalic Acid/Phthalic anhydride													
TRIBUTYLTIN HYDRIDE													

Notes:
mg/kg - milligram per kilogram
mV - millivolts
U - Not detected, value is reporting limit
J - Value is estimated.
T - The associated value is an estimated quantity and may be biased high due to the oxidation of Cr+3 to Cr+6
R - Value is rejected
> - Exceeded the maximum reportable value of the instrument

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO 1 ISCO1 9/1/2010	OC-ISCO 2 ISCO2 9/1/2010	OC-ISCO-1 ISCO1 2/24/2009	OC-ISCO-1 ISCO1 5/12/2009	OC-ISCO-1 ISCO1 8/12/2009	OC-ISCO1 ISCO1 3/21/2013	OC-ISCO1-SW ISCO1 2/23/2012	OC-ISCO-2 ISCO2 2/24/2009	OC-ISCO2 ISCO2 3/21/2013	OC-ISCO-2 ISCO2 5/12/2009	OC-ISCO-2 ISCO2 8/12/2009	OC-ISCO2-SW ISCO2 2/23/2012	OC-PZ 16 RR SW PZ-16RR 9/1/2010	OC-PZ 17 RR SW PZ-17RR 9/1/2010	OC-PZ 18 R SW PZ-18R 9/1/2010
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane															
1,1,1-Trichloroethane															
1,1,2,2-Tetrachloroethane															
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane															
1,1-Dichloroethane															
1,1-Dichloroethene															
1,1-Dichloropropene															
1,2,3-Trichlorobenzene															
1,2,3-Trichloropropane															
1,2,4-Trichlorobenzene															
1,2,4-Trimethylbenzene															
1,2-Dibromo-3-chloropropane															
1,2-Dibromoethane															
1,2-Dichlorobenzene															
1,2-Dichloroethane															
1,2-Dichloropropane															
1,3,5-Trimethylbenzene															
1,3-Dichlorobenzene															
1,3-Dichloropropane															
1,4-Dichlorobenzene															
1,4-Dioxane															
2,2-Dichloropropane															
2,4,4-Trimethyl-1-pentene															
2,4,4-Trimethyl-2-pentene															
2-Butanone															
2-Chlorotoluene															
2-Hexanone															
4-Chlorotoluene															
4-iso-Propyltoluene															
4-Methyl-2-pentanone															
Acetaldehyde															
Acetic acid, methyl ester															
Acetone															
Benzene															
Bromobenzene															
Bromochloromethane															
Bromodichloromethane															
Bromoform															
Bromomethane															
Butane, 2-methoxy-2-methyl-															
Carbon disulfide															
Carbon tetrachloride															
Chlorobenzene															
Chlorodibromomethane															
Chloroethane															
Chloroform															
Chloromethane															
Cis-1,2-Dichloroethene															
cis-1,3-Dichloropropene															
Cyclohexane															
Dibromomethane															
Dichlorodifluoromethane															
Diethyl ether															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO 1 ISCO1 9/1/2010	OC-ISCO 2 ISCO2 9/1/2010	OC-ISCO-1 ISCO1 2/24/2009	OC-ISCO-1 ISCO1 5/12/2009	OC-ISCO-1 ISCO1 8/12/2009	OC-ISCO1 ISCO1 3/21/2013	OC-ISCO1-SW ISCO1 2/23/2012	OC-ISCO-2 ISCO2 2/24/2009	OC-ISCO2 ISCO2 3/21/2013	OC-ISCO-2 ISCO2 5/12/2009	OC-ISCO-2 ISCO2 8/12/2009	OC-ISCO2-SW ISCO2 2/23/2012	OC-PZ 16 RR SW PZ-16RR 9/1/2010	OC-PZ 17 RR SW PZ-17RR 9/1/2010	OC-PZ 18 R SW PZ-18R 9/1/2010
Ethyl benzene															
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene															
Isopropyl ether															
Isopropylbenzene															
Methyl cyclohexane															
Methyl Tertbutyl Ether															
Methylene chloride															
Naphthalene															
n-Butylbenzene															
Propylbenzene															
sec-Butylbenzene															
Styrene															
tert-Butylbenzene															
Tetrachloroethene															
Tetrahydrofuran															
Toluene															
trans-1,2-Dichloroethene															
trans-1,3-Dichloropropene															
Trichloroethene															
Trichlorofluoromethane															
Vinyl chloride															
Xylene, o															
Xylenes (m&p)															
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene															
1-Methylnaphthalene															
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-Methylnaphthalene															
2-Methylphenol															
2-Nitroaniline															
2-Nitrophenol															
3 & 4 Methylphenol															
3,3'-Dichlorobenzidine															
3-Nitroaniline															
4,6-Dinitro-2-methylphenol															
4-Bromophenyl phenyl ether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenyl ether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene															
Acenaphthylene															
Acetophenone															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO 1 ISCO1 9/1/2010	OC-ISCO 2 ISCO2 9/1/2010	OC-ISCO-1 ISCO1 2/24/2009	OC-ISCO-1 ISCO1 5/12/2009	OC-ISCO-1 ISCO1 8/12/2009	OC-ISCO1 ISCO1 3/21/2013	OC-ISCO1-SW ISCO1 2/23/2012	OC-ISCO-2 ISCO2 2/24/2009	OC-ISCO2 ISCO2 3/21/2013	OC-ISCO-2 ISCO2 5/12/2009	OC-ISCO-2 ISCO2 8/12/2009	OC-ISCO2-SW ISCO2 2/23/2012	OC-PZ 16 RR SW PZ-16RR 9/1/2010	OC-PZ 17 RR SW PZ-17RR 9/1/2010	OC-PZ 18 R SW PZ-18R 9/1/2010
Aniline															
Anthracene															
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene															
Benzo(a)pyrene															
Benzo(b)fluoranthene															
Benzo(ghi)perylene															
Benzo(k)fluoranthene															
Benzoic Acid															
Benzyl alcohol															
Biphenyl															
Bis(2-Chloroethoxy)methane															
Bis(2-Chloroethyl)ether															
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate															
Butylbenzylphthalate															
Caprolactam															
Carbazole															
Chrysene															
Dibenz(a,h)anthracene															
Dibenzofuran															
Diethylphthalate															
Dimethylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene															
Fluorene															
Hexachlorobenzene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(1,2,3-cd)pyrene															
Isophorone															
Naphthalene															
Nitrobenzene															
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine															
N-Nitrosodiphenylamine															
Pentachlorophenol															
Phenanthrene															
Phenol															
Pyrene															
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)															
C9-C10 Aromatics															
C9-C12 Aliphatics (unadj.)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO 1 ISCO1 9/1/2010	OC-ISCO 2 ISCO2 9/1/2010	OC-ISCO-1 ISCO1 2/24/2009	OC-ISCO-1 ISCO1 5/12/2009	OC-ISCO-1 ISCO1 8/12/2009	OC-ISCO1 ISCO1 3/21/2013	OC-ISCO1-SW ISCO1 2/23/2012	OC-ISCO-2 ISCO2 2/24/2009	OC-ISCO2 ISCO2 3/21/2013	OC-ISCO-2 ISCO2 5/12/2009	OC-ISCO-2 ISCO2 8/12/2009	OC-ISCO2-SW ISCO2 2/23/2012	OC-PZ 16 RR SW PZ-16RR 9/1/2010	OC-PZ 17 RR SW PZ-17RR 9/1/2010	OC-PZ 18 R SW PZ-18R 9/1/2010
Volatile Petroleum Hydrocarbons, Total															
Total Metals (mg/L)															
Aluminum	0.95 J	0.36	0.35	0.21	0.12	0.17 J	0.085 J	1.3	0.96	2.5	9.6	0.14	1.1	0.94	1
Antimony															
Arsenic															
Barium															
Beryllium															
Cadmium															
Calcium															
Chromium	0.015	0.065	0.044	0.026	0.017	0.013	0.015	0.25	0.13	0.53	2.2	0.073	0.22	0.21	0.018
Chromium, Hexavalent															
Cobalt															
Copper															
Iron															
Lead															
Magnesium															
Manganese															
Mercury															
Nickel															
Potassium															
Selenium															
Silver															
Sodium	47 J	140	90	75 J	75 J	120	100 J	91	100	87 J	190 J	140	140	130	55
Thallium															
Tin															
Vanadium															
Zinc															
Dissolved Metals (mg/L)															
Aluminum	1.1 J	0.056 J	0.28	0.098 J	0.1 U	0.16 J	0.1 J	0.8	0.43	0.017 U	0.046 J	0.15	0.069 J	0.17	1.1
Chromium	0.01	0.013	0.04	0.012	0.0068	0.011	0.015	0.16	0.068	0.004 J	0.033	0.074	0.013	0.066	0.012
Sodium	55 J	150	98	84 J	87 J	130	120 J	100	100	100 J	220 J	150	140	140	61
Inorganics (mg/L)															
Bromide															
Chloride	60	170	140 J	120	110	190	140	120 J	150	140	200	130	250	230	64
Hardness															
LAB SPECIFIC CONDUCTANCE (mS/cm)	0.62	1.6	0.73	0.7	0.9	0.87	0.97	0.9	0.85	0.98	2.6	1.5	1.2	1.2	0.66
Nitrate as N	0.29	3.1	0.4	0.23	0.18	0.49	0.27	0.81	1.1	3.9	0.81	1.2	5.1	4 J	0.22
Nitrite as N	0.01 U	0.01 U	0.1 U	0.1 U	0.1 U	0.05 U	0.1 U	0.01 U	0.05 U	0.1 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U
Nitrogen, as Ammonia	19	63	18	24	48	14	44	42	19	34	250	92	19	25	21
Sulfate	180	480	94	110	180	63	170	210	150	190	900	420	180	200	200
Total Organic Carbon															
Total Suspended Solids															
Specialty Compounds (mg/L)															
Perchlorate															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															
4-(1,1,3,3-Tetramethylbutyl)phenol															
4,4'-Isopropylidenediphenol															
4-Nonylphenol (Tech.)															
Nonylphenol Diethoxylate															
Kempore (Azodicarbonamide)															
OPEX															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-PZ-16RR PZ-16RR 8/12/2009	OC-PZ-16RRSW PZ-16RR 2/24/2009	OC-PZ-16RRSW PZ-16RR 3/21/2013	OC-PZ16RRSW PZ-16RR 5/12/2009	OC-PZ-17RR PZ-17RR 8/12/2009	OC-PZ-17RRSW PZ-17RR 2/24/2009	OC-PZ-17RRSW PZ-17RR 3/21/2013	OC-PZ17RRSW PZ-17RR 5/12/2009	OC-PZ-18R PZ-18R 8/12/2009	OC-PZ18R-SW PZ-18R 2/23/2012	OC-PZ-18RSW PZ-18R 2/24/2009	OC-PZ-18RSW PZ-18R 3/21/2013	OC-PZ18RSW PZ-18R 5/12/2009	OC-SD-17 SD-17 2/24/2009	OC-SD17 SD-17 5/12/2009
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane															
1,1,1-Trichloroethane															
1,1,2,2-Tetrachloroethane															
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane															
1,1-Dichloroethane															
1,1-Dichloroethene															
1,1-Dichloropropene															
1,2,3-Trichlorobenzene															
1,2,3-Trichloropropane															
1,2,4-Trichlorobenzene															
1,2,4-Trimethylbenzene															
1,2-Dibromo-3-chloropropane															
1,2-Dibromoethane															
1,2-Dichlorobenzene															
1,2-Dichloroethane															
1,2-Dichloropropane															
1,3,5-Trimethylbenzene															
1,3-Dichlorobenzene															
1,3-Dichloropropane															
1,4-Dichlorobenzene															
1,4-Dioxane															
2,2-Dichloropropane															
2,4,4-Trimethyl-1-pentene															
2,4,4-Trimethyl-2-pentene															
2-Butanone															
2-Chlorotoluene															
2-Hexanone															
4-Chlorotoluene															
4-iso-Propyltoluene															
4-Methyl-2-pentanone															
Acetaldehyde															
Acetic acid, methyl ester															
Acetone															
Benzene															
Bromobenzene															
Bromochloromethane															
Bromodichloromethane															
Bromoform															
Bromomethane															
Butane, 2-methoxy-2-methyl-															
Carbon disulfide															
Carbon tetrachloride															
Chlorobenzene															
Chlorodibromomethane															
Chloroethane															
Chloroform															
Chloromethane															
Cis-1,2-Dichloroethene															
cis-1,3-Dichloropropene															
Cyclohexane															
Dibromomethane															
Dichlorodifluoromethane															
Diethyl ether															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-PZ-16RR PZ-16RR 8/12/2009	OC-PZ-16RRSW PZ-16RR 2/24/2009	OC-PZ-16RRSW PZ-16RR 3/21/2013	OC-PZ16RRSW PZ-16RR 5/12/2009	OC-PZ-17RR PZ-17RR 8/12/2009	OC-PZ-17RRSW PZ-17RR 2/24/2009	OC-PZ-17RRSW PZ-17RR 3/21/2013	OC-PZ17RRSW PZ-17RR 5/12/2009	OC-PZ-18R PZ-18R 8/12/2009	OC-PZ18R-SW PZ-18R 2/23/2012	OC-PZ-18RSW PZ-18R 2/24/2009	OC-PZ-18RSW PZ-18R 3/21/2013	OC-PZ18RSW PZ-18R 5/12/2009	OC-SD-17 SD-17 2/24/2009	OC-SD17 SD-17 5/12/2009
Ethyl benzene															
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene															
Isopropyl ether															
Isopropylbenzene															
Methyl cyclohexane															
Methyl Tertbutyl Ether															
Methylene chloride															
Naphthalene															
n-Butylbenzene															
Propylbenzene															
sec-Butylbenzene															
Styrene															
tert-Butylbenzene															
Tetrachloroethene															
Tetrahydrofuran															
Toluene															
trans-1,2-Dichloroethene															
trans-1,3-Dichloropropene															
Trichloroethene															
Trichlorofluoromethane															
Vinyl chloride															
Xylene, o															
Xylenes (m&p)															
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene															
1-Methylnaphthalene															
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-Methylnaphthalene															
2-Methylphenol															
2-Nitroaniline															
2-Nitrophenol															
3 & 4 Methylphenol															
3,3'-Dichlorobenzidine															
3-Nitroaniline															
4,6-Dinitro-2-methylphenol															
4-Bromophenyl phenyl ether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenyl ether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene															
Acenaphthylene															
Acetophenone															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-PZ-16RR PZ-16RR 8/12/2009	OC-PZ-16RRSW PZ-16RR 2/24/2009	OC-PZ-16RRSW PZ-16RR 3/21/2013	OC-PZ16RRSW PZ-16RR 5/12/2009	OC-PZ-17RR PZ-17RR 8/12/2009	OC-PZ-17RRSW PZ-17RR 2/24/2009	OC-PZ-17RRSW PZ-17RR 3/21/2013	OC-PZ17RRSW PZ-17RR 5/12/2009	OC-PZ-18R PZ-18R 8/12/2009	OC-PZ18R-SW PZ-18R 2/23/2012	OC-PZ-18RSW PZ-18R 2/24/2009	OC-PZ-18RSW PZ-18R 3/21/2013	OC-PZ18RSW PZ-18R 5/12/2009	OC-SD-17 SD-17 2/24/2009	OC-SD17 SD-17 5/12/2009
Aniline															
Anthracene															
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene															
Benzo(a)pyrene															
Benzo(b)fluoranthene															
Benzo(ghi)perylene															
Benzo(k)fluoranthene															
Benzoic Acid															
Benzyl alcohol															
Biphenyl															
Bis(2-Chloroethoxy)methane															
Bis(2-Chloroethyl)ether															
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate															
Butylbenzylphthalate															
Caprolactam															
Carbazole															
Chrysene															
Dibenz(a,h)anthracene															
Dibenzofuran															
Diethylphthalate															
Dimethylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene															
Fluorene															
Hexachlorobenzene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(1,2,3-cd)pyrene															
Isophorone															
Naphthalene															
Nitrobenzene															
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine															
N-Nitrosodiphenylamine															
Pentachlorophenol															
Phenanthrene															
Phenol															
Pyrene															
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)															
C9-C10 Aromatics															
C9-C12 Aliphatics (unadj.)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-PZ-16RR PZ-16RR 8/12/2009	OC-PZ-16RRSW PZ-16RR 2/24/2009	OC-PZ-16RRSW PZ-16RR 3/21/2013	OC-PZ16RRSW PZ-16RR 5/12/2009	OC-PZ-17RR PZ-17RR 8/12/2009	OC-PZ-17RRSW PZ-17RR 2/24/2009	OC-PZ-17RRSW PZ-17RR 3/21/2013	OC-PZ17RRSW PZ-17RR 5/12/2009	OC-PZ-18R PZ-18R 8/12/2009	OC-PZ18R-SW PZ-18R 2/23/2012	OC-PZ-18RSW PZ-18R 2/24/2009	OC-PZ-18RSW PZ-18R 3/21/2013	OC-PZ18RSW PZ-18R 5/12/2009	OC-SD-17 SD-17 2/24/2009	OC-SD17 SD-17 5/12/2009
Volatile Petroleum Hydrocarbons, Total															
Total Metals (mg/L)															
Aluminum	6.2	3	1.8	2.4	98	3.5	1.8	2.5	0.079 J	0.082 J	0.37	0.18 J	0.18	3.4	2.3
Antimony															
Arsenic															
Barium															
Beryllium															
Cadmium															
Calcium															
Chromium	1.7	0.74	0.37	0.54	22	0.88	0.41	0.6	0.014	0.014	0.047	0.012	0.022	0.87	0.58
Chromium, Hexavalent															
Cobalt															
Copper															
Iron															
Lead															
Magnesium															
Manganese															
Mercury															
Nickel															
Potassium															
Selenium															
Silver															
Sodium	200 J	110	130	92 J	200 J	120	120	110	77 J	98 J	100	130	65 J	120	100 J
Thallium															
Tin															
Vanadium															
Zinc															
Dissolved Metals (mg/L)															
Aluminum	1.8	1.3	0.53	0.02 J	3.6	2.2	1.2	0.1	0.1 U	0.092 J	0.23	0.15 J	0.094 J	1.5	0.13
Chromium	0.82	0.34	0.17	0.012	1.2	0.44	0.34	0.068	0.0052	0.014	0.036	0.013	0.012	0.39	0.072
Sodium	230 J	120	120	110 J	240 J	110	110	120	94 J	120 J	100	120	82 J	130	120 J
Inorganics (mg/L)															
Bromide															
Chloride	210	150 J	190	160	200	140 J	180	160	110	140	150 J	210	120	160 J	160
Hardness															
LAB SPECIFIC CONDUCTANCE (mS/cm)	2.6	1	0.99	1	2.7	1	0.96	1.1	0.9	1	0.74	0.87	0.7	1.1	1.1
Nitrate as N	0.52	0.49	0.6	4.4	0.41	0.48	0.71	4	0.18	0.34	0.41	0.5	0.25	0.45	4.1
Nitrite as N	0.1 U	0.1 U	0.05 U	0.1 U	0.1 U	0.1 U	0.05 U	0.1 U	0.1 U	0.1 U	0.1 U	0.05 U	0.1 U	0.1 U	0.1 U
Nitrogen, as Ammonia	180	41	23	18	160	34	25	36	58	51	17	14	25	37	35
Sulfate	880	240	170	180	870	240	160	220	180 J	180	91	73	120	240	220
Total Organic Carbon															
Total Suspended Solids															
Specialty Compounds (mg/L)															
Perchlorate															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															
4-(1,1,3,3-Tetramethylbutyl)phenol															
4,4'-Isopropylidenediphenol															
4-Nonylphenol (Tech.)															
Nonylphenol Diethoxylate															
Kempore (Azodicarbonamide)															
OPEX															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-17 SD-17 8/12/2009	OC-SD-17 SW SD-17 3/21/2013	OC-SD-17-SW SD-17 2/23/2012	OC-SD17SW SD-17 9/9/2010	OC-SW-18R-RISK PZ-18R 11/12/2009	OC-SW-ISCO1 ISCO1 11/12/2009	OC-SW-ISCO1 ISCO1 11/15/2010	OC-SW-ISCO1 ISCO1 11/16/2012	OC-SW-ISCO1 ISCO1 11/8/2011	OC-SW-ISCO1 ISCO1 3/22/2011	OC-SW-ISCO1 ISCO1 5/16/2011	OC-SW-ISCO1 ISCO1 6/7/2012	OC-SW-ISCO1 ISCO1 6/9/2010	OC-SW-ISCO1 ISCO1 8/23/2011	OC-SW-ISCO1 ISCO1 8/23/2012
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane															
1,1,1-Trichloroethane															
1,1,2,2-Tetrachloroethane															
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane															
1,1-Dichloroethane															
1,1-Dichloroethene															
1,1-Dichloropropene															
1,2,3-Trichlorobenzene															
1,2,3-Trichloropropane															
1,2,4-Trichlorobenzene															
1,2,4-Trimethylbenzene															
1,2-Dibromo-3-chloropropane															
1,2-Dibromoethane															
1,2-Dichlorobenzene															
1,2-Dichloroethane															
1,2-Dichloropropane															
1,3,5-Trimethylbenzene															
1,3-Dichlorobenzene															
1,3-Dichloropropane															
1,4-Dichlorobenzene															
1,4-Dioxane															
2,2-Dichloropropane															
2,4,4-Trimethyl-1-pentene															
2,4,4-Trimethyl-2-pentene															
2-Butanone															
2-Chlorotoluene															
2-Hexanone															
4-Chlorotoluene															
4-iso-Propyltoluene															
4-Methyl-2-pentanone															
Acetaldehyde															
Acetic acid, methyl ester															
Acetone															
Benzene															
Bromobenzene															
Bromochloromethane															
Bromodichloromethane															
Bromoform															
Bromomethane															
Butane, 2-methoxy-2-methyl-															
Carbon disulfide															
Carbon tetrachloride															
Chlorobenzene															
Chlorodibromomethane															
Chloroethane															
Chloroform															
Chloromethane															
Cis-1,2-Dichloroethene															
cis-1,3-Dichloropropene															
Cyclohexane															
Dibromomethane															
Dichlorodifluoromethane															
Diethyl ether															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-17 SD-17 8/12/2009	OC-SD-17 SW SD-17 3/21/2013	OC-SD-17-SW SD-17 2/23/2012	OC-SD17SW SD-17 9/9/2010	OC-SW-18R-RISK PZ-18R 11/12/2009	OC-SW-ISCO1 ISCO1 11/12/2009	OC-SW-ISCO1 ISCO1 11/15/2010	OC-SW-ISCO1 ISCO1 11/16/2012	OC-SW-ISCO1 ISCO1 11/8/2011	OC-SW-ISCO1 ISCO1 3/22/2011	OC-SW-ISCO1 ISCO1 5/16/2011	OC-SW-ISCO1 ISCO1 6/7/2012	OC-SW-ISCO1 ISCO1 6/9/2010	OC-SW-ISCO1 ISCO1 8/23/2011	OC-SW-ISCO1 ISCO1 8/23/2012
Ethyl benzene															
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene															
Isopropyl ether															
Isopropylbenzene															
Methyl cyclohexane															
Methyl Tertbutyl Ether															
Methylene chloride															
Naphthalene															
n-Butylbenzene															
Propylbenzene															
sec-Butylbenzene															
Styrene															
tert-Butylbenzene															
Tetrachloroethene															
Tetrahydrofuran															
Toluene															
trans-1,2-Dichloroethene															
trans-1,3-Dichloropropene															
Trichloroethene															
Trichlorofluoromethane															
Vinyl chloride															
Xylene, o															
Xylenes (m&p)															
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene															
1-Methylnaphthalene															
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-Methylnaphthalene															
2-Methylphenol															
2-Nitroaniline															
2-Nitrophenol															
3 & 4 Methylphenol															
3,3'-Dichlorobenzidine															
3-Nitroaniline															
4,6-Dinitro-2-methylphenol															
4-Bromophenyl phenyl ether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenyl ether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene															
Acenaphthylene															
Acetophenone															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-17 SD-17 8/12/2009	OC-SD-17 SW SD-17 3/21/2013	OC-SD-17-SW SD-17 2/23/2012	OC-SD17SW SD-17 9/9/2010	OC-SW-18R-RISK PZ-18R 11/12/2009	OC-SW-ISCO1 ISCO1 11/12/2009	OC-SW-ISCO1 ISCO1 11/15/2010	OC-SW-ISCO1 ISCO1 11/16/2012	OC-SW-ISCO1 ISCO1 11/8/2011	OC-SW-ISCO1 ISCO1 3/22/2011	OC-SW-ISCO1 ISCO1 5/16/2011	OC-SW-ISCO1 ISCO1 6/7/2012	OC-SW-ISCO1 ISCO1 6/9/2010	OC-SW-ISCO1 ISCO1 8/23/2011	OC-SW-ISCO1 ISCO1 8/23/2012
Aniline															
Anthracene															
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene															
Benzo(a)pyrene															
Benzo(b)fluoranthene															
Benzo(ghi)perylene															
Benzo(k)fluoranthene															
Benzoic Acid															
Benzyl alcohol															
Biphenyl															
Bis(2-Chloroethoxy)methane															
Bis(2-Chloroethyl)ether															
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate															
Butylbenzylphthalate															
Caprolactam															
Carbazole															
Chrysene															
Dibenz(a,h)anthracene															
Dibenzofuran															
Diethylphthalate															
Dimethylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene															
Fluorene															
Hexachlorobenzene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(1,2,3-cd)pyrene															
Isophorone															
Naphthalene															
Nitrobenzene															
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine															
N-Nitrosodiphenylamine															
Pentachlorophenol															
Phenanthrene															
Phenol															
Pyrene															
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)															
C9-C10 Aromatics															
C9-C12 Aliphatics (unadj.)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-17 SD-17 8/12/2009	OC-SD-17 SW SD-17 3/21/2013	OC-SD-17-SW SD-17 2/23/2012	OC-SD17SW SD-17 9/9/2010	OC-SW-18R-RISK PZ-18R 11/12/2009	OC-SW-ISCO1 ISCO1 11/12/2009	OC-SW-ISCO1 ISCO1 11/15/2010	OC-SW-ISCO1 ISCO1 11/16/2012	OC-SW-ISCO1 ISCO1 11/8/2011	OC-SW-ISCO1 ISCO1 3/22/2011	OC-SW-ISCO1 ISCO1 5/16/2011	OC-SW-ISCO1 ISCO1 6/7/2012	OC-SW-ISCO1 ISCO1 6/9/2010	OC-SW-ISCO1 ISCO1 8/23/2011	OC-SW-ISCO1 ISCO1 8/23/2012
Volatile Petroleum Hydrocarbons, Total															
Total Metals (mg/L)															
Aluminum	280	1.5	0.78 J	1.2	0.285	0.28	0.3	0.2	0.33	0.26	0.18	0.088 J	0.17	0.15	0.08 J
Antimony															
Arsenic															
Barium															
Beryllium															
Cadmium															
Calcium															
Chromium	64	0.36	0.37 J	0.29	0.035	0.034	0.027	0.019	0.03	0.016	0.012	0.0096	0.019	0.016	0.013
Chromium, Hexavalent															
Cobalt															
Copper															
Iron															
Lead															
Magnesium															
Manganese															
Mercury															
Nickel															
Potassium															
Selenium															
Silver															
Sodium	220	110	180 J	99 J	72.5 J	71 J	79 J	76	89	88	63	58 J	74 J	73 J	69
Thallium															
Tin															
Vanadium															
Zinc															
Dissolved Metals (mg/L)															
Aluminum	0.61	0.25	0.89 J	0.25	0.0795 J	0.073 J	0.19	0.17 J	0.15	0.17	0.074 J	0.1	0.1 U	0.04 J	0.043 J
Chromium	0.47	0.12	0.41 J	0.11	0.0125	0.012	0.019	0.017	0.013	0.013	0.0058	0.011	0.0056	0.0086	0.0096
Sodium	200	110	210 J	120 J	82.5 J	81 J	87 J	81	98	94	74	64	90 J	90 J	69
Inorganics (mg/L)															
Bromide															
Chloride	160	160	210	170	110	120	130	110	120	140	110 J	100	100	110	120
Hardness															
LAB SPECIFIC CONDUCTANCE (mS/cm)	2.5	0.89	1.8	1.2	0.8	0.79	0.87	0.72	0.76	0.7	0.63	0.64	0.88	0.79	0.68
Nitrate as N	0.5	0.71	3.7	1.8	0.05 U	0.05 U	0.38	0.34 J	0.2	0.36	0.14 J	0.27	0.05 U	0.08	0.12
Nitrite as N	0.1 U	0.05 U	0.1 U	0.1 U	0.01 U	0.01 U	0.01 U	R	0.01 U	0.1 U	0.01 UJ	0.1 U	0.01 U	0.1 U	0.1 U
Nitrogen, as Ammonia	170	20	77	36	34.5 J	33 J	38	23	25	14	18 J	23	51	37	29
Sulfate	820	140	460	310	145	150	220	110	110	68	89 J	98	190	130	120
Total Organic Carbon															
Total Suspended Solids															
Specialty Compounds (mg/L)															
Perchlorate															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															
4-(1,1,3,3-Tetramethylbutyl)phenol															
4,4'-Isopropylidenediphenol															
4-Nonylphenol (Tech.)															
Nonylphenol Diethoxylate															
Kempore (Azodicarbonamide)															
OPEX															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO-1-0.2 ISCO1 2/18/2010	OC-SW-ISCO-1-RISK ISCO1 12/10/2010	OC-SW-ISCO-1-RISK ISCO1 6/6/2011	OC-SW-ISCO2 ISCO2 11/12/2009	OC-SW-ISCO2 ISCO2 11/15/2010	OC-SW-ISCO2 ISCO2 11/16/2012	OC-SW-ISCO2 ISCO2 11/8/2011	OC-SW-ISCO2 ISCO2 3/22/2011	OC-SW-ISCO2 ISCO2 5/16/2011	OC-SW-ISCO2 ISCO2 6/7/2012	OC-SW-ISCO2 ISCO2 6/9/2010	OC-SW-ISCO2 ISCO2 8/23/2011	OC-SW-ISCO2 ISCO2 8/23/2012	OC-SW-ISCO-2-0.2 ISCO2 2/18/2010	OC-SW-ISCO-2-XXX ISCO2 12/9/2010
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane		0.001 U	0.001 U												0.001 U
1,1,1-Trichloroethane		0.001 U	0.001 U												0.001 U
1,1,2,2-Tetrachloroethane		0.0005 U	0.0005 U												0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane		0.001 U	0.001 U												0.001 U
1,1,2-Trichloroethane		0.001 U	0.001 U												0.001 U
1,1-Dichloroethane		0.001 U	0.001 U												0.001 U
1,1-Dichloroethene		0.001 U	0.001 U												0.001 U
1,1-Dichloropropene		0.001 U	0.001 U												0.001 U
1,2,3-Trichlorobenzene		0.001 U	0.001 U												0.001 U
1,2,3-Trichloropropane		0.001 U	0.001 U												0.001 U
1,2,4-Trichlorobenzene		0.001 U	0.001 U												0.001 U
1,2,4-Trimethylbenzene		0.001 U	0.001 U												0.001 U
1,2-Dibromo-3-chloropropane		0.005 U	0.005 U												0.005 U
1,2-Dibromoethane		0.001 U	0.001 U												0.001 U
1,2-Dichlorobenzene		0.001 U	0.001 U												0.001 U
1,2-Dichloroethane		0.001 U	0.001 U												0.001 U
1,2-Dichloropropane		0.001 U	0.001 U												0.001 U
1,3,5-Trimethylbenzene		0.001 U	0.001 U												0.001 U
1,3-Dichlorobenzene		0.001 U	0.001 U												0.001 U
1,3-Dichloropropane		0.001 U	0.001 U												0.001 U
1,4-Dichlorobenzene		0.001 U	0.001 U												0.001 U
1,4-Dioxane		R	0.05 U												R
2,2-Dichloropropane		0.001 U	0.001 U												0.001 U
2,4,4-Trimethyl-1-pentene		0.001 U	0.001 UJ												0.0024
2,4,4-Trimethyl-2-pentene		0.001 U	0.001 U												0.001 U
2-Butanone		0.01 U	0.01 U												0.01 U
2-Chlorotoluene		0.001 U	0.001 U												0.001 U
2-Hexanone		0.01 U	0.01 U												0.01 U
4-Chlorotoluene		0.001 U	0.001 U												0.001 U
4-iso-Propyltoluene		0.001 U	0.001 U												0.001 U
4-Methyl-2-pentanone		0.01 U	0.01 U												0.01 U
Acetaldehyde		0.03 U	0.03 U												0.03 U
Acetic acid, methyl ester		0.02 U	0.02 U												0.02 U
Acetone		0.05 U	0.05 U												0.05 U
Benzene		0.001 U	0.001 U												0.001 U
Bromobenzene		0.001 U	0.001 U												0.001 U
Bromochloromethane		0.001 U	0.001 U												0.001 U
Bromodichloromethane		0.001 U	0.0005 U												0.001 U
Bromoform		0.001 UJ	0.001 UJ												0.001 J
Bromomethane		0.002 U	0.002 U												0.002 U
Butane, 2-methoxy-2-methyl-		0.005 U	0.005 UJ												0.005 U
Carbon disulfide		0.000605 J	0.00021 J												0.01 U
Carbon tetrachloride		0.001 UJ	0.001 UJ												0.001 UJ
Chlorobenzene		0.001 U	0.001 U												0.001 U
Chlorodibromomethane		0.0005 U	0.0005 U												0.0034
Chloroethane		0.002 U	0.002 U												0.002 U
Chloroform		0.001 U	0.001 U												0.00027 J
Chloromethane		0.002 U	0.002 U												0.002 U
Cis-1,2-Dichloroethene		0.001 U	0.001 U												0.001 U
cis-1,3-Dichloropropene		0.0004 U	0.0004 U												0.0004 U
Cyclohexane		0.01 U	0.01 U												0.01 U
Dibromomethane		0.001 U	0.001 U												0.00032 J
Dichlorodifluoromethane		0.001 UJ	0.001 U												0.001 UJ
Diethyl ether		0.01 U	0.01 U												0.01 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO-1-0.2 ISCO1 2/18/2010	OC-SW-ISCO-1-RISK ISCO1 12/10/2010	OC-SW-ISCO-1-RISK ISCO1 6/6/2011	OC-SW-ISCO2 ISCO2 11/12/2009	OC-SW-ISCO2 ISCO2 11/15/2010	OC-SW-ISCO2 ISCO2 11/16/2012	OC-SW-ISCO2 ISCO2 11/8/2011	OC-SW-ISCO2 ISCO2 3/22/2011	OC-SW-ISCO2 ISCO2 5/16/2011	OC-SW-ISCO2 ISCO2 6/7/2012	OC-SW-ISCO2 ISCO2 6/9/2010	OC-SW-ISCO2 ISCO2 8/23/2011	OC-SW-ISCO2 ISCO2 8/23/2012	OC-SW-ISCO-2-0.2 ISCO2 2/18/2010	OC-SW-ISCO-2-XXX ISCO2 12/9/2010
Ethyl benzene		0.001 U	0.001 U												0.001 U
Ethyl-t-Butyl Ether		0.005 U	0.005 UJ												0.005 U
Formaldehyde		0.0145 J	0.03 U												0.019 J
Hexachlorobutadiene		0.0004 U	0.0004 U												0.0004 U
Isopropyl ether		0.01 U	0.01 U												0.01 U
Isopropylbenzene		0.001 U	0.001 U												0.001 U
Methyl cyclohexane		0.01 U	0.01 U												0.01 U
Methyl Tertbutyl Ether		0.001 U	0.001 UJ												0.001 U
Methylene chloride		0.002 U	0.002 U												0.002 U
Naphthalene		0.005 U	0.005 U												0.005 U
n-Butylbenzene		0.001 U	0.001 U												0.001 U
Propylbenzene		0.001 U	0.001 U												0.001 U
sec-Butylbenzene		0.001 U	0.001 U												0.001 U
Styrene		0.001 UJ	0.001 U												0.001 U
tert-Butylbenzene		0.001 U	0.001 U												0.001 U
Tetrachloroethene		0.001 U	0.001 U												0.001 U
Tetrahydrofuran		0.01 U	0.01 U												0.01 U
Toluene		0.001 U	0.001 U												0.001 U
trans-1,2-Dichloroethene		0.001 U	0.001 U												0.001 U
trans-1,3-Dichloropropene		0.0004 U	0.0004 U												0.0004 U
Trichloroethene		0.001 U	0.001 U												0.001 U
Trichlorofluoromethane		0.001 U	0.001 U												0.001 U
Vinyl chloride		0.0005 U	0.0005 U												0.0005 U
Xylene, o		0.001 U	0.001 U												0.001 U
Xylenes (m&p)		0.002 U	0.002 U												0.002 U
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene		0.0045 U	0.0045 U												0.0045 U
1-Methylnaphthalene		0.0045 U	0.0045 U												0.0045 U
2,3,4,6-Tetrachlorophenol		0.0045 U	0.0045 U												0.0045 U
2,4,5-Trichlorophenol		0.0045 U	0.0045 U												0.0045 U
2,4,6-Trichlorophenol		0.0045 U	0.0045 U												0.0045 U
2,4-Dichlorophenol		0.0045 U	0.0045 U												0.0045 U
2,4-Dimethylphenol		0.0045 U	0.0045 U												0.0045 U
2,4-Dinitrophenol		0.0045 U	0.0045 U												0.0045 U
2,4-Dinitrotoluene		0.0045 U	0.0045 U												0.0045 U
2,6-Dinitrotoluene		0.0045 U	0.0045 U												0.0045 U
2-Chloronaphthalene		0.0045 U	0.0045 U												0.0045 U
2-Chlorophenol		0.0045 U	0.0045 U												0.0045 U
2-Methylnaphthalene		0.00091 U	0.00091 U												0.00091 U
2-Methylphenol		0.0045 U	0.0045 U												0.0045 U
2-Nitroaniline		0.0045 U	0.0045 U												0.0045 U
2-Nitrophenol		0.0045 U	0.0045 U												0.00057 J
3 & 4 Methylphenol		0.0045 U	0.0045 U												0.0045 U
3,3'-Dichlorobenzidine		R	R												0.0045 U
3-Nitroaniline		0.0045 U	0.0045 U												0.0045 U
4,6-Dinitro-2-methylphenol		0.0045 U	0.0045 U												0.0045 U
4-Bromophenyl phenyl ether		0.0045 U	0.0045 U												0.0045 U
4-Chloro-3-methylphenol		0.0045 U	0.0045 U												0.0045 U
4-Chloroaniline		0.0045 UJ	0.0045 U												0.0045 U
4-Chlorophenyl phenyl ether		0.0045 U	0.0045 U												0.0045 U
4-Nitroaniline		0.0045 U	0.0045 U												0.0045 U
4-Nitrophenol		0.0045 UJ	0.0045 U												0.0045 UJ
Acenaphthene		0.00091 U	0.00091 U												0.00091 U
Acenaphthylene		0.00027 U	0.00027 U												0.00027 U
Acetophenone		0.0045 U	0.0045 U												0.0045 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO-1-0.2 ISCO1 2/18/2010	OC-SW-ISCO-1-RISK ISCO1 12/10/2010	OC-SW-ISCO-1-RISK ISCO1 6/6/2011	OC-SW-ISCO2 ISCO2 11/12/2009	OC-SW-ISCO2 ISCO2 11/15/2010	OC-SW-ISCO2 ISCO2 11/16/2012	OC-SW-ISCO2 ISCO2 11/8/2011	OC-SW-ISCO2 ISCO2 3/22/2011	OC-SW-ISCO2 ISCO2 5/16/2011	OC-SW-ISCO2 ISCO2 6/7/2012	OC-SW-ISCO2 ISCO2 6/9/2010	OC-SW-ISCO2 ISCO2 8/23/2011	OC-SW-ISCO2 ISCO2 8/23/2012	OC-SW-ISCO-2-0.2 ISCO2 2/18/2010	OC-SW-ISCO-2-XXX ISCO2 12/9/2010
Aniline		0.0045 UJ	0.0045 UJ												0.0045 UJ
Anthracene		0.00091 U	0.00091 U												0.00091 U
Atrazine		0.0045 U	0.0045 U												0.0045 U
Azobenzene		0.0045 U	0.0045 U												0.0045 U
Benzaldehyde		0.0045 U	0.0045 U												0.0045 U
Benzo(a)anthracene		0.00027 U	0.00027 U												0.00027 U
Benzo(a)pyrene		0.00018 U	0.00018 U												0.00018 U
Benzo(b)fluoranthene		0.00027 U	0.00027 UJ												0.00027 U
Benzo(ghi)perylene		0.00045 U	0.00045 U												0.00045 U
Benzo(k)fluoranthene		0.00027 U	0.00027 U												0.00027 U
Benzoic Acid		0.0019 J	0.0019 J												0.0045 UJ
Benzyl alcohol		0.0091 U	0.0091 U												0.0091 U
Biphenyl		0.0045 U	0.0045 U												0.0045 U
Bis(2-Chloroethoxy)methane		0.0045 U	0.0045 U												0.0045 U
Bis(2-Chloroethyl)ether		0.0045 U	0.0045 U												0.0045 U
Bis(2-Chloroisopropyl)ether		0.0045 U	0.0045 U												0.0045 U
Bis(2-Ethylhexyl)phthalate		R	0.0018 U												0.0065 U
Butylbenzylphthalate		0.0045 U	0.0045 U												0.0045 U
Caprolactam		0.0045 UJ	0.0045 UJ												0.0045 UJ
Carbazole		0.0045 U	0.0045 U												0.0045 U
Chrysene		0.00091 U	0.00091 U												0.00091 U
Dibenz(a,h)anthracene		0.00041 U	0.00041 U												0.00041 U
Dibenzofuran		0.0045 U	0.0045 U												0.0045 U
Diethylphthalate		0.0045 U	0.0045 U												0.0051 U
Dimethylphthalate		0.0045 U	0.0045 U												0.0045 U
Di-n-butylphthalate		0.0045 U	0.0045 U												0.0045 U
Di-n-octylphthalate		0.00083 J	0.0045 U												0.0045 U
Diphenyl ether		0.0045 U	0.0045 U												0.0045 U
Diphenylamine		0.0045 U	0.0045 U												0.0045 U
Diphenylmethanone		0.0045 U	0.0045 U												0.0045 U
Fluoranthene		0.00091 U	0.00091 U												0.00091 U
Fluorene		0.00091 U	0.00091 U												0.00091 U
Hexachlorobenzene		0.00091 U	0.00091 U												0.00091 U
Hexachlorocyclopentadiene		0.0045 U	0.0045 U												0.0045 U
Hexachloroethane		0.0027 U	0.0027 U												0.0027 U
Indeno(1,2,3-cd)pyrene		0.00041 U	0.00041 U												0.00041 U
Isophorone		0.0045 U	0.0045 U												0.0045 U
Naphthalene		0.00091 U	0.00091 U												0.00091 U
Nitrobenzene		0.0045 U	0.0045 U												0.0045 U
N-Nitrosodimethylamine		0.0000565	0.0000215 J												0.00012
N-Nitrosodi-n-propylamine		0.0000019 U	0.0000019 UJ												0.000002 U
N-Nitrosodiphenylamine		0.0045 U	0.0045 U												0.0045 U
Pentachlorophenol		0.00091 U	0.00091 U												0.00091 U
Phenanthrene		0.00018 U	0.00018 U												0.00018 U
Phenol		0.0045 UJ	0.0045 UJ												0.0045 UJ
Pyrene		0.00091 U	0.00091 U												0.00091 U
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)		0.05 U	0.05 U												0.05 U
C9-C10 Aromatics		0.05 U	0.05 U												0.05 U
C9-C12 Aliphatics (unadj.)		0.05 U	0.05 U												0.05 U
C11-C22 Aromatics		0.091 U	0.091 U												0.091 U
C11-C22 Aromatics (unadj.)		0.091 U	0.091 U												0.091 U
C19-C36 Aliphatics		0.091 U	0.091 U												0.091 U
C9-C18 Aliphatics		0.091 U	0.091 U												0.091 U
Extractable Petroleum Hydrocarbons, Total		0.091 U	0.091 U												0.091 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO-1-0.2 ISCO1 2/18/2010	OC-SW-ISCO-1-RISK ISCO1 12/10/2010	OC-SW-ISCO-1-RISK ISCO1 6/6/2011	OC-SW-ISCO2 ISCO2 11/12/2009	OC-SW-ISCO2 ISCO2 11/15/2010	OC-SW-ISCO2 ISCO2 11/16/2012	OC-SW-ISCO2 ISCO2 11/8/2011	OC-SW-ISCO2 ISCO2 3/22/2011	OC-SW-ISCO2 ISCO2 5/16/2011	OC-SW-ISCO2 ISCO2 6/7/2012	OC-SW-ISCO2 ISCO2 6/9/2010	OC-SW-ISCO2 ISCO2 8/23/2011	OC-SW-ISCO2 ISCO2 8/23/2012	OC-SW-ISCO-2-0.2 ISCO2 2/18/2010	OC-SW-ISCO-2-XXX ISCO2 12/9/2010
Volatile Petroleum Hydrocarbons, Total		0.05 U	0.05 U												0.05 U
Total Metals (mg/L)															
Aluminum	0.13	0.235	0.0955 J	0.35	0.51	0.55	4	1.7	0.6	0.8	1.2	0.23	0.16	3.9	0.6 J
Antimony		0.0037 J	0.006 U												0.006 U
Arsenic		0.01 U	0.01 U												0.0031 J
Barium		0.032	0.028												0.025
Beryllium		0.001 U	0.001 U												0.001 U
Cadmium		0.001 U	0.001 U												0.001 U
Calcium		26	25												56 J
Chromium	0.02	0.027	0.012	0.068	0.047	0.074	0.75	0.26	0.065	0.17	0.32	0.051	0.03	0.81	0.11 J
Chromium, Hexavalent			0.001 UJ												
Cobalt		0.013	0.0053 J												0.025
Copper		0.0095 J	0.000555 J												0.0042 J
Iron		7.5	4.65												2.4 J
Lead		0.00075 J	0.00028 J												0.001 U
Magnesium		4.25	4.4												9.9
Manganese		1.05	0.81												1.4
Mercury		0.0002 U	0.0002 U												0.0002 U
Nickel		0.0125	0.00415 J												0.026
Potassium		1.75 J	2.3 J												2.2 J
Selenium		0.01 U	0.01 U												0.01 U
Silver		0.001 UJ	0.0001 U												0.001 UJ
Sodium	110 J	91	97.5	120 J	120	120	84 J	73	56	84 J	240	150 J	190	160	120 J
Thallium		0.0031 J	0.01 U												0.01 U
Tin		0.05 U	0.05 U												0.05 U
Vanadium		0.01 UJ	0.01 U												0.01 U
Zinc		0.021 J	0.017 J												0.057
Dissolved Metals (mg/L)															
Aluminum	0.11			0.11	0.29	0.14 J	0.13	0.36	0.15	0.12	0.098 J	0.036 J	0.058 J	0.51	
Chromium	0.019			0.029	0.027	0.031	0.027	0.049	0.016	0.037	0.055	0.013	0.013	0.17	
Sodium	130 J			150 J	120	120	100 J	76	66	83	260	190 J	200	170	
Inorganics (mg/L)															
Bromide		0.175	0.14												0.33
Chloride	220	150	130	170	140	140	97	90	70 J	100	210	170	210	220	190
Hardness		82	80												180 J
LAB SPECIFIC CONDUCTANCE (mS/cm)	0.94			1.6	1.4	1.3	0.86	0.72	0.74	1	3	2.2	2.1	1.7	
Nitrate as N	0.76	0.11	0.05 U	1.4	2.8	2 J	1.1	1	0.57 J	0.55	0.59	0.79	2.1	0.94	2.8
Nitrite as N	0.01 U	0.01 U	0.01 U	0.01 U	0.017	R	0.01 U	0.1 U	0.01 UJ	0.1 U	0.01 U	0.1 U	0.1 U	0.01 U	0.1 U
Nitrogen, as Ammonia	14	39	31.5	83 J	61	50	33	19	28 J	46	170	98	110	72	74
Sulfate	80	240	150	510	470	330	180	130	190 J	250	1200	580	690	450	560
Total Organic Carbon		7.4	6												9.7
Total Suspended Solids		16.5	7 J												2
Specialty Compounds (mg/L)															
Perchlorate		0.01 U													0.01 U
Hydrazine		0.0001 U	0.0001 U												0.0001 U
Monomethylhydrazine (MMH)		0.0005 U	0.0005 U												0.0005 U
UDMH		0.0005 U	0.0005 U												0.0005 U
Dimethylformamide		0.02 U	0.02 UJ												0.02 U
Phthalic Acid/Phthalic anhydride		0.01 U	0.01 U												0.01 U
4-(1,1,3,3-Tetramethylbutyl)phenol		0.00094 U	0.00095 UJ												0.00094 U
4,4'-Isopropylidenediphenol		0.00094 U	0.00095 UJ												0.00094 U
4-Nonylphenol (Tech.)		0.0047 U	0.0048 UJ												0.0062
Nonylphenol Diethoxylate		0.019 U	0.019 UJ												0.019 U
Kempore (Azodicarbonamide)		1 U	1 U												1 U
OPEX		0.1 UJ	0.1 UJ												0.1 UJ

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO-2-XXX ISCO2 6/6/2011	OC-SW-PZ16RR PZ-16RR 11/12/2009	OC-SW-PZ-16RR PZ-16RR 11/15/2010	OC-SW-PZ16RR PZ-16RR 11/8/2011	OC-SW-PZ-16RR PZ-16RR 6/9/2010	OC-SW-PZ-16RR-0.2-RISK PZ-16RR 2/18/2010	OC-SW-PZ-16RRSW PZ-16RR 11/16/2012	OC-SW-PZ16RR-SW PZ-16RR 2/23/2012	OC-SW-PZ-16RRSW PZ-16RR 3/22/2011	OC-SW-PZ-16RRSW PZ-16RR 5/16/2011	OC-SW-PZ-16RRSW PZ-16RR 6/7/2012	OC-SW-PZ-16RRSW PZ-16RR 8/23/2011	OC-SW-PZ-16RRSW PZ-16RR 8/23/2012	OC-SW-PZ-16RR-XXX PZ-16RR 12/9/2010	OC-SW-PZ-16RR-XXX PZ-16RR 6/6/2011
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane	0.001 U													0.001 U	0.001 U
1,1,1-Trichloroethane	0.001 U													0.001 U	0.001 U
1,1,2,2-Tetrachloroethane	0.0005 U													0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U													0.001 U	0.001 U
1,1,2-Trichloroethane	0.001 U													0.001 U	0.001 U
1,1-Dichloroethane	0.001 U													0.001 U	0.001 U
1,1-Dichloroethene	0.001 U													0.001 U	0.001 U
1,1-Dichloropropene	0.001 U													0.001 U	0.001 U
1,2,3-Trichlorobenzene	0.001 U													0.001 U	0.001 U
1,2,3-Trichloropropane	0.001 U													0.001 U	0.001 U
1,2,4-Trichlorobenzene	0.001 U													0.001 U	0.001 U
1,2,4-Trimethylbenzene	0.001 U													0.001 U	0.001 U
1,2-Dibromo-3-chloropropane	0.005 U													0.005 U	0.005 U
1,2-Dibromoethane	0.001 U													0.001 U	0.001 U
1,2-Dichlorobenzene	0.001 U													0.001 U	0.001 U
1,2-Dichloroethane	0.001 U													0.001 U	0.001 U
1,2-Dichloropropane	0.001 U													0.001 U	0.001 U
1,3,5-Trimethylbenzene	0.001 U													0.001 U	0.001 U
1,3-Dichlorobenzene	0.001 U													0.001 U	0.0003 J
1,3-Dichloropropane	0.001 U													0.001 U	0.001 U
1,4-Dichlorobenzene	0.001 U													0.001 U	0.001 U
1,4-Dioxane	0.05 U													R	0.05 U
2,2-Dichloropropane	0.001 U													0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene	0.0019 J													0.0042	0.0056 J
2,4,4-Trimethyl-2-pentene	0.00045 J													0.001 U	0.0012
2-Butanone	0.01 U													0.01 U	0.01 U
2-Chlorotoluene	0.001 U													0.001 U	0.001 U
2-Hexanone	0.01 U													0.01 U	0.01 U
4-Chlorotoluene	0.001 U													0.001 U	0.001 U
4-iso-Propyltoluene	0.001 U													0.001 U	0.001 U
4-Methyl-2-pentanone	0.01 U													0.01 U	0.01 U
Acetaldehyde	0.03 U													0.03 U	0.03 U
Acetic acid, methyl ester	0.02 U													0.02 U	0.02 U
Acetone	0.05 U													0.05 U	0.05 U
Benzene	0.001 U													0.001 U	0.001 U
Bromobenzene	0.001 U													0.001 U	0.001 U
Bromochloromethane	0.001 U													0.001 U	0.001 U
Bromodichloromethane	0.0005 U													0.001 U	0.00021 J
Bromoform	0.00067 J													0.0017 J	0.0018
Bromomethane	0.002 U													0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-	0.005 UJ													0.005 U	0.005 UJ
Carbon disulfide	0.01 U													0.01 U	0.01 U
Carbon tetrachloride	0.001 UJ													0.001 UJ	0.001 UJ
Chlorobenzene	0.001 U													0.001 U	0.001 U
Chlorodibromomethane	0.0005 U													0.0036	0.00048 J
Chloroethane	0.002 U													0.002 U	0.002 U
Chloroform	0.001 U													0.0005 J	0.00049 J
Chloromethane	0.002 U													0.002 U	0.002 U
Cis-1,2-Dichloroethene	0.001 U													0.001 U	0.001 U
cis-1,3-Dichloropropene	0.0004 U													0.0004 U	0.0004 U
Cyclohexane	0.01 U													0.01 U	0.01 U
Dibromomethane	0.001 U													0.00055 J	0.00057 J
Dichlorodifluoromethane	0.001 U													0.001 UJ	0.001 U
Diethyl ether	0.01 U													0.01 U	0.01 U

Attachment 1-5
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Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
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Parameter	OC-SW-ISCO-2-XXX ISCO2 6/6/2011	OC-SW-PZ16RR PZ-16RR 11/12/2009	OC-SW-PZ-16RR PZ-16RR 11/15/2010	OC-SW-PZ16RR PZ-16RR 11/8/2011	OC-SW-PZ-16RR PZ-16RR 6/9/2010	OC-SW-PZ-16RR-0.2-RISK PZ-16RR 2/18/2010	OC-SW-PZ-16RRSW PZ-16RR 11/16/2012	OC-SW-PZ16RR-SW PZ-16RR 2/23/2012	OC-SW-PZ-16RRSW PZ-16RR 3/22/2011	OC-SW-PZ-16RRSW PZ-16RR 5/16/2011	OC-SW-PZ-16RRSW PZ-16RR 6/7/2012	OC-SW-PZ-16RRSW PZ-16RR 8/23/2011	OC-SW-PZ-16RRSW PZ-16RR 8/23/2012	OC-SW-PZ-16RR-XXX PZ-16RR 12/9/2010	OC-SW-PZ-16RR-XXX PZ-16RR 6/6/2011
Ethyl benzene	0.001 U													0.001 U	0.001 U
Ethyl-t-Butyl Ether	0.005 UJ													0.005 U	0.005 UJ
Formaldehyde	0.03 U													0.021 J	0.03 U
Hexachlorobutadiene	0.0004 U													0.0004 U	0.0004 U
Isopropyl ether	0.01 U													0.01 U	0.01 U
Isopropylbenzene	0.001 U													0.001 U	0.001 U
Methyl cyclohexane	0.01 U													0.01 U	0.01 U
Methyl Tertbutyl Ether	0.001 UJ													0.001 U	0.001 UJ
Methylene chloride	0.002 U													0.002 U	0.002 U
Naphthalene	0.005 U													0.005 U	0.005 U
n-Butylbenzene	0.001 U													0.001 U	0.001 U
Propylbenzene	0.001 U													0.001 U	0.001 U
sec-Butylbenzene	0.001 U													0.001 U	0.001 U
Styrene	0.001 U													0.001 U	0.001 U
tert-Butylbenzene	0.001 U													0.001 U	0.001 U
Tetrachloroethene	0.001 U													0.001 U	0.001 U
Tetrahydrofuran	0.01 U													0.01 U	0.01 U
Toluene	0.001 U													0.001 U	0.001 U
trans-1,2-Dichloroethene	0.001 U													0.001 U	0.001 U
trans-1,3-Dichloropropene	0.0004 U													0.0004 U	0.0004 U
Trichloroethene	0.001 U													0.001 U	0.001 U
Trichlorofluoromethane	0.001 U													0.001 U	0.001 U
Vinyl chloride	0.0005 U													0.0005 U	0.0005 U
Xylene, o	0.001 U													0.001 U	0.001 U
Xylenes (m&p)	0.002 U													0.002 U	0.002 U
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene	0.0045 U													0.0045 U	0.0045 U
1-Methylnaphthalene	0.0045 U													0.0045 U	0.0045 U
2,3,4,6-Tetrachlorophenol	0.0045 U													0.0045 U	0.0045 U
2,4,5-Trichlorophenol	0.0045 U													0.0045 U	0.0045 U
2,4,6-Trichlorophenol	0.0045 U													0.0045 U	0.0045 U
2,4-Dichlorophenol	0.0045 U													0.0045 U	0.0045 U
2,4-Dimethylphenol	0.0045 U													0.0045 U	0.0045 U
2,4-Dinitrophenol	0.0045 U													0.0045 U	0.0045 U
2,4-Dinitrotoluene	0.0045 U													0.0045 U	0.0045 U
2,6-Dinitrotoluene	0.0045 U													0.0045 U	0.0045 U
2-Chloronaphthalene	0.0045 U													0.0045 U	0.0045 U
2-Chlorophenol	0.0045 U													0.0045 U	0.0045 U
2-Methylnaphthalene	0.00091 U													0.00091 U	0.00091 U
2-Methylphenol	0.0045 U													0.0045 U	0.0045 U
2-Nitroaniline	0.0045 U													0.0045 U	0.0045 U
2-Nitrophenol	0.00091 J													0.001 J	0.0013 J
3 & 4 Methylphenol	0.0045 U													0.0045 U	0.0045 U
3,3'-Dichlorobenzidine	0.0045 U													0.0045 U	0.0045 U
3-Nitroaniline	0.0045 U													0.0045 U	0.0045 U
4,6-Dinitro-2-methylphenol	0.0045 U													0.0045 U	0.0045 U
4-Bromophenyl phenyl ether	0.0045 U													0.0045 U	0.0045 U
4-Chloro-3-methylphenol	0.0045 U													0.0045 U	0.0045 U
4-Chloroaniline	0.0045 U													0.0045 U	0.0045 U
4-Chlorophenyl phenyl ether	0.0045 U													0.0045 U	0.0045 U
4-Nitroaniline	0.0045 U													0.0045 U	0.0045 U
4-Nitrophenol	0.0045 U													0.00072 J	0.0018 J
Acenaphthene	0.00091 U													0.00091 U	0.00091 U
Acenaphthylene	0.00027 U													0.00027 U	0.00027 U
Acetophenone	0.0045 U													0.0045 U	0.0045 U

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Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
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Parameter	OC-SW-ISCO-2-XXX ISCO2 6/6/2011	OC-SW-PZ16RR PZ-16RR 11/12/2009	OC-SW-PZ-16RR PZ-16RR 11/15/2010	OC-SW-PZ16RR PZ-16RR 11/8/2011	OC-SW-PZ-16RR PZ-16RR 6/9/2010	OC-SW-PZ-16RR-0.2-RISK PZ-16RR 2/18/2010	OC-SW-PZ-16RRSW PZ-16RR 11/16/2012	OC-SW-PZ16RR-SW PZ-16RR 2/23/2012	OC-SW-PZ-16RRSW PZ-16RR 3/22/2011	OC-SW-PZ-16RRSW PZ-16RR 5/16/2011	OC-SW-PZ-16RRSW PZ-16RR 6/7/2012	OC-SW-PZ-16RRSW PZ-16RR 8/23/2011	OC-SW-PZ-16RRSW PZ-16RR 8/23/2012	OC-SW-PZ-16RR-XXX PZ-16RR 12/9/2010	OC-SW-PZ-16RR-XXX PZ-16RR 6/6/2011
Aniline	0.0045 UJ													0.0045 UJ	0.0045 UJ
Anthracene	0.00091 U													0.00091 U	0.00091 U
Atrazine	0.0045 U													0.0045 U	0.0045 U
Azobenzene	0.0045 U													0.0045 U	0.00046 J
Benzaldehyde	0.0045 U													0.0045 U	0.0045 U
Benzo(a)anthracene	0.00027 U													0.00027 U	0.00027 U
Benzo(a)pyrene	0.00015 J													0.00018 UJ	0.00018 U
Benzo(b)fluoranthene	0.00027 UJ													0.00027 UJ	0.00027 UJ
Benzo(ghi)perylene	0.00045 U													0.00045 UJ	0.00045 U
Benzo(k)fluoranthene	0.00027 U													0.00027 UJ	0.00027 U
Benzoic Acid	0.0019 J													0.0018 J	0.002 J
Benzyl alcohol	0.0091 U													0.0091 U	0.0091 U
Biphenyl	0.0045 U													0.0045 U	0.0045 U
Bis(2-Chloroethoxy)methane	0.0045 U													0.0045 U	0.0045 U
Bis(2-Chloroethyl)ether	0.0045 U													0.0045 U	0.0045 U
Bis(2-Chloroisopropyl)ether	0.0045 U													0.0045 U	0.0045 U
Bis(2-Ethylhexyl)phthalate	0.0061													0.0038 U	0.0018 U
Butylbenzylphthalate	0.0045 U													0.0045 U	0.0045 U
Caprolactam	0.0045 UJ													0.0045 UJ	0.0045 UJ
Carbazole	0.0045 U													0.0045 U	0.0045 U
Chrysene	0.00091 U													0.00091 U	0.00091 U
Dibenz(a,h)anthracene	0.00041 U													0.00041 U	0.00041 U
Dibenzofuran	0.0045 U													0.0045 U	0.0045 U
Diethylphthalate	0.0045 U													0.0045 U	0.0045 U
Dimethylphthalate	0.0045 U													0.0045 U	0.0045 U
Di-n-butylphthalate	0.0045 U													0.0045 U	0.0045 U
Di-n-octylphthalate	0.0045 U													0.0045 UJ	0.0045 U
Diphenyl ether	0.0045 U													0.00056 J	0.00062 J
Diphenylamine	0.0045 U													0.0045 U	0.0045 U
Diphenylmethanone	0.00067 J													0.0045 U	0.001 J
Fluoranthene	0.00091 U													0.00091 U	0.00091 U
Fluorene	0.00091 U													0.00091 U	0.00091 U
Hexachlorobenzene	0.00091 U													0.00091 U	0.00091 U
Hexachlorocyclopentadiene	0.0045 U													0.0045 U	0.0045 U
Hexachloroethane	0.0027 U													0.0027 U	0.0027 U
Indeno(1,2,3-cd)pyrene	0.00041 U													0.00041 U	0.00041 U
Isophorone	0.0045 U													0.0045 U	0.0045 U
Naphthalene	0.00091 U													0.00091 U	0.00091 U
Nitrobenzene	0.0045 U													0.0045 U	0.0045 U
N-Nitrosodimethylamine	0.000078													0.00017	0.00017 J
N-Nitrosodi-n-propylamine	0.000002 U													0.000004 U	0.0000095 UJ
N-Nitrosodiphenylamine	0.0045 U													0.0045 U	0.0045 U
Pentachlorophenol	0.00091 U													0.00091 U	0.00091 U
Phenanthrene	0.00018 U													0.00018 U	0.00018 U
Phenol	0.0045 UJ													0.0045 UJ	0.0045 UJ
Pyrene	0.00091 U													0.00091 U	0.00091 U
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)	0.05 U													0.05 U	0.05 U
C9-C10 Aromatics	0.05 U													0.05 U	0.05 U
C9-C12 Aliphatics (unadj.)	0.05 U													0.05 U	0.05 U
C11-C22 Aromatics	0.091 U													0.091 U	0.091 U
C11-C22 Aromatics (unadj.)	0.091 U													0.091 U	0.091 U
C19-C36 Aliphatics	0.091 U													0.091 U	0.091 U
C9-C18 Aliphatics	0.091 U													0.091 U	0.091 U
Extractable Petroleum Hydrocarbons, Total	0.091 U													0.091 U	0.091 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO-2-XXX ISCO2 6/6/2011	OC-SW-PZ16RR PZ-16RR 11/12/2009	OC-SW-PZ-16RR PZ-16RR 11/15/2010	OC-SW-PZ16RR PZ-16RR 11/8/2011	OC-SW-PZ-16RR PZ-16RR 6/9/2010	OC-SW-PZ-16RR-0.2-RISK PZ-16RR 2/18/2010	OC-SW-PZ-16RRSW PZ-16RR 11/16/2012	OC-SW-PZ16RR-SW PZ-16RR 2/23/2012	OC-SW-PZ-16RRSW PZ-16RR 3/22/2011	OC-SW-PZ-16RRSW PZ-16RR 5/16/2011	OC-SW-PZ-16RRSW PZ-16RR 6/7/2012	OC-SW-PZ-16RRSW PZ-16RR 8/23/2011	OC-SW-PZ-16RRSW PZ-16RR 8/23/2012	OC-SW-PZ-16RR-XXX PZ-16RR 12/9/2010	OC-SW-PZ-16RR-XXX PZ-16RR 6/6/2011
Volatile Petroleum Hydrocarbons, Total	0.05 U													0.05 U	0.05 U
Total Metals (mg/L)															
Aluminum	5.4	4.8	1.9	1.8	4.1	5.05	2.3	0.64 J	1.8	0.99	0.31	1.9	0.99	2.9	0.85
Antimony	0.006 U													0.006 U	0.006 U
Arsenic	0.01 U													0.0035 J	0.01 U
Barium	0.027													0.023	0.023
Beryllium	0.00074 J													0.001 U	0.0003 J
Cadmium	0.001 U													0.001 U	0.001 U
Calcium	67													57	72
Chromium	1.1	1	0.39	0.38	0.97	1.15	0.53	0.34	0.38	0.19	0.14 J	0.56	0.37	0.61	0.27
Chromium, Hexavalent	0.001 UJ														
Cobalt	0.032													0.035	0.041
Copper	0.0078													0.0091 J	0.0064
Iron	13													5.7	4.8
Lead	0.0021													0.00039 J	0.0001 U
Magnesium	14													12	16
Manganese	1.7													1.6	1.9
Mercury	0.0002 U													0.0002 U	0.00029
Nickel	0.034													0.039	0.047
Potassium	2.2 J													2.5 J	2.2 J
Selenium	0.01 U													0.01 U	0.01 U
Silver	0.0001 U													0.001 UJ	0.0001 U
Sodium	170	150 J	120	110 J	120 J	160	130	150 J	85 J	69	88 J	160 J	210	150	200
Thallium	0.01 U													0.01 U	0.01 U
Tin	0.05 U													0.05 U	0.05 U
Vanadium	0.01 U													0.01 U	0.01 U
Zinc	0.059													0.066	0.075
Dissolved Metals (mg/L)															
Aluminum		0.093 J	0.86	0.069 J	0.56	0.215	1.1	0.76 J	0.46	0.18	0.36	1.5	0.14		
Chromium		0.06	0.25	0.023	0.16	0.125	0.3	0.36	0.12	0.062	0.16 J	0.49	0.17		
Sodium		170 J	130	130 J	160 J	160	130	170 J	100 J	80	95	200 J	220		
Inorganics (mg/L)															
Bromide	0.43													0.36	0.43
Chloride	180	250	160	120	180	240	140	160	130	90 J	120	190	230	200	190
Hardness	220													190	240
LAB SPECIFIC CONDUCTANCE (mS/cm)		1.6	1.5	0.95	1.5	1.5	1.4	1.6	0.82	0.84	1.1	2.3	2.4		
Nitrate as N	0.57	3.9	2	1.8	4.6	2.4	1.3 J	1.1	1.4	0.47 J	0.44	0.39	0.7	1.9	0.26
Nitrite as N	0.1 U	0.1 U	0.017	0.1 U	0.01 U	0.01 U	R	0.1 U	0.1 U	0.01 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.01 U
Nitrogen, as Ammonia	110	57 J	66	31	48	41.5	52	100	19	24 J	48	110	140	77	110
Sulfate	800	380	520	160	380	315	320	470	120	200 J	270	620	830	660	800
Total Organic Carbon	9.4													13	10
Total Suspended Solids	240 J													13	14 J
Specialty Compounds (mg/L)															
Perchlorate														0.01 U	
Hydrazine	0.00008 J													0.0001 U	0.0001 U
Monomethylhydrazine (MMH)	0.0005 U													0.0005 U	0.0005 U
UDMH	0.0005 U													0.0005 U	0.0005 U
Dimethylformamide	0.02 UJ													0.02 U	0.02 UJ
Phthalic Acid/Phthalic anhydride	0.01 U													0.01 U	0.01 U
4-(1,1,3,3-Tetramethylbutyl)phenol	0.00099 U													0.00098 U	0.00095 U
4,4'-Isopropylidenediphenol	0.00065 J													0.00098 U	0.00096
4-Nonylphenol (Tech.)	0.0056													0.015	0.017
Nonylphenol Diethoxylate	0.02 U													0.02 U	0.019 U
Kempore (Azodicarbonamide)	1.2 N													1 U	1.1 U
OPEX	0.1 UJ													0.1 UJ	0.1 UJ

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ17RR PZ-17RR 11/12/2009	OC-SW-PZ-17RR PZ-17RR 11/15/2010	OC-SW-PZ17RR PZ-17RR 11/8/2011	OC-SW-PZ-17RR PZ-17RR 6/9/2010	OC-SW-PZ-17RR-0.2 PZ-17RR 2/18/2010	OC-SW-PZ-17RRSW PZ-17RR 11/16/2012	OC-SW-PZ-17RR-SW PZ-17RR 2/23/2012	OC-SW-PZ-17RRSW PZ-17RR 3/22/2011	OC-SW-PZ-17RRSW PZ-17RR 5/16/2011	OC-SW-PZ-17RRSW PZ-17RR 6/7/2012	OC-SW-PZ-17RRSW PZ-17RR 8/23/2011	OC-SW-PZ-17RRSW PZ-17RR 8/23/2012	OC-SW-PZ-17RR-XXX PZ-17RR 12/10/2010	OC-SW-PZ-17RR-XXX PZ-17RR 12/17/2012	OC-SW-PZ-17RR-XXX PZ-17RR 6/6/2011
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane													0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane													0.001 U	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane													0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane													0.001 U	0.001 U	0.001 U
1,1,2-Trichloroethane													0.001 U	0.001 U	0.001 U
1,1-Dichloroethane													0.001 U	0.001 U	0.001 U
1,1-Dichloroethene													0.001 U	0.001 U	0.001 U
1,1-Dichloropropene													0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene													0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane													0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene													0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene													0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane													0.005 U	0.005 U	0.005 U
1,2-Dibromoethane													0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene													0.001 U	0.001 U	0.001 U
1,2-Dichloroethane													0.001 U	0.001 U	0.001 U
1,2-Dichloropropane													0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene													0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene													0.001 U	0.001 U	0.00057 J
1,3-Dichloropropane													0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene													0.001 U	0.001 U	0.001 U
1,4-Dioxane													R	R	0.05 U
2,2-Dichloropropane													0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene													0.0074	0.0014	0.01 J
2,4,4-Trimethyl-2-pentene													0.0007 J	0.001 U	0.002
2-Butanone													0.01 U	0.0071 J	0.01 U
2-Chlorotoluene													0.001 U	0.001 U	0.001 U
2-Hexanone													0.01 U	0.01 U	0.01 U
4-Chlorotoluene													0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene													0.001 U	0.001 U	0.001 U
4-Methyl-2-pentanone													0.01 U	0.01 U	0.01 U
Acetaldehyde													0.03 U		0.03 U
Acetic acid, methyl ester													0.02 U	0.02 U	0.02 U
Acetone													0.05 U	0.0084 J	0.05 U
Benzene													0.001 U	0.001 U	0.001 U
Bromobenzene													0.001 U	0.001 U	0.001 U
Bromochloromethane													0.001 U	0.001 U	0.001 U
Bromodichloromethane													0.00036 J	0.0005 U	0.00051
Bromoform													0.0029 J	0.001 U	0.0034
Bromomethane													0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-													0.005 U	0.005 U	0.005 UJ
Carbon disulfide													0.00058 J	0.01 U	0.01 U
Carbon tetrachloride													0.001 UJ	0.001 U	0.001 UJ
Chlorobenzene													0.001 U	0.001 U	0.001 U
Chlorodibromomethane													0.0038	0.0005 U	0.001
Chloroethane													0.002 U	0.002 U	0.002 U
Chloroform													0.00098 J	0.001 U	0.0012
Chloromethane													0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene													0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene													0.0004 U	0.0004 U	0.0004 U
Cyclohexane													0.01 U	0.001 U	0.01 U
Dibromomethane													0.001	0.001 U	0.0011
Dichlorodifluoromethane													0.001 UJ	0.001 U	0.001 U
Diethyl ether													0.01 U	0.001 U	0.01 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ17RR PZ-17RR 11/12/2009	OC-SW-PZ-17RR PZ-17RR 11/15/2010	OC-SW-PZ17RR PZ-17RR 11/8/2011	OC-SW-PZ-17RR PZ-17RR 6/9/2010	OC-SW-PZ-17RR-0.2 PZ-17RR 2/18/2010	OC-SW-PZ-17RRSW PZ-17RR 11/16/2012	OC-SW-PZ-17RR-SW PZ-17RR 2/23/2012	OC-SW-PZ-17RRSW PZ-17RR 3/22/2011	OC-SW-PZ-17RRSW PZ-17RR 5/16/2011	OC-SW-PZ-17RRSW PZ-17RR 6/7/2012	OC-SW-PZ-17RRSW PZ-17RR 8/23/2011	OC-SW-PZ-17RRSW PZ-17RR 8/23/2012	OC-SW-PZ-17RR-XXX PZ-17RR 12/10/2010	OC-SW-PZ-17RR-XXX PZ-17RR 12/17/2012	OC-SW-PZ-17RR-XXX PZ-17RR 6/6/2011
Ethyl benzene													0.001 U	0.001 U	0.001 U
Ethyl-t-Butyl Ether													0.005 U	0.005 U	0.005 UJ
Formaldehyde													0.016 J		0.03 U
Hexachlorobutadiene													0.0004 U	0.0004 U	0.0004 U
Isopropyl ether													0.01 U	0.01 U	0.01 U
Isopropylbenzene													0.001 U	0.001 U	0.001 U
Methyl cyclohexane													0.01 U	0.001 U	0.01 U
Methyl Tertbutyl Ether													0.001 U	0.001 U	0.001 UJ
Methylene chloride													0.002 U	0.001 U	0.002 U
Naphthalene													0.005 U	0.005 U	0.005 U
n-Butylbenzene													0.001 U	0.001 U	0.001 U
Propylbenzene													0.001 U	0.001 U	0.001 U
sec-Butylbenzene													0.001 U	0.001 U	0.001 U
Styrene													0.001 U	0.001 U	0.001 U
tert-Butylbenzene													0.001 U	0.001 U	0.001 U
Tetrachloroethene													0.001 U	0.001 U	0.001 U
Tetrahydrofuran													0.01 U	0.01 U	0.01 U
Toluene													0.00046 J	0.001 U	0.00048 J
trans-1,2-Dichloroethene													0.001 U	0.001 U	0.001 U
trans-1,3-Dichloropropene													0.0004 U	0.0004 U	0.0004 U
Trichloroethene													0.001 U	0.001 U	0.001 U
Trichlorofluoromethane													0.001 U	0.001 U	0.001 U
Vinyl chloride													0.0005 U	0.0005 U	0.0005 U
Xylene, o													0.001 U	0.001 U	0.001 U
Xylenes (m&p)													0.002 U	0.002 U	0.002 U
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene													0.0045 U	0.00096 U	0.0045 U
1-Methylnaphthalene													0.0045 U	0.00096 U	0.0045 U
2,3,4,6-Tetrachlorophenol													0.0045 U	0.00096 UJ	0.0045 U
2,4,5-Trichlorophenol													0.0045 U	0.00096 U	0.0045 U
2,4,6-Trichlorophenol													0.0045 U	0.00096 UJ	0.0045 U
2,4-Dichlorophenol													0.0045 U	0.00096 UJ	0.0045 U
2,4-Dimethylphenol													0.0045 U	0.00096 U	0.0045 U
2,4-Dinitrophenol													0.0045 U	0.00096 U	0.0045 U
2,4-Dinitrotoluene													0.0045 U	0.00096 U	0.0045 U
2,6-Dinitrotoluene													0.0045 U	0.00096 U	0.0045 U
2-Chloronaphthalene													0.0045 U	0.00096 U	0.0045 U
2-Chlorophenol													0.0045 U	0.00096 U	0.0045 U
2-Methylnaphthalene													0.00091 U	0.00096 U	0.00091 U
2-Methylphenol													0.0045 U	0.00096 U	0.0045 U
2-Nitroaniline													0.0045 U	0.0048 U	0.0045 U
2-Nitrophenol													0.0045 U	0.00096 U	0.0018 J
3 & 4 Methylphenol													0.0045 U	0.00096 U	0.0045 U
3,3'-Dichlorobenzidine													0.0045 U	0.0019 U	0.0045 U
3-Nitroaniline													0.0045 U	0.0048 U	0.0045 U
4,6-Dinitro-2-methylphenol													0.0045 U	0.0048 U	0.0045 U
4-Bromophenyl phenyl ether													0.0045 U	0.00096 U	0.0045 U
4-Chloro-3-methylphenol													0.0045 U	0.0019 U	0.0045 U
4-Chloroaniline													0.0045 U	0.0019 U	0.0045 U
4-Chlorophenyl phenyl ether													0.0045 U	0.00096 U	0.0045 U
4-Nitroaniline													0.0045 U	0.0048 U	0.0045 U
4-Nitrophenol													0.0016 J	0.0048 UJ	0.0021 J
Acenaphthene													0.00091 U	0.00096 U	0.00091 U
Acenaphthylene													0.00027 U	0.00096 U	0.00027 U
Acetophenone													0.0045 U	0.00096 U	0.0045 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ17RR PZ-17RR 11/12/2009	OC-SW-PZ-17RR PZ-17RR 11/15/2010	OC-SW-PZ17RR PZ-17RR 11/8/2011	OC-SW-PZ-17RR PZ-17RR 6/9/2010	OC-SW-PZ-17RR-0.2 PZ-17RR 2/18/2010	OC-SW-PZ-17RRSW PZ-17RR 11/16/2012	OC-SW-PZ-17RR-SW PZ-17RR 2/23/2012	OC-SW-PZ-17RRSW PZ-17RR 3/22/2011	OC-SW-PZ-17RRSW PZ-17RR 5/16/2011	OC-SW-PZ-17RRSW PZ-17RR 6/7/2012	OC-SW-PZ-17RRSW PZ-17RR 8/23/2011	OC-SW-PZ-17RRSW PZ-17RR 8/23/2012	OC-SW-PZ-17RR-XXX PZ-17RR 12/10/2010	OC-SW-PZ-17RR-XXX PZ-17RR 12/17/2012	OC-SW-PZ-17RR-XXX PZ-17RR 6/6/2011
Aniline													0.0045 UJ	0.00096 U	0.0045 UJ
Anthracene													0.00091 U	0.00096 U	0.00091 U
Atrazine													0.0045 U	0.00096 U	0.0045 U
Azobenzene													0.0045 U	0.00096 U	0.00053 J
Benzaldehyde													0.0045 U	0.00096 U	0.0045 U
Benzo(a)anthracene													0.00027 U	0.00096 U	0.00027 U
Benzo(a)pyrene													0.00018 U	0.00096 U	0.00018 U
Benzo(b)fluoranthene													0.00027 U	0.00096 UJ	0.00027 UJ
Benzo(ghi)perylene													0.00045 U	0.00096 U	0.00045 U
Benzo(k)fluoranthene													0.00027 U	0.00096 U	0.00027 U
Benzoic Acid													0.0045 UJ	R	0.0021 J
Benzyl alcohol													0.0091 U	0.0019 U	0.0091 U
Biphenyl													0.0045 U	0.00096 U	0.0045 U
Bis(2-Chloroethoxy)methane													0.0045 U	0.00096 U	0.0045 U
Bis(2-Chloroethyl)ether													0.0045 U	0.00096 U	0.0045 U
Bis(2-Chloroisopropyl)ether													0.0045 U	0.00096 U	0.0045 U
Bis(2-Ethylhexyl)phthalate													0.0089 U	0.0048 U	0.0018 U
Butylbenzylphthalate													0.0045 U	0.00096 U	0.0045 U
Caprolactam													0.0045 UJ	0.00096 UJ	0.0045 UJ
Carbazole													0.0045 U	0.00096 U	0.0045 U
Chrysene													0.00091 U	0.00096 U	0.00091 U
Dibenz(a,h)anthracene													0.00041 U	0.00096 U	0.00041 U
Dibenzofuran													0.0045 U	0.00096 U	0.0045 U
Diethylphthalate													0.0045 U	0.00096 U	0.0045 U
Dimethylphthalate													0.0045 U	0.00096 U	0.0045 U
Di-n-butylphthalate													0.0045 U	0.0048 U	0.0045 U
Di-n-octylphthalate													0.0045 U	0.00096 U	0.0045 U
Diphenyl ether													0.00076 J	0.00096 U	0.0011 J
Diphenylamine													0.0045 U		0.0045 U
Diphenylmethanone													0.00052 J	0.00096 U	0.0012 J
Fluoranthene													0.00091 U	0.00096 U	0.00091 U
Fluorene													0.00091 U	0.00096 U	0.00091 U
Hexachlorobenzene													0.00091 U	0.00096 U	0.00091 U
Hexachlorocyclopentadiene													0.0045 U	0.0019 U	0.0045 U
Hexachloroethane													0.0027 U	0.00096 U	0.0027 U
Indeno(1,2,3-cd)pyrene													0.00041 U	0.00096 U	0.00041 U
Isophorone													0.0045 U	0.00096 U	0.0045 U
Naphthalene													0.00091 U		0.00091 U
Nitrobenzene													0.0045 U	0.00096 U	0.0045 U
N-Nitrosodimethylamine													0.0003	0.000045 J	0.00029 J
N-Nitrosodi-n-propylamine													0.0000095 U	0.0000093	0.000021 UJ
N-Nitrosodiphenylamine													0.00047 J	0.00096 U	0.00064 J
Pentachlorophenol													0.00091 U	0.00096 U	0.00091 U
Phenanthrene													0.00018 U	0.00096 U	0.00018 U
Phenol													0.0045 UJ	0.00096 U	0.0045 UJ
Pyrene													0.00091 U	0.00096 U	0.00091 U
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)													0.05 U		0.05 U
C9-C10 Aromatics													0.05 U		0.05 U
C9-C12 Aliphatics (unadj.)													0.05 U		0.05 U
C11-C22 Aromatics													0.091 U		0.091 U
C11-C22 Aromatics (unadj.)													0.091 U		0.091 U
C19-C36 Aliphatics													0.091 U		0.091 U
C9-C18 Aliphatics													0.091 U		0.091 U
Extractable Petroleum Hydrocarbons, Total													0.091 U		0.091 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ17RR PZ-17RR 11/12/2009	OC-SW-PZ-17RR PZ-17RR 11/15/2010	OC-SW-PZ17RR PZ-17RR 11/8/2011	OC-SW-PZ-17RR PZ-17RR 6/9/2010	OC-SW-PZ-17RR-0.2 PZ-17RR 2/18/2010	OC-SW-PZ-17RRSW PZ-17RR 11/16/2012	OC-SW-PZ-17RR-SW PZ-17RR 2/23/2012	OC-SW-PZ-17RRSW PZ-17RR 3/22/2011	OC-SW-PZ-17RRSW PZ-17RR 5/16/2011	OC-SW-PZ-17RRSW PZ-17RR 6/7/2012	OC-SW-PZ-17RRSW PZ-17RR 8/23/2011	OC-SW-PZ-17RRSW PZ-17RR 8/23/2012	OC-SW-PZ-17RR-XXX PZ-17RR 12/10/2010	OC-SW-PZ-17RR-XXX PZ-17RR 12/17/2012	OC-SW-PZ-17RR-XXX PZ-17RR 6/6/2011
Volatile Petroleum Hydrocarbons, Total													0.05 U		0.05 U
Total Metals (mg/L)															
Aluminum	3.4	3.4	2	2	2.6	3.8	1 J	1.3	1.5	0.54	5.7	7.6	11	3.6	9
Antimony													0.006 U	0.006 U	0.006 U
Arsenic													0.01 U	0.01 U	0.01 U
Barium													0.025	0.021	0.021
Beryllium													0.0011	0.00056 J	0.0011
Cadmium													0.001 U	0.001 U	0.001 U
Calcium													62	26	72
Chromium	0.77	0.79	0.47	0.5	0.63	0.92	0.51	0.3	0.36	0.26	1.3	1.8	2.2	0.71	1.8
Chromium, Hexavalent														0.005 U	
Cobalt													0.047	0.013	0.05
Copper													0.026 J	0.0096 J	0.021
Iron													10	3.7	12
Lead													0.0012	0.00056 J	0.00042 J
Magnesium													15	5.1	17
Manganese													2.1	0.85	2.2
Mercury													0.0002 U	0.0002 U	0.0002 U
Nickel													0.052	0.014	0.057
Potassium													2.5 J	1.7	3.4 J
Selenium													0.01 U	0.01 U	0.01 U
Silver													0.001 UJ	0.001 UJ	0.0001 U
Sodium	130 J	130	120 J	120 J	140	140	190 J	98 J	81	110 J	160 J	240	180	88	220
Thallium													0.01 U	0.01 U	0.01 U
Tin													0.05 U	0.01 UJ	0.05 U
Vanadium													0.01 UJ	0.0022 J	0.01 U
Zinc													0.083	0.038 J	0.097
Dissolved Metals (mg/L)															
Aluminum	0.07 J	1.6	0.11	0.058 J	0.13	0.93	1.2 J	0.39	0.29	0.53	1.4	1.9			
Chromium	0.068	0.49	0.055	0.039	0.083	0.36	0.54	0.12	0.16	0.26	0.6	0.83			
Sodium	150 J	140	140 J	140 J	150	140	220 J	110 J	97	99	190 J	240			
Inorganics (mg/L)															
Bromide													0.45	0.2 U	0.48
Chloride	240	160	130	170	230	160	220	160	120 J	130	190	250	240	96	230
Hardness													220	80	250
LAB SPECIFIC CONDUCTANCE (mS/cm)	1.3	1.5	1	1.2	1.3	1.4	2	0.9	0.98	1.1	2.2	2.4			
Nitrate as N	4	0.53	1.8	5.9	3.3	0.69 J	3.4	1.9	0.35 J	0.35	0.18	0.36	0.69	0.62 J	1.8
Nitrite as N	0.1 U	0.01 U	0.1 U	0.01 U	0.01 U	R	0.1 U	0.1 U	0.01 UJ	0.1 U	0.1 U	0.1 U	0.01 U	0.022 J	0.1 U
Nitrogen, as Ammonia	37 J	66	33	24	33	58	89	17	30 J	49	110	130	96	33	130
Sulfate	250	530	180	210	210	350	550	120	230 J	280	600	850	810	150	990
Total Organic Carbon													20	7.6	14
Total Suspended Solids													76	19	70 J
Specialty Compounds (mg/L)															
Perchlorate													0.01 U		
Hydrazine													0.0001 U		0.0001 U
Monomethylhydrazine (MMH)													0.0005 U		0.0005 U
UDMH													0.0005 U		0.0005 U
Dimethylformamide													0.02 U		0.02 UJ
Phthalic Acid/Phthalic anhydride															0.01 U
4-(1,1,3,3-Tetramethylbutyl)phenol													0.00094 U		0.00095 UJ
4,4'-Isopropylidenediphenol													0.00094 U		0.00087 J
4-Nonylphenol (Tech.)													0.014		0.018 J
Nonylphenol Diethoxylate													0.019 U		0.019 UJ
Kempore (Azodicarbonamide)													1 U		1.1 NJ
OPEX													0.1 UJ		0.1 UJ

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ18R-RISK PZ-18R 11/15/2010	OC-SW-PZ18R-RISK PZ-18R 11/8/2011	OC-SW-PZ-18R PZ-18R 6/9/2010	OC-SW-PZ-18R-0.2 PZ-18R 2/18/2010	OC-SW-PZ-18RSW PZ-18R 11/16/2012	OC-SW-PZ-18RSW PZ-18R 3/22/2011	OC-SW-PZ-18RSW-RISK PZ-18R 5/16/2011	OC-SW-PZ-18RSW-RISK PZ-18R 6/7/2012	OC-SW-PZ-18RSW PZ-18R 8/23/2011	OC-SW-PZ-18RSW PZ-18R 8/23/2012	OC-SW-SD17 SD-17 11/12/2009	OC-SW-SD-17 SD-17 11/15/2010	OC-SW-SD-17 SD-17 11/16/2012	OC-SW-SD17 SD-17 11/8/2011	OC-SW-SD-17 SD-17 3/22/2011
Volatile Organic Compounds (mg/L)															
1,1,1,2-Tetrachloroethane															
1,1,1-Trichloroethane															
1,1,2,2-Tetrachloroethane															
1,1,2-Trichloro-1,2,2-Trifluoroethane															
1,1,2-Trichloroethane															
1,1-Dichloroethane															
1,1-Dichloroethene															
1,1-Dichloropropene															
1,2,3-Trichlorobenzene															
1,2,3-Trichloropropane															
1,2,4-Trichlorobenzene															
1,2,4-Trimethylbenzene															
1,2-Dibromo-3-chloropropane															
1,2-Dibromoethane															
1,2-Dichlorobenzene															
1,2-Dichloroethane															
1,2-Dichloropropane															
1,3,5-Trimethylbenzene															
1,3-Dichlorobenzene															
1,3-Dichloropropane															
1,4-Dichlorobenzene															
1,4-Dioxane															
2,2-Dichloropropane															
2,4,4-Trimethyl-1-pentene															
2,4,4-Trimethyl-2-pentene															
2-Butanone															
2-Chlorotoluene															
2-Hexanone															
4-Chlorotoluene															
4-iso-Propyltoluene															
4-Methyl-2-pentanone															
Acetaldehyde															
Acetic acid, methyl ester															
Acetone															
Benzene															
Bromobenzene															
Bromochloromethane															
Bromodichloromethane															
Bromoform															
Bromomethane															
Butane, 2-methoxy-2-methyl-															
Carbon disulfide															
Carbon tetrachloride															
Chlorobenzene															
Chlorodibromomethane															
Chloroethane															
Chloroform															
Chloromethane															
Cis-1,2-Dichloroethene															
cis-1,3-Dichloropropene															
Cyclohexane															
Dibromomethane															
Dichlorodifluoromethane															
Diethyl ether															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ18R-RISK PZ-18R 11/15/2010	OC-SW-PZ18R-RISK PZ-18R 11/8/2011	OC-SW-PZ-18R PZ-18R 6/9/2010	OC-SW-PZ-18R-0.2 PZ-18R 2/18/2010	OC-SW-PZ-18RSW PZ-18R 11/16/2012	OC-SW-PZ-18RSW PZ-18R 3/22/2011	OC-SW-PZ-18RSW-RISK PZ-18R 5/16/2011	OC-SW-PZ-18RSW-RISK PZ-18R 6/7/2012	OC-SW-PZ-18RSW PZ-18R 8/23/2011	OC-SW-PZ-18RSW PZ-18R 8/23/2012	OC-SW-SD17 SD-17 11/12/2009	OC-SW-SD-17 SD-17 11/15/2010	OC-SW-SD-17 SD-17 11/16/2012	OC-SW-SD17 SD-17 11/8/2011	OC-SW-SD-17 SD-17 3/22/2011
Ethyl benzene															
Ethyl-t-Butyl Ether															
Formaldehyde															
Hexachlorobutadiene															
Isopropyl ether															
Isopropylbenzene															
Methyl cyclohexane															
Methyl Tertbutyl Ether															
Methylene chloride															
Naphthalene															
n-Butylbenzene															
Propylbenzene															
sec-Butylbenzene															
Styrene															
tert-Butylbenzene															
Tetrachloroethene															
Tetrahydrofuran															
Toluene															
trans-1,2-Dichloroethene															
trans-1,3-Dichloropropene															
Trichloroethene															
Trichlorofluoromethane															
Vinyl chloride															
Xylene, o															
Xylenes (m&p)															
Semivolatile Organic Compounds (mg/L)															
1,2,4,5-Tetrachlorobenzene															
1-Methylnaphthalene															
2,3,4,6-Tetrachlorophenol															
2,4,5-Trichlorophenol															
2,4,6-Trichlorophenol															
2,4-Dichlorophenol															
2,4-Dimethylphenol															
2,4-Dinitrophenol															
2,4-Dinitrotoluene															
2,6-Dinitrotoluene															
2-Chloronaphthalene															
2-Chlorophenol															
2-Methylnaphthalene															
2-Methylphenol															
2-Nitroaniline															
2-Nitrophenol															
3 & 4 Methylphenol															
3,3'-Dichlorobenzidine															
3-Nitroaniline															
4,6-Dinitro-2-methylphenol															
4-Bromophenyl phenyl ether															
4-Chloro-3-methylphenol															
4-Chloroaniline															
4-Chlorophenyl phenyl ether															
4-Nitroaniline															
4-Nitrophenol															
Acenaphthene															
Acenaphthylene															
Acetophenone															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ18R-RISK PZ-18R 11/15/2010	OC-SW-PZ18R-RISK PZ-18R 11/8/2011	OC-SW-PZ-18R PZ-18R 6/9/2010	OC-SW-PZ-18R-0.2 PZ-18R 2/18/2010	OC-SW-PZ-18RSW PZ-18R 11/16/2012	OC-SW-PZ-18RSW PZ-18R 3/22/2011	OC-SW-PZ-18RSW-RISK PZ-18R 5/16/2011	OC-SW-PZ-18RSW-RISK PZ-18R 6/7/2012	OC-SW-PZ-18RSW PZ-18R 8/23/2011	OC-SW-PZ-18RSW PZ-18R 8/23/2012	OC-SW-SD17 SD-17 11/12/2009	OC-SW-SD-17 SD-17 11/15/2010	OC-SW-SD-17 SD-17 11/16/2012	OC-SW-SD17 SD-17 11/8/2011	OC-SW-SD-17 SD-17 3/22/2011
Aniline															
Anthracene															
Atrazine															
Azobenzene															
Benzaldehyde															
Benzo(a)anthracene															
Benzo(a)pyrene															
Benzo(b)fluoranthene															
Benzo(ghi)perylene															
Benzo(k)fluoranthene															
Benzoic Acid															
Benzyl alcohol															
Biphenyl															
Bis(2-Chloroethoxy)methane															
Bis(2-Chloroethyl)ether															
Bis(2-Chloroisopropyl)ether															
Bis(2-Ethylhexyl)phthalate															
Butylbenzylphthalate															
Caprolactam															
Carbazole															
Chrysene															
Dibenz(a,h)anthracene															
Dibenzofuran															
Diethylphthalate															
Dimethylphthalate															
Di-n-butylphthalate															
Di-n-octylphthalate															
Diphenyl ether															
Diphenylamine															
Diphenylmethanone															
Fluoranthene															
Fluorene															
Hexachlorobenzene															
Hexachlorocyclopentadiene															
Hexachloroethane															
Indeno(1,2,3-cd)pyrene															
Isophorone															
Naphthalene															
Nitrobenzene															
N-Nitrosodimethylamine															
N-Nitrosodi-n-propylamine															
N-Nitrosodiphenylamine															
Pentachlorophenol															
Phenanthrene															
Phenol															
Pyrene															
EPH/VPH (mg/L)															
C5-C8 Aliphatics (unadj.)															
C9-C10 Aromatics															
C9-C12 Aliphatics (unadj.)															
C11-C22 Aromatics															
C11-C22 Aromatics (unadj.)															
C19-C36 Aliphatics															
C9-C18 Aliphatics															
Extractable Petroleum Hydrocarbons, Total															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-PZ18R-RISK PZ-18R 11/15/2010	OC-SW-PZ18R-RISK PZ-18R 11/8/2011	OC-SW-PZ-18R PZ-18R 6/9/2010	OC-SW-PZ-18R-0.2 PZ-18R 2/18/2010	OC-SW-PZ-18RSW PZ-18R 11/16/2012	OC-SW-PZ-18RSW PZ-18R 3/22/2011	OC-SW-PZ-18RSW-RISK PZ-18R 5/16/2011	OC-SW-PZ-18RSW-RISK PZ-18R 6/7/2012	OC-SW-PZ-18RSW PZ-18R 8/23/2011	OC-SW-PZ-18RSW PZ-18R 8/23/2012	OC-SW-SD17 SD-17 11/12/2009	OC-SW-SD-17 SD-17 11/15/2010	OC-SW-SD-17 SD-17 11/16/2012	OC-SW-SD17 SD-17 11/8/2011	OC-SW-SD-17 SD-17 3/22/2011
Volatile Petroleum Hydrocarbons, Total															
Total Metals (mg/L)															
Aluminum	0.235 J	0.265	0.12	0.14	0.21	0.25	0.185	0.155	0.14	0.093 J	2.7	3.6	3.4	2.1	1.3
Antimony															
Arsenic															
Barium															
Beryllium															
Cadmium															
Calcium															
Chromium	0.023	0.0215	0.015	0.022	0.02	0.016	0.012	0.0165	0.015	0.013	0.62	0.85	0.84	0.47	0.3
Chromium, Hexavalent															
Cobalt															
Copper															
Iron															
Lead															
Magnesium															
Manganese															
Mercury															
Nickel															
Potassium															
Selenium															
Silver															
Sodium	70.5 J	85.5 J	71 J	120	78	86	67.5	64.5 J	67 J	64	130	140	130	120 J	100 J
Thallium															
Tin															
Vanadium															
Zinc															
Dissolved Metals (mg/L)															
Aluminum	0.15 J	0.175	0.1 U	0.12	0.12 J	0.17	0.099 J	0.155	0.036 J	0.064 J	0.07 J	1.7	0.95	1.9	0.11
Chromium	0.0155	0.0145	0.0066	0.02	0.015	0.013	0.00715	0.015	0.0082	0.011	0.059	0.5	0.36	0.37	0.058
Sodium	80.5 J	96 J	83 J	130	79	92	73	63.5	89 J	64	140	140	140	140 J	120 J
Inorganics (mg/L)															
Bromide															
Chloride	115	120	98	220	110	150	125 J	110	110	100	230	170	170	130	170
Hardness															
LAB SPECIFIC CONDUCTANCE (mS/cm)	0.785	0.78	0.82	0.95	0.73	0.69	0.635	0.64	0.79	0.63	1.3	1.6	1.5	1	0.94
Nitrate as N	0.24	0.2	0.05 U	0.69	0.35 J	0.43	0.135 J	0.27	0.078	0.14	4.3	0.52	0.6 J	1.7	2.3
Nitrite as N	0.01 U	0.01 U	0.1 U	0.01 U	R	0.1 U	0.01 UJ	0.1 U	0.01 U	0.1 U	0.1 U	0.01	R	0.01 U	0.1 U
Nitrogen, as Ammonia	36.5	29.5	55	16	24	14	18 J	25.5	33	27	28 J	71	61	32	18
Sulfate	185 J	115	180	86	110	75	86 J	97.5	130	97	200	540	350	190	130
Total Organic Carbon															
Total Suspended Solids															
Specialty Compounds (mg/L)															
Perchlorate															
Hydrazine															
Monomethylhydrazine (MMH)															
UDMH															
Dimethylformamide															
Phthalic Acid/Phthalic anhydride															
4-(1,1,3,3-Tetramethylbutyl)phenol															
4,4'-Isopropylidenediphenol															
4-Nonylphenol (Tech.)															
Nonylphenol Diethoxylate															
Kempore (Azodicarbonamide)															
OPEX															

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-17 SD-17 5/16/2011	OC-SW-SD-17 SD-17 6/7/2012	OC-SW-SD-17 SD-17 6/9/2010	OC-SW-SD-17 SD-17 8/23/2011	OC-SW-SD-17 SD-17 8/23/2012	OC-SW-SD-17- 0.2 SD-17 2/18/2010	OC-SW-SD-1- XXX SD-1 12/17/2012	OC-SW-SD-1- XXX SD-1 12/9/2010	OC-SW-SD-1- XXX SD-1 6/6/2011
Volatile Organic Compounds (mg/L)									
1,1,1,2-Tetrachloroethane							0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane							0.001 U	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane							0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane							0.001 U	0.001 U	0.001 U
1,1,2-Trichloroethane							0.001 U	0.001 U	0.001 U
1,1-Dichloroethane							0.001 U	0.001 U	0.001 U
1,1-Dichloroethene							0.001 U	0.001 U	0.001 U
1,1-Dichloropropene							0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene							0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane							0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene							0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene							0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane							0.005 U	0.005 U	0.005 U
1,2-Dibromoethane							0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene							0.001 U	0.001 U	0.001 U
1,2-Dichloroethane							0.001 U	0.001 U	0.001 U
1,2-Dichloropropane							0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene							0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene							0.001 U	0.001 U	0.001 U
1,3-Dichloropropane							0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene							0.001 U	0.001 U	0.001 U
1,4-Dioxane							R	R	0.05 U
2,2-Dichloropropane							0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene							0.001 U	0.003	0.0019 J
2,4,4-Trimethyl-2-pentene							0.001 U	0.001 U	0.00044 J
2-Butanone							0.025 J	0.01 U	0.01 U
2-Chlorotoluene							0.001 U	0.001 U	0.001 U
2-Hexanone							0.01 U	0.01 U	0.01 U
4-Chlorotoluene							0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene							0.001 U	0.001 U	0.001 U
4-Methyl-2-pentanone							0.01 U	0.01 U	0.01 U
Acetaldehyde								0.03 U	0.03 U
Acetic acid, methyl ester							0.02 U	0.02 U	0.02 U
Acetone							0.012 J	0.05 U	0.05 U
Benzene							0.001 U	0.001 U	0.001 U
Bromobenzene							0.001 U	0.001 U	0.001 U
Bromochloromethane							0.001 U	0.001 U	0.001 U
Bromodichloromethane							0.0005 U	0.001 U	0.0005 U
Bromoform							0.001 U	0.0012 J	0.00072 J
Bromomethane							0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-							0.005 U	0.005 U	0.005 UJ
Carbon disulfide							0.01 U	0.01 U	0.01 U
Carbon tetrachloride							0.001 U	0.001 UJ	0.001 UJ
Chlorobenzene							0.001 U	0.001 U	0.001 U
Chlorodibromomethane							0.0005 U	0.0034	0.0005 U
Chloroethane							0.002 U	0.002 U	0.002 U
Chloroform							0.001 U	0.00037 J	0.001 U
Chloromethane							0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene							0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene							0.0004 U	0.0004 U	0.0004 U
Cyclohexane							0.001 U	0.01 U	0.01 U
Dibromomethane							0.001 U	0.00038 J	0.001 U
Dichlorodifluoromethane							0.001 U	0.001 UJ	0.001 U
Diethyl ether							0.001 U	0.01 U	0.01 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-17 SD-17 5/16/2011	OC-SW-SD-17 SD-17 6/7/2012	OC-SW-SD-17 SD-17 6/9/2010	OC-SW-SD-17 SD-17 8/23/2011	OC-SW-SD-17 SD-17 8/23/2012	OC-SW-SD-17 0.2 SD-17 2/18/2010	OC-SW-SD-1-XXX SD-1 12/17/2012	OC-SW-SD-1-XXX SD-1 12/9/2010	OC-SW-SD-1-XXX SD-1 6/6/2011
Ethyl benzene							0.001 U	0.001 U	0.001 U
Ethyl-t-Butyl Ether							0.005 U	0.005 U	0.005 UJ
Formaldehyde								0.018 J	0.03 U
Hexachlorobutadiene							0.0004 U	0.0004 U	0.0004 U
Isopropyl ether							0.01 U	0.01 U	0.01 U
Isopropylbenzene							0.001 U	0.001 U	0.001 U
Methyl cyclohexane							0.001 U	0.01 U	0.01 U
Methyl Tertbutyl Ether							0.001 U	0.001 U	0.001 UJ
Methylene chloride							0.001 U	0.002 U	0.002 U
Naphthalene							0.005 U	0.005 U	0.005 U
n-Butylbenzene							0.001 U	0.001 U	0.001 U
Propylbenzene							0.001 U	0.001 U	0.001 U
sec-Butylbenzene							0.001 U	0.001 U	0.001 U
Styrene							0.001 U	0.001 U	0.001 U
tert-Butylbenzene							0.001 U	0.001 U	0.001 U
Tetrachloroethene							0.001 U	0.001 U	0.001 U
Tetrahydrofuran							0.01 U	0.01 U	0.01 U
Toluene							0.001 U	0.001 U	0.001 U
trans-1,2-Dichloroethene							0.001 U	0.001 U	0.001 U
trans-1,3-Dichloropropene							0.0004 U	0.0004 U	0.0004 U
Trichloroethene							0.001 U	0.001 U	0.001 U
Trichlorofluoromethane							0.001 U	0.001 U	0.001 U
Vinyl chloride							0.0005 U	0.0005 U	0.0005 U
Xylene, o							0.001 U	0.001 U	0.001 U
Xylenes (m&p)							0.002 U	0.002 U	0.002 U
Semivolatile Organic Compounds (mg/L)									
1,2,4,5-Tetrachlorobenzene							0.00099 U	0.0045 U	0.005 U
1-Methylnaphthalene							0.00099 U	0.0045 U	0.005 U
2,3,4,6-Tetrachlorophenol							0.00099 UJ	0.0045 U	0.005 U
2,4,5-Trichlorophenol							0.00099 U	0.0045 U	0.005 U
2,4,6-Trichlorophenol							0.00099 UJ	0.0045 U	0.005 U
2,4-Dichlorophenol							0.00099 UJ	0.0045 U	0.005 U
2,4-Dimethylphenol							0.00099 U	0.0045 U	0.005 U
2,4-Dinitrophenol							0.00099 U	0.0045 U	0.005 U
2,4-Dinitrotoluene							0.00099 U	0.0045 U	0.005 U
2,6-Dinitrotoluene							0.00099 U	0.0045 U	0.005 U
2-Chloronaphthalene							0.00099 U	0.0045 U	0.005 U
2-Chlorophenol							0.00099 U	0.0045 U	0.005 U
2-Methylnaphthalene							0.00099 U	0.00091 U	0.00091 U
2-Methylphenol							0.00099 U	0.0045 U	0.005 U
2-Nitroaniline							0.005 U	0.0045 U	0.005 U
2-Nitrophenol							0.00099 U	0.00072 J	0.00067 J
3 & 4 Methylphenol							0.00099 U	0.0045 U	0.005 U
3,3'-Dichlorobenzidine							0.002 U	0.0045 U	0.005 U
3-Nitroaniline							0.005 U	0.0045 U	0.005 U
4,6-Dinitro-2-methylphenol							0.005 U	0.0045 U	0.005 U
4-Bromophenyl phenyl ether							0.00099 U	0.0045 U	0.005 U
4-Chloro-3-methylphenol							0.002 U	0.0045 U	0.005 U
4-Chloroaniline							0.002 U	0.0045 U	0.005 U
4-Chlorophenyl phenyl ether							0.00099 U	0.0045 U	0.005 U
4-Nitroaniline							0.005 U	0.0045 U	0.005 U
4-Nitrophenol							0.005 UJ	0.0045 UJ	0.005 U
Acenaphthene							0.00099 U	0.00091 U	0.00091 U
Acenaphthylene							0.00099 U	0.00027 U	0.00027 U
Acetophenone							0.00099 U	0.0045 U	0.005 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-17 SD-17 5/16/2011	OC-SW-SD-17 SD-17 6/7/2012	OC-SW-SD-17 SD-17 6/9/2010	OC-SW-SD-17 SD-17 8/23/2011	OC-SW-SD-17 SD-17 8/23/2012	OC-SW-SD-17- 0.2 SD-17 2/18/2010	OC-SW-SD-1- XXX SD-1 12/17/2012	OC-SW-SD-1- XXX SD-1 12/9/2010	OC-SW-SD-1- XXX SD-1 6/6/2011
Aniline							0.00099 U	0.0045 UJ	0.005 UJ
Anthracene							0.00099 U	0.00091 U	0.00091 U
Atrazine							0.00099 U	0.0045 U	0.005 U
Azobenzene							0.00099 U	0.0045 U	0.005 U
Benzaldehyde							0.00099 U	0.0045 U	0.005 U
Benzo(a)anthracene							0.00099 U	0.00027 U	0.00027 U
Benzo(a)pyrene							0.00099 U	0.00018 UJ	0.00018 U
Benzo(b)fluoranthene							0.00099 UJ	0.00027 UJ	0.00027 U
Benzo(ghi)perylene							0.00099 U	0.00045 UJ	0.00045 U
Benzo(k)fluoranthene							0.00099 U	0.00027 UJ	0.00027 U
Benzoic Acid							R	0.0045 UJ	0.0021 J
Benzyl alcohol							0.002 U	0.0091 U	0.01 U
Biphenyl							0.00099 U	0.0045 U	0.005 U
Bis(2-Chloroethoxy)methane							0.00099 U	0.0045 U	0.005 U
Bis(2-Chloroethyl)ether							0.00099 U	0.0045 U	0.005 U
Bis(2-Chloroisopropyl)ether							0.00099 U	0.0045 U	0.005 U
Bis(2-Ethylhexyl)phthalate							0.005 U	0.0035 U	0.0018 J
Butylbenzylphthalate							0.00099 U	0.0045 U	0.005 U
Caprolactam							0.00099 UJ	0.0045 UJ	0.005 UJ
Carbazole							0.00099 U	0.0045 U	0.005 U
Chrysene							0.00099 U	0.00091 U	0.00091 U
Dibenz(a,h)anthracene							0.00099 U	0.00041 U	0.00041 U
Dibenzofuran							0.00099 U	0.0045 U	0.005 U
Diethylphthalate							0.00099 U	0.0045 U	0.005 U
Dimethylphthalate							0.00099 U	0.0045 U	0.005 U
Di-n-butylphthalate							0.005 U	0.0045 U	0.005 U
Di-n-octylphthalate							0.00099 U	0.0045 UJ	0.005 U
Diphenyl ether							0.00099 U	0.0045 U	0.005 U
Diphenylamine								0.0045 U	0.005 U
Diphenylmethanone							0.00099 U	0.0045 U	0.005 U
Fluoranthene							0.00099 U	0.00091 U	0.00091 U
Fluorene							0.00099 U	0.00091 U	0.00091 U
Hexachlorobenzene							0.00099 U	0.00091 U	0.001 U
Hexachlorocyclopentadiene							0.002 U	0.0045 U	0.005 U
Hexachloroethane							0.00099 U	0.0027 U	0.003 U
Indeno(1,2,3-cd)pyrene							0.00099 U	0.00041 U	0.00041 U
Isophorone							0.00099 U	0.0045 U	0.005 U
Naphthalene								0.00091 U	0.00091 U
Nitrobenzene							0.00099 U	0.0045 U	0.005 U
N-Nitrosodimethylamine							0.000024 J	0.00014	0.000048
N-Nitrosodi-n-propylamine							0.0000049	0.000002 U	0.000002 U
N-Nitrosodiphenylamine							0.00099 U	0.0045 U	0.005 U
Pentachlorophenol							0.00099 U	0.00091 U	0.001 U
Phenanthrene							0.00099 U	0.00018 U	0.00018 U
Phenol							0.00099 U	0.0045 UJ	0.005 UJ
Pyrene							0.00099 U	0.00091 U	0.00091 U
EPH/VPH (mg/L)									
C5-C8 Aliphatics (unadj.)								0.05 U	0.05 U
C9-C10 Aromatics								0.05 U	0.05 U
C9-C12 Aliphatics (unadj.)								0.05 U	0.05 U
C11-C22 Aromatics								0.091 U	0.091 U
C11-C22 Aromatics (unadj.)								0.091 U	0.091 U
C19-C36 Aliphatics								0.091 U	0.091 U
C9-C18 Aliphatics								0.091 U	0.091 U
Extractable Petroleum Hydrocarbons, Total								0.091 U	0.091 U

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-17 SD-17 5/16/2011	OC-SW-SD-17 SD-17 6/7/2012	OC-SW-SD-17 SD-17 6/9/2010	OC-SW-SD-17 SD-17 8/23/2011	OC-SW-SD-17 SD-17 8/23/2012	OC-SW-SD-17-0.2 SD-17 2/18/2010	OC-SW-SD-1-XXX SD-1 12/17/2012	OC-SW-SD-1-XXX SD-1 12/9/2010	OC-SW-SD-1-XXX SD-1 6/6/2011
Volatile Petroleum Hydrocarbons, Total								0.05 U	0.05 U
Total Metals (mg/L)									
Aluminum	1.4	2.9	4.8	1.2	11	4.6	1.8	1.1	0.46
Antimony							0.006 U	0.006 U	0.006 U
Arsenic							0.01 U	0.01 U	0.01 U
Barium							0.013	0.027	0.026
Beryllium							0.001 U	0.001 U	0.001 U
Cadmium							0.001 U	0.001 U	0.001 U
Calcium							23	70	81
Chromium	0.33	0.68	1.3	0.28	2.4	0.84	0.29	0.23	0.11
Chromium, Hexavalent							0.005 U		
Cobalt							0.0076	0.034	0.039
Copper							0.0044 J	0.0095 J	0.00021 J
Iron							1.5	3.7	2
Lead							0.00043 J	0.00054 J	0.0003 J
Magnesium							3.3	13	17
Manganese							0.5	1.8	2
Mercury							0.0002 U	0.0002 U	0.0002 U
Nickel							0.009 J	0.036	0.041
Potassium							1.3	3.2 J	2.6 J
Selenium							0.01 U	0.01 U	0.01 U
Silver							0.000017 J	0.001 UJ	0.0001 U
Sodium	82	110 J	130	96 J	190	130 J	52	160	220
Thallium							0.01 U	0.01 U	0.01 U
Tin							0.01 UJ	0.05 U	0.05 U
Vanadium							0.01 U	0.01 U	0.01 U
Zinc							0.025 J	0.076	0.055
Dissolved Metals (mg/L)									
Aluminum	0.34	2.9	0.069 J	0.92	1	0.15			
Chromium	0.16	0.66	0.043	0.28	0.52	0.06			
Sodium	97	99	140	140 J	200	150 J			
Inorganics (mg/L)									
Bromide							0.2 U	0.34	0.46
Chloride	120 J	130	180	130	210	240	64	200	300
Hardness							80	230	270
LAB SPECIFIC CONDUCTANCE (mS/cm)	0.98	1.1	1.2	1.1	2	1.3			
Nitrate as N	0.42 J	0.44	6	0.16	0.6	3.6	0.96 J	2.8	6
Nitrite as N	0.01 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.043 J	0.1 U	0.1 U
Nitrogen, as Ammonia	32 J	60	32	41	110	48	21	66	95
Sulfate	230 J	280	250	240	670	200	110	590	800
Total Organic Carbon							4.5	11	24
Total Suspended Solids							6	2.8	19 J
Specialty Compounds (mg/L)									
Perchlorate								0.01 U	
Hydrazine								0.0001 U	0.000076 J
Monomethylhydrazine (MMH)								0.0005 U	0.0005 U
UDMH								0.0005 U	0.0005 U
Dimethylformamide								0.02 U	0.02 UJ
Phthalic Acid/Phthalic anhydride								0.01 U	0.01 U
4-(1,1,3,3-Tetramethylbutyl)phenol								0.00097 U	
4,4'-Isopropylidenediphenol								0.00097 U	
4-Nonylphenol (Tech.)								0.0077	
Nonylphenol Diethoxylate								0.019 U	
Kempore (Azodicarbonamide)								1 U	1.4 N
OPEX								0.1 UJ	0.1 UJ

Attachment 1-5
Surface Water Data Summary - South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO 1 ISCO1 9/1/2010	OC-ISCO 2 ISCO2 9/1/2010	OC-ISCO-1 ISCO1 2/24/2009	OC-ISCO-1 ISCO1 5/12/2009	OC-ISCO-1 ISCO1 8/12/2009	OC-ISCO1 ISCO1 3/21/2013	OC-ISCO1-SW ISCO1 2/23/2012	OC-ISCO-2 ISCO2 2/24/2009	OC-ISCO2 ISCO2 3/21/2013	OC-ISCO-2 ISCO2 5/12/2009	OC-ISCO-2 ISCO2 8/12/2009	OC-ISCO2-SW ISCO2 2/23/2012	OC-PZ 16 RR SW PZ-16RR 9/1/2010	OC-PZ 17 RR SW PZ-17RR 9/1/2010	OC-PZ 18 R SW PZ-18R 9/1/2010

Notes:
mg/L - milligram per liter
mS/cm - milliSiemens per centimeter
U - Not detected, value is reporting limit
J - Value is estimated
R - Value is rejected
N - Presumptive evidence of presence of material

Attachment 1-6
Surface Water Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-501-XXX SD-501 12/17/2012
Volatile Organic Compounds (mg/L)	
1,1,1,2-Tetrachloroethane	0.002 U
1,1,1-Trichloroethane	0.002 U
1,1,2,2-Tetrachloroethane	0.001 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.002 U
1,1,2-Trichloroethane	0.002 U
1,1-Dichloroethane	0.002 U
1,1-Dichloroethene	0.002 U
1,1-Dichloropropene	0.002 U
1,2,3-Trichlorobenzene	0.002 U
1,2,3-Trichloropropane	0.002 U
1,2,4-Trichlorobenzene	0.002 U
1,2,4-Trimethylbenzene	0.002 U
1,2-Dibromo-3-chloropropane	0.01 U
1,2-Dibromoethane	0.002 U
1,2-Dichlorobenzene	0.002 U
1,2-Dichloroethane	0.002 U
1,2-Dichloropropane	0.002 U
1,3,5-Trimethylbenzene	0.002 U
1,3-Dichlorobenzene	0.002 U
1,3-Dichloropropane	0.002 U
1,4-Dichlorobenzene	0.002 U
1,4-Dioxane	R
2,2-Dichloropropane	0.002 U
2,4,4-Trimethyl-1-pentene	0.002 U
2,4,4-Trimethyl-2-pentene	0.002 U
2-Butanone	0.02 U
2-Chlorotoluene	0.002 U
2-Hexanone	0.02 U
4-Chlorotoluene	0.002 U
4-iso-Propyltoluene	0.002 U
4-Methyl-2-pentanone	0.02 U
Acetic acid, methyl ester	0.04 U
Acetone	0.1 U
Benzene	0.002 U
Bromobenzene	0.002 U
Bromochloromethane	0.002 U
Bromodichloromethane	0.001 U
Bromoform	0.002 U
Bromomethane	0.004 U
Butane, 2-methoxy-2-methyl-	0.01 U
Carbon disulfide	0.02 U
Carbon tetrachloride	0.002 U
Chlorobenzene	0.002 U
Chlorodibromomethane	0.001 U
Chloroethane	0.004 U
Chloroform	0.002 U
Chloromethane	0.004 U
Cis-1,2-Dichloroethene	0.002 U
cis-1,3-Dichloropropene	0.0008 U
Cyclohexane	0.002 U
Dibromomethane	0.002 U
Dichlorodifluoromethane	0.002 U
Diethyl ether	0.002 U
Ethyl benzene	0.002 U
Ethyl-t-Butyl Ether	0.01 U

Attachment 1-6
Surface Water Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-501-XXX SD-501 12/17/2012
Hexachlorobutadiene	0.0008 U
Isopropyl ether	0.02 U
Isopropylbenzene	0.002 U
Methyl cyclohexane	0.002 U
Methyl Tertbutyl Ether	0.002 U
Methylene chloride	0.002 U
Naphthalene	0.01 U
n-Butylbenzene	0.002 U
Propylbenzene	0.002 U
sec-Butylbenzene	0.002 U
Styrene	0.002 U
tert-Butylbenzene	0.002 U
Tetrachloroethene	0.002 U
Tetrahydrofuran	0.02 U
Toluene	0.002 U
trans-1,2-Dichloroethene	0.002 U
trans-1,3-Dichloropropene	0.0008 U
Trichloroethene	0.002 U
Trichlorofluoromethane	0.002 U
Vinyl chloride	0.001 U
Xylene, o	0.002 U
Xylenes (m&p)	0.004 U
Semivolatile Organic Compounds (mg/L)	
1,2,4,5-Tetrachlorobenzene	0.00095 U
1-Methylnaphthalene	0.00095 U
2,3,4,6-Tetrachlorophenol	0.00095 UJ
2,4,5-Trichlorophenol	0.00095 U
2,4,6-Trichlorophenol	0.00095 UJ
2,4-Dichlorophenol	0.00095 UJ
2,4-Dimethylphenol	0.00095 U
2,4-Dinitrophenol	0.00095 U
2,4-Dinitrotoluene	0.00095 U
2,6-Dinitrotoluene	0.00095 U
2-Chloronaphthalene	0.00095 U
2-Chlorophenol	0.00095 U
2-Methylnaphthalene	0.00095 U
2-Methylphenol	0.00095 U
2-Nitroaniline	0.0048 U
2-Nitrophenol	0.00095 U
3 & 4 Methylphenol	0.00095 U
3,3'-Dichlorobenzidine	0.0019 U
3-Nitroaniline	0.0048 U
4,6-Dinitro-2-methylphenol	0.0048 U
4-Bromophenyl phenyl ether	0.00095 U
4-Chloro-3-methylphenol	0.0019 U
4-Chloroaniline	0.0019 U
4-Chlorophenyl phenyl ether	0.00095 U
4-Nitroaniline	0.0048 U
4-Nitrophenol	0.0048 UJ
Acenaphthene	0.00095 U
Acenaphthylene	0.00095 U
Acetophenone	0.00095 U
Aniline	0.00095 U
Anthracene	0.00095 U
Atrazine	0.00095 U
Azobenzene	0.00095 U

Attachment 1-6
Surface Water Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-501-XXX SD-501 12/17/2012
Benzaldehyde	0.00095 U
Benzo(a)anthracene	0.00095 U
Benzo(a)pyrene	0.00095 U
Benzo(b)fluoranthene	0.00095 UJ
Benzo(ghi)perylene	0.00095 U
Benzo(k)fluoranthene	0.00095 U
Benzoic Acid	R
Benzyl alcohol	0.0019 U
Biphenyl	0.00095 U
Bis(2-Chloroethoxy)methane	0.00095 U
Bis(2-Chloroethyl)ether	0.00095 U
Bis(2-Chloroisopropyl)ether	0.00095 U
Bis(2-Ethylhexyl)phthalate	0.0048 U
Butylbenzylphthalate	0.00095 U
Caprolactam	0.00095 UJ
Carbazole	0.00095 U
Chrysene	0.00095 U
Dibenz(a,h)anthracene	0.00095 U
Dibenzofuran	0.00095 U
Diethylphthalate	0.00095 U
Dimethylphthalate	0.00095 U
Di-n-butylphthalate	0.0048 U
Di-n-octylphthalate	0.00095 U
Diphenyl ether	0.00095 U
Diphenylmethanone	0.00095 U
Fluoranthene	0.00095 U
Fluorene	0.00095 U
Hexachlorobenzene	0.00095 U
Hexachlorocyclopentadiene	0.0019 U
Hexachloroethane	0.00095 U
Indeno(1,2,3-cd)pyrene	0.00095 U
Isophorone	0.00095 U
Nitrobenzene	0.00095 U
N-Nitrosodimethylamine	0.0000019 UJ
N-Nitrosodi-n-propylamine	0.0000019 U
N-Nitrosodiphenylamine	0.00095 U
Pentachlorophenol	0.00095 U
Phenanthrene	0.00095 U
Phenol	0.00095 U
Pyrene	0.00095 U
Total Metals (mg/L)	
Aluminum	0.21
Antimony	0.006 U
Arsenic	0.01 U
Barium	0.049
Beryllium	0.001 U
Cadmium	0.001 U
Calcium	190
Chromium	0.0085
Chromium, Hexavalent	0.005 U
Cobalt	0.0012 J
Copper	0.0018 J
Iron	0.43
Lead	0.0009 J
Magnesium	13
Manganese	0.7

Attachment 1-6
Surface Water Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-501-XXX SD-501 12/17/2012
Mercury	0.0002 U
Nickel	0.0053 J
Potassium	7.6
Selenium	0.01 U
Silver	0.000015 J
Sodium	68
Thallium	0.01 U
Tin	0.01 UJ
Vanadium	0.01 U
Zinc	0.04 J
Inorganics (mg/L)	
Bromide	0.13 J
Chloride	52
Hardness	460
Nitrate as N	3.6 J
Nitrite as N	0.075 J
Nitrogen, as Ammonia	28
Sulfate	460
Total Organic Carbon	11
Total Suspended Solids	4 U

Notes:
mg/L - milligram per liter
U - Not detected, value is reporting limit
J - Value is estimated
R - Value is rejected

Attachment 1-7
Surface Water Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-503-XXX SD-503 12/17/2012
Volatile Organic Compounds (mg/L)	
1,1,1,2-Tetrachloroethane	0.002 U
1,1,1-Trichloroethane	0.002 U
1,1,2,2-Tetrachloroethane	0.001 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.002 U
1,1,2-Trichloroethane	0.002 U
1,1-Dichloroethane	0.002 U
1,1-Dichloroethene	0.002 U
1,1-Dichloropropene	0.002 U
1,2,3-Trichlorobenzene	0.002 U
1,2,3-Trichloropropane	0.002 U
1,2,4-Trichlorobenzene	0.002 U
1,2,4-Trimethylbenzene	0.002 U
1,2-Dibromo-3-chloropropane	0.01 U
1,2-Dibromoethane	0.002 U
1,2-Dichlorobenzene	0.002 U
1,2-Dichloroethane	0.002 U
1,2-Dichloropropane	0.002 U
1,3,5-Trimethylbenzene	0.002 U
1,3-Dichlorobenzene	0.002 U
1,3-Dichloropropane	0.002 U
1,4-Dichlorobenzene	0.002 U
1,4-Dioxane	R
2,2-Dichloropropane	0.002 U
2,4,4-Trimethyl-1-pentene	0.002 U
2,4,4-Trimethyl-2-pentene	0.002 U
2-Butanone	0.02 U
2-Chlorotoluene	0.002 U
2-Hexanone	0.02 U
4-Chlorotoluene	0.002 U
4-iso-Propyltoluene	0.002 U
4-Methyl-2-pentanone	0.02 U
Acetic acid, methyl ester	0.04 U
Acetone	0.1 U
Benzene	0.002 U
Bromobenzene	0.002 U
Bromochloromethane	0.002 U
Bromodichloromethane	0.001 U
Bromoform	0.002 U
Bromomethane	0.004 U
Butane, 2-methoxy-2-methyl-	0.01 U
Carbon disulfide	0.02 U
Carbon tetrachloride	0.002 U
Chlorobenzene	0.002 U
Chlorodibromomethane	0.001 U
Chloroethane	0.004 U
Chloroform	0.002 U
Chloromethane	0.004 U
Cis-1,2-Dichloroethene	0.002 U
cis-1,3-Dichloropropene	0.0008 U
Cyclohexane	0.002 U
Dibromomethane	0.002 U
Dichlorodifluoromethane	0.002 U
Diethyl ether	0.002 U
Ethyl benzene	0.002 U
Ethyl-t-Butyl Ether	0.01 U

Attachment 1-7
Surface Water Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-503-XXX SD-503 12/17/2012
Hexachlorobutadiene	0.0008 U
Isopropyl ether	0.02 U
Isopropylbenzene	0.002 U
Methyl cyclohexane	0.002 U
Methyl Tertbutyl Ether	0.002 U
Methylene chloride	0.002 U
Naphthalene	0.01 U
n-Butylbenzene	0.002 U
Propylbenzene	0.002 U
sec-Butylbenzene	0.002 U
Styrene	0.002 U
tert-Butylbenzene	0.002 U
Tetrachloroethene	0.002 U
Tetrahydrofuran	0.02 U
Toluene	0.002 U
trans-1,2-Dichloroethene	0.002 U
trans-1,3-Dichloropropene	0.0008 U
Trichloroethene	0.002 U
Trichlorofluoromethane	0.002 U
Vinyl chloride	0.001 U
Xylene, o	0.002 U
Xylenes (m&p)	0.004 U
Semivolatile Organic Compounds (mg/L)	
1,2,4,5-Tetrachlorobenzene	0.00095 U
1-Methylnaphthalene	0.00095 U
2,3,4,6-Tetrachlorophenol	0.00095 UJ
2,4,5-Trichlorophenol	0.00095 U
2,4,6-Trichlorophenol	0.00095 UJ
2,4-Dichlorophenol	0.00095 UJ
2,4-Dimethylphenol	0.00095 U
2,4-Dinitrophenol	0.00095 U
2,4-Dinitrotoluene	0.00095 U
2,6-Dinitrotoluene	0.00095 U
2-Chloronaphthalene	0.00095 U
2-Chlorophenol	0.00095 U
2-Methylnaphthalene	0.00095 U
2-Methylphenol	0.00095 U
2-Nitroaniline	0.0048 U
2-Nitrophenol	0.00095 U
3 & 4 Methylphenol	0.00095 U
3,3'-Dichlorobenzidine	0.0019 U
3-Nitroaniline	0.0048 U
4,6-Dinitro-2-methylphenol	0.0048 U
4-Bromophenyl phenyl ether	0.00095 U
4-Chloro-3-methylphenol	0.0019 U
4-Chloroaniline	0.0019 U
4-Chlorophenyl phenyl ether	0.00095 U
4-Nitroaniline	0.0048 U
4-Nitrophenol	0.0048 UJ
Acenaphthene	0.00095 U
Acenaphthylene	0.00095 U
Acetophenone	0.00095 U
Aniline	0.00095 U
Anthracene	0.00095 U
Atrazine	0.00095 U
Azobenzene	0.00095 U

Attachment 1-7
Surface Water Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-503-XXX SD-503 12/17/2012
Benzaldehyde	0.00095 U
Benzo(a)anthracene	0.00095 U
Benzo(a)pyrene	0.00095 U
Benzo(b)fluoranthene	0.00095 UJ
Benzo(ghi)perylene	0.00095 U
Benzo(k)fluoranthene	0.00095 U
Benzoic Acid	R
Benzyl alcohol	0.0019 U
Biphenyl	0.00095 U
Bis(2-Chloroethoxy)methane	0.00095 U
Bis(2-Chloroethyl)ether	0.00095 U
Bis(2-Chloroisopropyl)ether	0.00095 U
Bis(2-Ethylhexyl)phthalate	0.0048 U
Butylbenzylphthalate	0.00095 U
Caprolactam	0.00095 UJ
Carbazole	0.00095 U
Chrysene	0.00095 U
Dibenz(a,h)anthracene	0.00095 U
Dibenzofuran	0.00095 U
Diethylphthalate	0.00095 U
Dimethylphthalate	0.00095 U
Di-n-butylphthalate	0.0048 U
Di-n-octylphthalate	0.00095 U
Diphenyl ether	0.00095 U
Diphenylmethanone	0.00095 U
Fluoranthene	0.00095 U
Fluorene	0.00095 U
Hexachlorobenzene	0.00095 U
Hexachlorocyclopentadiene	0.0019 U
Hexachloroethane	0.00095 U
Indeno(1,2,3-cd)pyrene	0.00095 U
Isophorone	0.00095 U
Nitrobenzene	0.00095 U
N-Nitrosodimethylamine	0.0000032 J
N-Nitrosodi-n-propylamine	0.0000074
N-Nitrosodiphenylamine	0.00095 U
Pentachlorophenol	0.00095 U
Phenanthrene	0.00095 U
Phenol	0.00095 U
Pyrene	0.00095 U
Total Metals (mg/L)	
Aluminum	0.9
Antimony	0.006 U
Arsenic	0.01 U
Barium	0.026
Beryllium	0.001 U
Cadmium	0.001 U
Calcium	53
Chromium	0.0068 J
Chromium, Hexavalent	0.01
Cobalt	0.004 U
Copper	0.0027 J
Iron	1.5
Lead	0.003 J
Magnesium	2.4
Manganese	0.12

Attachment 1-7
Surface Water Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-SD-503-XXX SD-503 12/17/2012
Mercury	0.0002 U
Nickel	0.0014 J
Potassium	4
Selenium	0.01 U
Silver	0.000056 J
Sodium	18
Thallium	0.01 U
Tin	0.01 UJ
Vanadium	0.002 J
Zinc	0.01 J
Inorganics (mg/L)	
Bromide	0.2 U
Chloride	9
Hardness	120
Nitrate as N	0.084 J
Nitrite as N	0.026 J
Nitrogen, as Ammonia	7.5
Sulfate	96
Total Organic Carbon	11
Total Suspended Solids	38

Notes:
mg/L - milligram per liter
U - Not detected, value is reporting limit
J - Value is estimated
R - Value is rejected

Attachment 1-8
Surface Water Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-OPWD-1-XXX OPWD-1 12/10/2010	OC-SW-OPWD-1-XXX OPWD-1 6/7/2011	OC-SW-OPWD-2-XXX OPWD-2 12/10/2010	OC-SW-OPWD-2-XXX OPWD-2 6/7/2011	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 12/10/2010	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 6/7/2011
Volatile Organics Compounds (mg/L)						
1,1,1,2-Tetrachloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloropropene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,2-Dibromoethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dioxane	R	0.05 U	R	0.05 U	R	0.05 U
2,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene	0.001 U	0.001 UJ	0.0025	0.0071 J	0.00071 J	0.001 UJ
2,4,4-Trimethyl-2-pentene	0.001 U	0.001 U	0.001 U	0.0019	0.001 U	0.001 U
2-Butanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
2-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Hexanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-Methyl-2-pentanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Acetaldehyde	0.03 U	0.03 U	0.03 U	0.03 U		
Acetic acid, methyl ester	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acetone	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U

Attachment 1-8
Surface Water Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-OPWD-1-XXX OPWD-1 12/10/2010	OC-SW-OPWD-1-XXX OPWD-1 6/7/2011	OC-SW-OPWD-2-XXX OPWD-2 12/10/2010	OC-SW-OPWD-2-XXX OPWD-2 6/7/2011	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 12/10/2010	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 6/7/2011
Bromochloromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromodichloromethane	0.001 U	0.0005 U	0.001 U	0.0005 U	0.001 U	0.0005 U
Bromoform	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ
Bromomethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 UJ
Carbon disulfide	0.001 J	0.01 UJ	0.01 U	0.0025 J	0.0011 J	0.01 UJ
Carbon tetrachloride	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ
Chlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chlorodibromomethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Chloroethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloroform	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chloromethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Dibromomethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Dichlorodifluoromethane	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U
Diethyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Ethyl benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethyl-t-Butyl Ether	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 UJ
Formaldehyde	0.02 J	0.03 U	0.0099 J	0.0064 J		
Hexachlorobutadiene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Isopropyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Isopropylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Methyl cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Methyl Tertbutyl Ether	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ
Methylene chloride	0.002 U	0.002 UJ	0.002 U	0.002 UJ	0.002 U	0.002 UJ
Naphthalene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
n-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Propylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
sec-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Styrene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
tert-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrachloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrahydrofuran	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Toluene	0.001 U	0.001 U	0.001 U	0.0005 J	0.001 U	0.001 U
trans-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U

Attachment 1-8
Surface Water Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-OPWD-1-XXX OPWD-1 12/10/2010	OC-SW-OPWD-1-XXX OPWD-1 6/7/2011	OC-SW-OPWD-2-XXX OPWD-2 12/10/2010	OC-SW-OPWD-2-XXX OPWD-2 6/7/2011	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 12/10/2010	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 6/7/2011
trans-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Trichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Trichlorofluoromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Vinyl chloride	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Xylene, o	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylenes (m&p)	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Semivolatile Organics Compounds (mg/L)						
1,2,4,5-Tetrachlorobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
1-Methylnaphthalene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,3,4,6-Tetrachlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,4,5-Trichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,4,6-Trichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,4-Dichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,4-Dimethylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,4-Dinitrophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,4-Dinitrotoluene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2,6-Dinitrotoluene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2-Chloronaphthalene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2-Chlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2-Methylnaphthalene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U
2-Methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
2-Nitrophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
3 & 4 Methylphenol	0.00073 J	0.0045 U	0.0045 U	0.00076 J	0.0045 U	0.005 U
3,3'-Dichlorobenzidine	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.0045 U	0.005 U
3-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4,6-Dinitro-2-methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4-Bromophenyl phenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4-Chloro-3-methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4-Chloroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4-Chlorophenyl phenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
4-Nitrophenol	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 U	0.00075 J	0.005 U
Acenaphthene	0.00091 U	0.00091 U	0.000047 J	0.00091 U	0.00091 U	0.001 U
Acenaphthylene	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.0003 U
Acetophenone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Aniline	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 U	0.0045 UJ	0.005 U

Attachment 1-8
Surface Water Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-OPWD-1-XXX OPWD-1 12/10/2010	OC-SW-OPWD-1-XXX OPWD-1 6/7/2011	OC-SW-OPWD-2-XXX OPWD-2 12/10/2010	OC-SW-OPWD-2-XXX OPWD-2 6/7/2011	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 12/10/2010	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 6/7/2011
Anthracene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U
Atrazine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Azobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Benzaldehyde	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Benzo(a)anthracene	0.00027 U	0.00027 U	0.002 J	0.00024 J	0.00027 U	0.0003 U
Benzo(a)pyrene	0.00012 J	0.00022	0.0042 J	0.00059	0.00018 U	0.0002 U
Benzo(b)fluoranthene	0.00019 J	0.00029	0.0077 J	0.0011	0.00027 U	0.0003 U
Benzo(ghi)perylene	0.00011 J	0.00045 U	0.0046 J	0.00054	0.00045 U	0.0005 U
Benzo(k)fluoranthene	0.00027 U	0.00027 U	0.0026 J	0.0005	0.00027 U	0.0003 U
Benzoic Acid	0.0021 J	0.0019 J	0.0042 J	0.0021 J	0.0045 UJ	0.0021 J
Benzyl alcohol	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.01 U
Biphenyl	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Bis(2-Chloroethoxy)methane	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Bis(2-Chloroethyl)ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Bis(2-Chloroisopropyl)ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Bis(2-Ethylhexyl)phthalate	0.01 U	0.0018 U	0.044 UJ	0.0018 U	0.0088 U	0.002 U
Butylbenzylphthalate	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.0045 U	0.005 U
Caprolactam	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.005 UJ
Carbazole	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Chrysene	0.00018 J	0.00018 J	0.0053 J	0.00067 J	0.00091 U	0.001 U
Dibenz(a,h)anthracene	0.00045 U	0.00045 U	0.0012 J	0.00045 U	0.00045 U	0.0005 U
Dibenzofuran	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Diethylphthalate	0.0049 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Dimethylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Di-n-butylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Di-n-octylphthalate	0.00087 J	0.0045 U	0.00081 J	0.0045 U	0.0045 U	0.005 U
Diphenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Diphenylmethanone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Fluoranthene	0.00023 J	0.00024 J	0.0051	0.00092	0.00091 U	0.001 U
Fluorene	0.00091 U	0.00091 U	0.000056 J	0.00091 U	0.00091 U	0.001 U
Hexachlorobenzene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U
Hexachlorocyclopentadiene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Hexachloroethane	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.003 U
Indeno(1,2,3-cd)pyrene	0.000098 J	0.00045 U	0.004 J	0.00049	0.00045 U	0.0005 U
Isophorone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Nitrobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
N-Nitrosodimethylamine	0.00011	0.00006	0.0000056	0.000038 UJ	0.000076	0.000023

Attachment 1-8
Surface Water Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-OPWD-1-XXX OPWD-1 12/10/2010	OC-SW-OPWD-1-XXX OPWD-1 6/7/2011	OC-SW-OPWD-2-XXX OPWD-2 12/10/2010	OC-SW-OPWD-2-XXX OPWD-2 6/7/2011	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 12/10/2010	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 6/7/2011
N-Nitrosodi-n-propylamine	0.0000019 U	0.000019 U	0.0000019 U	0.000038 U	0.0000019 U	0.00002 U
N-Nitrosodiphenylamine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U
Pentachlorophenol	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U
Phenanthrene	0.000081 J	0.0001 J	0.0025	0.00032	0.00018 U	0.0002 U
Phenol	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.00051 J	0.0045 UJ	0.005 UJ
Pyrene	0.00022 J	0.00028 J	0.012 J	0.0011 J	0.0045 U	0.005 U
Total Metals (mg/L)						
Aluminum	1.1	0.83	0.96	1.6	0.33	0.1
Antimony	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U
Arsenic	0.01 U	0.0038 J	0.01 U	0.012	0.01 U	0.01 U
Barium	0.032	0.042	0.026	0.046	0.033	0.028
Beryllium	0.00026 J	0.00019 J	0.001 U	0.00017 J	0.001 U	0.001 U
Cadmium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Calcium	21	26	6.1	6.8	28	24
Chromium	0.13	0.099	0.0061	0.013	0.037	0.012
Chromium, Hexavalent					0.001 U	0.001 U
Cobalt	0.018	0.017	0.0034 J	0.0033 J	0.011	0.0056 J
Copper	0.0058 J	0.0034	0.0061 J	0.0039	0.0041 J	0.00079
Iron	17	29	8.8	30	8.3	5
Lead	0.0025	0.002	0.0058	0.0041	0.00083 J	0.00082 J
Magnesium	4.7	5.4	1.2	1.2	4.2	4.2
Manganese	1.3	1.5	0.27	0.27	0.98	0.8
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel	0.018	0.012	0.005 J	0.0051 J	0.0096 J	0.0041 J
Potassium	1.6 J	2.3 J	4 U	4 U	2.1 J	2.2 J
Selenium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Silver	0.001 UJ	0.0002 U	0.001 UJ	0.0005 U	0.001 UJ	0.0001 U
Sodium	100	120	41	42	89	94
Thallium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Tin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Vanadium	0.0026 J	0.0031 J	0.0062 J	0.012	0.01 UJ	0.01 U
Zinc	0.019 J	0.019 J	0.04 J	0.12	0.018 J	0.009 J
Inorganics (mg/L)						
Bromide	0.21	0.2	0.1 U	0.1	0.19	0.14
Chloride	170	180	94	82	180	130
Hardness	72	87	20	22	87	77
Nitrate as N	0.05 U	0.05 U	0.05 U	0.05 U	0.069	0.05 U

Attachment 1-8
Surface Water Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-OPWD-1-XXX OPWD-1 12/10/2010	OC-SW-OPWD-1-XXX OPWD-1 6/7/2011	OC-SW-OPWD-2-XXX OPWD-2 12/10/2010	OC-SW-OPWD-2-XXX OPWD-2 6/7/2011	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 12/10/2010	OC-SW-OPWD-SD/SO/SW-S-XXX OPWD-SW-S 6/7/2011
Nitrite as N	0.01 U	0.1 U	0.02	0.01 U	0.01 U	0.1 U
Nitrogen, as Ammonia	66	63	17	36	48	37
Sulfate	360	320	66	69	290	160
Total Organic Carbon	11	5.9	13	17	9.3	5
Total Suspended Solids	62	77	190	250	28	11
Specialty Compound (mg/L)						
Perchlorate	0.01 U		0.001 U		0.01 U	
Hydrazine	0.0001 U	0.0001 U	0.0001 U	0.0001 U		
Monomethylhydrazine (MMH)	0.0005 U	0.0005 U	0.0005 U	0.0005 U		
UDMH	0.0005 U	0.0005 U	0.0005 U	0.0005 U		
Kempore (Azodicarbonamide)	1 U	1 U	1 U	1 U	1 U	1 U
OPEX	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ

Notes:
mg/L - milligram per liter
U - Not detected, value is reporting limit
J - Value is estimated
R - Value is rejected

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 6/6/2011	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 6/7/2011	OC-SW-MMB-SW/SD-1-RISK MMB-SW/SD-1 6/6/2011	OC-SW-MMB-SW/SD-1-XXX MMB-SW/SD-1 12/1/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 6/8/2011	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 6/8/2011	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 6/6/2011	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010
Volatile Organics Compounds (mg/L)													
1,1,1,2-Tetrachloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloropropene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,2-Dibromoethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dioxane	R	0.05 U	R	0.05 U	0.05 U	R	R	0.05 U	R	0.05 U	R	0.05 U	R
2,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 UJ	0.001 U	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U
2,4,4-Trimethyl-2-pentene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Butanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
2-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Hexanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-Methyl-2-pentanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Acetaldehyde	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Acetic acid, methyl ester	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acetone	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromochloromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromodichloromethane	0.001 U	0.0005 U	0.001 U	0.0005 U	0.0005 U	0.001 U	0.001 U	0.0005 U	0.001 U	0.0005 U	0.001 U	0.0005 U	0.001 U
Bromoform	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 UJ	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U
Bromomethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 UJ	0.005 U	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 U
Carbon disulfide	0.01 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.00027 J	0.01 U	0.01 UJ	0.01 U
Carbon tetrachloride	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 UJ	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U
Chlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chlorodibromomethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Chloroethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloroform	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chloromethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00062 J	0.0002 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Dibromomethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Dichlorodifluoromethane	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 U	0.001 UJ	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ
Diethyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Ethyl benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 6/6/2011	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 6/7/2011	OC-SW-MMB-SW/SD-1-RISK MMB-SW/SD-1 6/6/2011	OC-SW-MMB-SW/SD-1-XXX MMB-SW/SD-1 12/1/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 6/8/2011	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 6/8/2011	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 6/6/2011	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010
Ethyl-t-Butyl Ether	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 UJ	0.005 U	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 UJ	0.005 U
Formaldehyde	0.03 U	0.03 UJ	0.0088 J	0.03 U	0.03 UJ	0.0068 J	0.005 J	0.03 U	0.0056 J	0.03 U	0.01 J	0.03 U	0.0084 J
Hexachlorobutadiene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Isopropyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Isopropylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Methyl cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Methyl Tertbutyl Ether	0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 UJ	0.001 U	0.00033 J	0.0002 J	0.00029 J	0.0002 J	0.001 U	0.001 UJ	0.001 U
Methylene chloride	0.002 U	0.002 UJ	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 UJ	0.002 U
Naphthalene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
n-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Propylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
sec-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Styrene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
tert-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrachloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrahydrofuran	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Toluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00075 J	0.001 U	0.001 U	0.001 U
trans-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
trans-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Trichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.0004 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Trichlorofluoromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Vinyl chloride	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Xylene, o	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylenes (m&p)	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Semivolatile Organics Compounds (mg/L)													
1,2,4,5-Tetrachlorobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
1-Methylnaphthalene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,3,4,6-Tetrachlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,4,5-Trichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,4,6-Trichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dimethylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dinitrophenol	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 U	0.0045 U	R	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 UJ	0.0045 U	0.0045 UJ
2,4-Dinitrotoluene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2,6-Dinitrotoluene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2-Chloronaphthalene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2-Chlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2-Methylnaphthalene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
2-Methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
2-Nitrophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
3 & 4 Methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
3,3'-Dichlorobenzidine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	R	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
3-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4,6-Dinitro-2-methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	R	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4-Bromophenyl phenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4-Chloro-3-methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4-Chloroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4-Chlorophenyl phenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
4-Nitrophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Acenaphthene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
Acenaphthylene	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.0003 U	0.00027 U	0.0003 U	0.00027 U	0.00027 U	0.00027 U
Acetophenone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Aniline	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.005 U	0.0045 UJ	0.005 U	0.0045 UJ	0.0045 UJ	0.0045 UJ
Anthracene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 6/6/2011	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 6/7/2011	OC-SW-MMB-SW/SD-1-RISK MMB-SW/SD-1 6/6/2011	OC-SW-MMB-SW/SD-1-XXX MMB-SW/SD-1 12/1/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 6/8/2011	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 6/8/2011	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 6/6/2011	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010
Atrazine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Azobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Benzaldehyde	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Benzo(a)anthracene	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.0003 U	0.00027 U	0.0003 U	0.00027 U	0.00027 U	0.00027 U
Benzo(a)pyrene	0.00018 U	0.00018 U	0.00018 UJ	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.0002 U	0.00018 UJ	0.0002 U	0.00018 U	0.00018 U	0.00018 U
Benzo(b)fluoranthene	0.00027 U	0.00027 UJ	0.00027 UJ	0.00027 U	0.00027 UJ	0.00027 U	0.00027 U	0.0003 U	0.00027 UJ	0.0003 U	0.00027 U	0.00027 UJ	0.00027 U
Benzo(ghi)perylene	0.00045 U	0.00045 U	0.00045 UJ	0.00045 U	0.00045 U	0.00045 U	0.00045 U	0.0005 U	0.00045 UJ	0.0005 U	0.00045 U	0.00045 U	0.00045 U
Benzo(k)fluoranthene	0.00027 U	0.00027 U	0.00027 UJ	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.0003 U	0.00027 UJ	0.0003 U	0.00027 U	0.00027 U	0.00027 U
Benzoic Acid	0.0045 UJ	0.0045 U	0.0045 UJ	0.0019 J	0.0019 J	R	0.0045 U	0.0022 J	0.0045 U	0.0021 J	0.0045 UJ	0.0019 J	0.0045 UJ
Benzyl alcohol	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.01 U	0.0091 U	0.01 U	0.0091 U	0.0091 U	0.0091 U
Biphenyl	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroethoxy)methane	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroethyl)ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroisopropyl)ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Ethylhexyl)phthalate	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U	0.0065 U	0.002 U	0.0045 U	0.002 U	0.0027 U	0.0018 U	0.0018 U
Butylbenzylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Caprolactam	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.005 UJ	0.0045 UJ	0.00066 J	0.0045 UJ	0.0045 UJ	0.0045 UJ
Carbazole	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Chrysene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
Dibenz(a,h)anthracene	0.00045 U	0.00045 U	0.00045 UJ	0.00045 U	0.00045 U	0.00045 U	0.00045 U	0.0005 U	0.00045 UJ	0.0005 U	0.00045 U	0.00045 U	0.00045 U
Dibenzofuran	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Diethylphthalate	0.0085 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.014 UJ	0.0048 U	0.005 U	0.0045 U	0.005 U	0.0098 U	0.0045 U	0.0093 U
Dimethylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Di-n-butylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.00098 J	0.00059 J	0.005 U	0.00056 J	0.005 U	0.0045 U	0.0045 U	0.0045 U
Di-n-octylphthalate	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 UJ	0.005 U	0.0045 U	0.0045 U	0.0045 U
Diphenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Diphenylamine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Diphenylmethanone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Fluoranthene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
Fluorene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
Hexachlorobenzene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
Hexachlorocyclopentadiene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Hexachloroethane	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.003 U	0.0027 U	0.003 U	0.0027 U	0.0027 U	0.0027 U
Indeno(1,2,3-cd)pyrene	0.00045 U	0.00045 U	0.00045 UJ	0.00045 U	0.0002 J	0.00045 U	0.00045 U	0.0005 U	0.00045 UJ	0.0005 U	0.00045 U	0.00045 U	0.00045 U
Isophorone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Nitrobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
N-Nitrosodimethylamine	0.0000019 U	0.0000019 U	0.0000019 U	0.000019 U	0.00000047 J	0.0000019 U	0.0000023 U	0.00002 U	0.0000019 U	0.000019 U	0.0000019 U	0.0000019 U	0.0000019 U
N-Nitrosodi-n-propylamine	0.0000019 U	0.0000019 U	0.00000044 J	0.000019 U	0.0000019 U	0.00000078 J	0.0000019 U	0.00002 U	0.0000019 U	0.000019 U	0.0000019 U	0.0000019 U	0.000002 U
N-Nitrosodiphenylamine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Pentachlorophenol	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	R	0.00091 U	0.001 U	0.00091 U	0.001 U	0.00091 U	0.00091 U	0.00091 U
Phenanthrene	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.0002 U	0.00018 U	0.0002 U	0.00018 U	0.00018 U	0.00018 U
Phenol	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.005 UJ	0.0045 UJ	0.005 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ
Pyrene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.005 U	0.0045 U	0.005 U	0.0045 U	0.0045 U	0.0045 U
Total Metals (mg/L)													
Aluminum	0.1 U	0.1 U	0.081 J	0.036 J	0.063 J	0.092 J	0.093 J	0.026 J	0.22	0.12	0.017 J	0.1 U	0.083 J
Antimony	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U
Arsenic	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Barium	0.027	0.034	0.018	0.032	0.0265	0.026	0.035	0.049	0.032	0.042	0.022	0.025	0.018
Beryllium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Calcium	21	30	12	24	22	17	27	33	24	30	18	22	13
Chromium	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Cobalt	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Copper	0.0038 NJ	0.0005 U	0.0034 NJ	0.0015	0.0027	0.0024 NJ	0.0029 NJ	0.00077	0.0045 NJ	0.0026	0.0031 NJ	0.0005 U	0.0024 NJ
Iron	0.43	1.2	0.45	1.3	1.15	0.53	1.1	1.6	2.3	2.7	0.46	0.88	0.49
Lead	0.00016 J	0.0001 U	0.0014	0.00064 J	0.00023 J	0.00054 J	0.0012	0.00044 J	0.0032	0.0016 J	0.00058 J	0.0001 U	0.0014

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010	OC-SW-MMB-SW/SD-10-XXX MMB-SW/SD-10 6/6/2011	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010	OC-SW-MMB-SW/SD-11-XXX MMB-SW/SD-11 6/7/2011	OC-SW-MMB-SW/SD-1-RISK MMB-SW/SD-1 6/6/2011	OC-SW-MMB-SW/SD-1-XXX MMB-SW/SD-1 12/1/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010	OC-SW-MMB-SW/SD-2-XXX MMB-SW/SD-2 6/8/2011	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010	OC-SW-MMB-SW/SD-3-XXX MMB-SW/SD-3 6/8/2011	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010	OC-SW-MMB-SW/SD-4-XXX MMB-SW/SD-4 6/6/2011	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010
Magnesium	3.3	4.4	2.3	4.6	3.9	3.4	4.3	5.1	4.1	5	3.5	3.9	2.6
Manganese	0.16	0.3	0.066	0.2	0.205	0.16	0.95	1.5	0.52	2.1	0.13	0.14	0.034
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0012 J	0.0072 J	0.01 U	0.01 U	0.01 U
Potassium	2.8 J	1.8 J	1.4 J	2.8 J	2 J	2.9 J	3.1 J	3.3 J	3.5 J	1.4 J	2.6 J	2.3 J	2.2 J
Selenium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Silver	0.001 U	0.0001 U	0.001 U	0.0001 U	0.0001 U	0.001 U	0.001 U	0.0001 U	0.001 U	0.0001 U	0.001 U	0.0001 U	0.001 U
Sodium	44	70	29	110	78.5	48	58	85	56	65	53	80	44
Thallium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Tin	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Vanadium	0.01 UJ	0.01 U	0.01 UJ	0.01 U	0.01 U	0.01 UJ	0.01 UJ	0.01 U	0.01 UJ	0.01 U	0.01 UJ	0.01 U	0.01 UJ
Zinc	0.05 U	0.05 U	0.019 J	0.05 U	0.05 U	0.0071 J	0.0085 J	0.05 U	0.012 J	0.021 J	0.05 U	0.05 U	0.011 J
Inorganics (mg/L)													
Bromide	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chloride	110	130	48	220	135	100	120	160	120	150	100	130	79
Hardness	66	92	38	78	70	57	84	100	76	95	59	70	43
Nitrate as N	0.39	0.05 U	0.36	0.31 J	0.05 U	0.12	0.6	0.55 J	0.21	0.05 U	0.11	0.05 U	0.24
Nitrite as N	0.1 U	0.1 U	0.01 U	0.1 UJ	0.01 U	0.1 U	0.01 U	0.1 U	0.01 U	0.1 U	0.1 U	0.1 U	0.1 U
Nitrogen, as Ammonia	0.23	0.1 U	0.1 U	0.25	0.1 U	0.18	0.6	0.66	0.22	0.29	0.16	0.1 U	0.1 U
Sulfate	24	3.2	15	13	5.65	22	25 J	16	22	8	19	7.1	15
Total Organic Carbon	5.3	4.5	4.7	2.3	4.4	4.8	3.8	1.7	6.9	3.4	4.5	4.8	3.6
Total Suspended Solids	2 U	5 U	2	5 U	5 UJ	4	6.4	5 U	18	5 U	2 U	6	4
Specialty Compound (mg/L)													
Hydrazine	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U
Monomethylhydrazine (MMH)	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
UDMH	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Kempore (Azodicarbonamide)							1 U	0.71 NJ					1 U
OPEX							0.1 U	0.1 UJ					0.1 U

Notes:
mg/L - milligram per liter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptively present
R - Value is rejected

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 6/7/2011	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 6/8/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/7/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/8/2011	OC-SW-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010	OC-SW-MMB-SW/SD-8-XXX MMB-SW/SD-8 6/7/2011	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 12/1/2010	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 6/6/2011
Volatile Organics Compounds (mg/L)										
1,1,1,2-Tetrachloroethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U		0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloropropene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,2-Dibromoethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dioxane	0.05 U	R	0.05 U	R		0.05 U	R	0.05 U	R	0.05 U
2,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene	0.001 UJ	0.001 U	0.001 UJ	0.001 U		0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ
2,4,4-Trimethyl-2-pentene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Butanone	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
2-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Hexanone	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-Methyl-2-pentanone	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Acetaldehyde	0.03 U	0.03 U	0.03 U	0.03 U		0.03 U	0.03 U	0.03 U	0.03 U	0.03 U
Acetic acid, methyl ester	0.02 U	0.02 U	0.02 U	0.02 U		0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acetone	0.05 U	0.05 U	0.05 U	0.05 U		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromochloromethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromodichloromethane	0.0005 U	0.001 U	0.0005 U	0.001 U		0.0005 U	0.001 U	0.0005 U	0.001 U	0.0005 U
Bromoform	0.001 UJ	0.001 U	0.001 UJ	0.001 U		0.001 UJ	0.001 U	0.001 UJ	0.001 UJ	0.001 UJ
Bromomethane	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-	0.005 UJ	0.005 U	0.005 UJ	0.005 U		0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 UJ
Carbon disulfide	0.01 UJ	0.01 U	0.00029 J	0.01 U		0.00028 J	0.01 U	0.01 UJ	0.01 U	0.01 U
Carbon tetrachloride	0.001 UJ	0.001 U	0.001 UJ	0.001 U		0.001 UJ	0.001 U	0.001 UJ	0.001 UJ	0.001 UJ
Chlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chlorodibromomethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U		0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Chloroethane	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloroform	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chloromethane	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U		0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Dibromomethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Dichlorodifluoromethane	0.001 U	0.001 UJ	0.001 U	0.001 UJ		0.001 U	0.001 UJ	0.001 U	0.001 UJ	0.001 U
Diethyl ether	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Ethyl benzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 6/7/2011	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 6/8/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/7/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/8/2011	OC-SW-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010	OC-SW-MMB-SW/SD-8-XXX MMB-SW/SD-8 6/7/2011	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 12/1/2010	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 6/6/2011
Ethyl-t-Butyl Ether	0.005 UJ	0.005 U	0.005 UJ	0.005 U		0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 UJ
Formaldehyde	0.03 U	0.0051 J	0.03 U	0.0071 J		0.03 U	0.00885 J	0.03 U	0.0093 J	0.03 U
Hexachlorobutadiene	0.0004 U	0.0004 U	0.0004 U	0.0004 U		0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Isopropyl ether	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Isopropylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Methyl cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Methyl Tertbutyl Ether	0.001 UJ	0.001 U	0.001 UJ	0.001 U		0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 UJ
Methylene chloride	0.002 UJ	0.002 U	0.002 U	0.002 U		0.002 U	0.002 U	0.002 UJ	0.002 U	0.002 U
Naphthalene	0.005 U	0.005 U	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
n-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Propylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
sec-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Styrene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
tert-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrachloroethene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrahydrofuran	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Toluene	0.001 U	0.001 U	0.0004 J	0.001 U		0.00034 J	0.001 U	0.001 U	0.001 U	0.001 U
trans-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
trans-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U		0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Trichloroethene	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Trichlorofluoromethane	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Vinyl chloride	0.0005 U	0.0005 U	0.0005 U	0.0005 U		0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Xylene, o	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylenes (m&p)	0.002 U	0.002 U	0.002 U	0.002 U		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Semivolatile Organics Compounds (mg/L)										
1,2,4,5-Tetrachlorobenzene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
1-Methylnaphthalene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,3,4,6-Tetrachlorophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U
2,4,5-Trichlorophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,6-Trichlorophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dichlorophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dimethylphenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dinitrophenol	0.0045 U	0.0045 U	0.005 U	0.0045 UJ		0.005 U	0.0045 UJ	0.0045 U	R	0.0045 U
2,4-Dinitrotoluene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,6-Dinitrotoluene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Chloronaphthalene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Chlorophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Methylnaphthalene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
2-Methylphenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Nitroaniline	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Nitrophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U
3 & 4 Methylphenol	0.0045 U	0.0045 U	0.00074 J	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
3,3'-Dichlorobenzidine	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 U
3-Nitroaniline	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4,6-Dinitro-2-methylphenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	R	0.0045 U
4-Bromophenyl phenyl ether	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Chloro-3-methylphenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Chloroaniline	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 UJ	0.0045 U	0.0045 U	0.0045 U
4-Chlorophenyl phenyl ether	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Nitroaniline	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 U
4-Nitrophenol	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U
Acenaphthene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Acenaphthylene	0.00027 U	0.00027 U	0.0003 U	0.00027 U		0.0003 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Acetophenone	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Aniline	0.0045 UJ	0.0045 UJ	0.005 U	0.0045 UJ		0.005 U	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 UJ
Anthracene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 6/7/2011	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 6/8/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/7/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/8/2011	OC-SW-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010	OC-SW-MMB-SW/SD-8-XXX MMB-SW/SD-8 6/7/2011	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 12/1/2010	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 6/6/2011
Atrazine	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Azobenzene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Benzaldehyde	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Benzo(a)anthracene	0.00027 U	0.00027 U	0.0003 U	0.00027 U		0.0003 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Benzo(a)pyrene	0.00018 U	0.000096 J	0.0002 U	0.00018 U		0.0002 U	0.00018 U	0.00018 U	0.00018 U	0.00013 J
Benzo(b)fluoranthene	0.00027 UJ	0.00013 J	0.0003 U	0.00027 U		0.0003 U	0.00027 U	0.00027 U	0.00027 U	0.00027 UJ
Benzo(ghi)perylene	0.00045 U	0.000089 J	0.0005 U	0.00045 U		0.0005 U	0.00045 U	0.00045 U	0.00045 U	0.00045 U
Benzo(k)fluoranthene	0.00027 U	0.00027 U	0.0003 U	0.00027 U		0.0003 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Benzoic Acid	0.002 J	0.0045 U	0.0024 J	0.0045 UJ		0.0021 J	0.0045 UJ	0.0019 J	R	0.0019 J
Benzyl alcohol	0.0091 U	0.0091 U	0.01 U	0.0091 U		0.01 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U
Biphenyl	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroethoxy)methane	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroethyl)ether	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroisopropyl)ether	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Ethylhexyl)phthalate	0.0018 U	0.0041 U	0.002 U	0.0037 U		0.002 U	0.0018 U	0.0018 U	0.0018 U	0.0018 U
Butylbenzylphthalate	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Caprolactam	0.0045 UJ	0.0045 UJ	0.005 UJ	0.0045 UJ		0.00066 J	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ
Carbazole	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Chrysene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Dibenz(a,h)anthracene	0.00045 U	0.00045 U	0.0005 U	0.00045 U		0.0005 U	0.00045 U	0.00045 U	0.00045 U	0.00045 U
Dibenzofuran	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Diethylphthalate	0.0045 U	0.0071 U	0.005 U	0.0045 U		0.005 U	0.007 U	0.0045 U	0.012 UJ	0.0045 U
Dimethylphthalate	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Di-n-butylphthalate	0.0045 U	0.00057 J	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.00078 J	0.0045 U
Di-n-octylphthalate	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U
Diphenyl ether	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Diphenylamine	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Diphenylmethanone	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Fluoranthene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Fluorene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Hexachlorobenzene	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Hexachlorocyclopentadiene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 UJ	0.0045 U	0.0045 UJ	0.0045 U
Hexachloroethane	0.0027 U	0.0027 U	0.003 U	0.0027 U		0.003 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U
Indeno(1,2,3-cd)pyrene	0.00045 U	0.00045 U	0.0005 U	0.00045 U		0.0005 U	0.00045 U	0.00045 U	0.00045 U	0.00045 U
Isophorone	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U
Nitrobenzene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
N-Nitrosodimethylamine	0.000019 U	0.0000019 U	0.000038 U	0.0000019 U		0.000019 U	0.0000019 U	0.000019 U	0.0000019 U	0.0000019 U
N-Nitrosodi-n-propylamine	0.000019 U	0.0000019 U	0.000038 U	0.00000066 J		0.000019 U	0.0000019 U	0.000019 U	0.0000019 U	0.0000019 UJ
N-Nitrosodiphenylamine	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Pentachlorophenol	0.00091 U	0.00091 U	0.001 U	0.00091 U		0.001 U	0.00091 U	0.00091 U	R	0.00091 U
Phenanthrene	0.00018 U	0.00018 U	0.0002 U	0.00018 U		0.0002 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U
Phenol	0.0045 UJ	0.0045 UJ	0.00083 J	0.0045 UJ		0.005 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ
Pyrene	0.0045 U	0.0045 U	0.005 U	0.0045 U		0.005 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Total Metals (mg/L)										
Aluminum	0.11	1.8	0.48	0.077 J		0.14	0.041 J	0.035 J	0.012 J	0.1 U
Antimony	0.006 U	0.006 U	0.006 U	0.006 U		0.006 U	0.006 U	0.006 U	0.006 U	0.006 U
Arsenic	0.01 U	0.0045 J	0.0048 J	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Barium	0.04	0.065	0.15	0.015		0.042	0.0205	0.044	0.025	0.022
Beryllium	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	0.001 U	0.00025 J	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Calcium	22	23	40	9.7		24	12	25	21	24
Chromium	0.005 U	0.005 U	0.00098 J	0.005 U		0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Cobalt	0.0022 J	0.0023 J	0.0077 J	0.01 U		0.0016 J	0.01 U	0.0021 J	0.01 U	0.01 U
Copper	0.0018	0.0083 NJ	0.054	0.01 U	0.0012		0.0028 NJ	0.00083	0.0016 NJ	0.0005 U
Iron	1.9	20	29	0.48		3.3	0.39	2.8	0.45	2.2
Lead	0.0014 J	0.014	0.11	0.0016	0.0015 J		0.00175	0.00042 J	0.001 U	0.0001 U

Attachment 1-9
Surface Water Data Summary - Maple Meadow Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-MMB-SW/SD-5-XXX MMB-SW/SD-5 6/7/2011	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010	OC-SW-MMB-SW/SD-6-XXX MMB-SW/SD-6 6/8/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/7/2011	OC-SW-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 6/8/2011	OC-SW-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010	OC-SW-MMB-SW/SD-8-XXX MMB-SW/SD-8 6/7/2011	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 12/1/2010	OC-SW-MMB-SW/SD-9-XXX MMB-SW/SD-9 6/6/2011
Magnesium	4.2	3.6	5.9	2		4.7	2.55	4.8	3.7	4.1
Manganese	1.2	1.2	9.3	0.03		0.57	0.046	0.83	0.16	0.17
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U		0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel	0.0013 J	0.0032 J	0.0043 J	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Potassium	2.1 J	2 J	3.6 J	1.2 J		2.5 J	2.15 J	2.6 J	3.1 J	1.9 J
Selenium	0.01 U	0.01 U	0.01 U	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Silver	0.0001 U	0.001 U	0.0005 U	0.001 U	0.0001 U		0.001 U	0.0001 U	0.001 U	0.0001 U
Sodium	93	37	45	30		110	44	110	54	76
Thallium	0.01 U	0.01 U	0.0066 J	0.01 U		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Tin	0.05 U	0.05 U	0.05 U	0.05 U		0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Vanadium	0.01 U	0.0037 J	0.0015 J	0.01 UJ		0.01 U	0.01 UJ	0.01 U	0.01 UJ	0.01 U
Zinc	0.05 U	0.069	0.027 J	0.0093 J		0.05 U	0.011 J	0.05 U	0.05 U	0.05 U
Inorganics (mg/L)										
Bromide	0.1	0.1 U	0.1 U	0.1 U		0.1 U	0.1 U	0.12	0.1 U	0.1 U
Chloride	160	76	76	49		210	89	180	100	130
Hardness	72	73	120	32		80	41	83	67	77
Nitrate as N	0.05 U	0.24	0.05 UJ	0.31		0.15 J	0.22	0.097	0.12	0.05 U
Nitrite as N	0.1 U	0.01 U	0.01 U	0.01 U		0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Nitrogen, as Ammonia	0.1	0.48	2.5	0.1 U		0.15	0.1 U	0.16	0.23	0.1 U
Sulfate	5.7	20	39	12		11	16	8.7	21	3.9
Total Organic Carbon	3.7	6.7	7.5	4.9		2.9	4.2	2.7	4.5	5.1
Total Suspended Solids	10	930	1000	2 U		40	2 U	6	2 U	5 UJ
Specialty Compound (mg/L)										
Hydrazine	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U		0.0001 U	0.00006 J	0.0001 U	0.0001 U
Monomethylhydrazine (MMH)	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U		0.0005 U	0.0005 U	0.0005 U	0.0005 U
UDMH	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U		0.0005 U	0.0005 U	0.0005 U	0.0005 U
Kempore (Azodicarbonamide)	1 U									
OPEX	0.1 UJ									

Notes:
mg/L - milligram per liter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptively present
R - Value is rejected

Attachment 1-10
Surface Water Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-LB-1-XXX LB-1 12/9/2010	OC-SW-LB-1-XXX LB-1 6/7/2011	OC-SW-LB-2-XXX LB-2 6/7/2011	OC-SW-LB-3-XXX LB-3 12/9/2010	OC-SW-LB-3-XXX LB-3 6/7/2011	OC-SW-LB-S2-XXX LB-2 12/9/2010
Volatile Organic Compounds (mg/L)						
1,1,1,2-Tetrachloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1,2-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloroethane	0.001 U	0.001 U	0.001 U	0.00028 J	0.001 U	0.001 U
1,1-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,1-Dichloropropene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
1,2-Dibromoethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,3-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
1,4-Dioxane	R	0.05 U	0.05 U	R	0.05 U	R
2,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene	0.001 U	0.001 UJ	0.001 UJ	0.001 U	0.001 UJ	0.001 U
2,4,4-Trimethyl-2-pentene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Butanone	0.01 U	0.01 U	0.01 U	0.01 U	0.0014 J	0.01 U
2-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
2-Hexanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
4-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.00025 J	0.001 U
4-Methyl-2-pentanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Acetic acid, methyl ester	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acetone	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromochloromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Bromodichloromethane	0.001 U	0.0005 U	0.0005 U	0.001 U	0.0005 U	0.001 U
Bromoform	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ

Attachment 1-10
Surface Water Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-LB-1-XXX LB-1 12/9/2010	OC-SW-LB-1-XXX LB-1 6/7/2011	OC-SW-LB-2-XXX LB-2 6/7/2011	OC-SW-LB-3-XXX LB-3 12/9/2010	OC-SW-LB-3-XXX LB-3 6/7/2011	OC-SW-LB-S2-XXX LB-2 12/9/2010
Bromomethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-	0.005 U	0.005 UJ	0.005 UJ	0.005 U	0.005 UJ	0.005 U
Carbon disulfide	0.01 U	0.00043 J	0.01 UJ	0.01 U	0.01 UJ	0.01 U
Carbon tetrachloride	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ
Chlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chlorodibromomethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Chloroethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Chloroform	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Chloromethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Dibromomethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Dichlorodifluoromethane	0.001 UJ	0.001 U	0.001 U	0.001 UJ	0.001 U	0.001 UJ
Diethyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Ethyl benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethyl-t-Butyl Ether	0.005 U	0.005 UJ	0.005 UJ	0.005 U	0.005 UJ	0.005 U
Hexachlorobutadiene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Isopropyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Isopropylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Methyl cyclohexane	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Methyl Tertbutyl Ether	0.00056 J	0.0002 J	0.00047 J	0.00028 J	0.00035 J	0.00049 J
Methylene chloride	0.002 U	0.002 UJ	0.002 UJ	0.002 U	0.002 UJ	0.002 U
Naphthalene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
n-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Propylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
sec-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Styrene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
tert-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrachloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Tetrahydrofuran	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Toluene	0.001 U	0.00036 J	0.001 U	0.00044 J	0.0046	0.001 U
trans-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
trans-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U
Trichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Trichlorofluoromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Vinyl chloride	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Xylene, o	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylenes (m&p)	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U

Attachment 1-10
Surface Water Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-LB-1-XXX LB-1 12/9/2010	OC-SW-LB-1-XXX LB-1 6/7/2011	OC-SW-LB-2-XXX LB-2 6/7/2011	OC-SW-LB-3-XXX LB-3 12/9/2010	OC-SW-LB-3-XXX LB-3 6/7/2011	OC-SW-LB-S2-XXX LB-2 12/9/2010
Semivolatile Organic Compounds (mg/L)						
1,2,4,5-Tetrachlorobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
1-Methylnaphthalene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,3,4,6-Tetrachlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,5-Trichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,6-Trichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dichlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dimethylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dinitrophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4-Dinitrotoluene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,6-Dinitrotoluene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Chloronaphthalene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Chlorophenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Methylnaphthalene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
2-Methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2-Nitrophenol	0.0045 UJ	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
3 & 4 Methylphenol	0.0018 J	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
3,3'-Dichlorobenzidine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
3-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4,6-Dinitro-2-methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Bromophenyl phenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Chloro-3-methylphenol	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Chloroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Chlorophenyl phenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Nitroaniline	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
4-Nitrophenol	0.0045 UJ	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.0045 UJ
Acenaphthene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Acenaphthylene	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Acetophenone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Aniline	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ
Anthracene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Atrazine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Azobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Benzaldehyde	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Benzo(a)anthracene	0.00052	0.00027 U	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Benzo(a)pyrene	0.001	0.00018 U	0.00017 J	0.00018 UJ	0.00018 U	0.00018 U
Benzo(b)fluoranthene	0.0015	0.00027 UJ	0.00013 J	0.00027 UJ	0.00027 UJ	0.00027 U
Benzo(ghi)perylene	0.0016	0.00045 U	0.00045 U	0.00045 UJ	0.00045 U	0.00045 U

Attachment 1-10
Surface Water Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-LB-1-XXX LB-1 12/9/2010	OC-SW-LB-1-XXX LB-1 6/7/2011	OC-SW-LB-2-XXX LB-2 6/7/2011	OC-SW-LB-3-XXX LB-3 12/9/2010	OC-SW-LB-3-XXX LB-3 6/7/2011	OC-SW-LB-S2-XXX LB-2 12/9/2010
Benzo(k)fluoranthene	0.00061	0.00027 U	0.00015 J	0.00027 UJ	0.00027 U	0.00027 U
Benzoic Acid	0.0043 J	0.002 J	0.0019 J	0.0045 UJ	0.0019 J	0.0045 UJ
Benzyl alcohol	0.00076 J	0.0091 U	0.0091 U	0.0091 U	0.0091 U	0.0091 U
Biphenyl	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroethoxy)methane	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroethyl)ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Chloroisopropyl)ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Bis(2-Ethylhexyl)phthalate	0.027 UJ	0.00074 J	0.0018 U	0.0045 U	0.0018 U	0.0032 U
Butylbenzylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Caprolactam	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ
Carbazole	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Chrysene	0.001	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Dibenz(a,h)anthracene	0.00045 U	0.00045 U	0.00045 U	0.00045 UJ	0.00045 U	0.00045 U
Dibenzofuran	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Diethylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0046 U	0.0045 U	0.0055 U
Dimethylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Di-n-butylphthalate	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Di-n-octylphthalate	0.0045 UJ	0.0045 U	0.0045 U	0.0045 UJ	0.0045 U	0.0045 U
Diphenyl ether	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Diphenylmethanone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Fluoranthene	0.001	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Fluorene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Hexachlorobenzene	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Hexachlorocyclopentadiene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Hexachloroethane	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U	0.0027 U
Indeno(1,2,3-cd)pyrene	0.0012	0.00045 U	0.0002 J	0.00045 UJ	0.00045 U	0.00045 U
Isophorone	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Nitrobenzene	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
N-Nitrosodi-n-propylamine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
N-Nitrosodiphenylamine	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Pentachlorophenol	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U	0.00091 U
Phenanthrene	0.00041	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U
Phenol	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0045 UJ
Pyrene	0.0014 J	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
Total Metals (mg/L)						
Aluminum	12	1.2	1	0.1 U	0.035 J	0.1 U
Antimony	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U
Arsenic	0.03	0.011	0.034	0.007 J	0.047	0.0048 J
Barium	0.26	0.095	0.053	0.04	0.056	0.039

Attachment 1-10
Surface Water Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-LB-1-XXX LB-1 12/9/2010	OC-SW-LB-1-XXX LB-1 6/7/2011	OC-SW-LB-2-XXX LB-2 6/7/2011	OC-SW-LB-3-XXX LB-3 12/9/2010	OC-SW-LB-3-XXX LB-3 6/7/2011	OC-SW-LB-S2-XXX LB-2 12/9/2010
Beryllium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Cadmium	0.0028	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Calcium	53	31	24	49	44	25
Chromium	0.047	0.0054	0.02	0.0017 J	0.0039 J	0.0015 J
Cobalt	0.01	0.0026 J	0.0014 J	0.01 U	0.01 U	0.01 U
Copper	0.051 J	0.012	0.0087	0.01 J	0.0087	0.0036 J
Iron	33	15	18	2.6	12	1.6
Lead	0.24	0.027	0.022	0.001 U	0.00042 J	0.0015
Magnesium	8.1	3.3	3.6	6.6	6.1	4
Manganese	1.6	0.54	0.99	1.4	2.2	0.76
Mercury	0.00055	0.0002 U	0.0002 U	0.0002 U	0.00027	0.0002 U
Nickel	0.019	0.0046 J	0.0023 J	0.01 U	0.01 U	0.01 U
Potassium	6.9	1.4 J	4.1	8	5.7	4.8
Selenium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Silver	0.001 UJ	0.00021 U	0.0002 U	0.001 UJ	0.0001 U	0.001 UJ
Sodium	190	180	83	87	94	81
Thallium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Tin	0.007 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Vanadium	0.038	0.007 J	0.0047 J	0.01 U	0.01 U	0.01 U
Zinc	0.5	0.11	0.038 J	0.0073 J	0.05 U	0.023 J
Inorganics (mg/L)						
Bromide	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Chloride	410	360	150	160	140	170
Hardness	170	90	74	150	140	79
Nitrate as N	0.05 U	0.05 UJ	0.91	0.87	0.13	0.94
Nitrite as N	0.1 U	0.1 UJ	0.01 U	0.1 U	0.1 U	0.1 U
Nitrogen, as Ammonia	1.3	0.52	3.7	6.9	8.7	4.6
Sulfate	88	4.4	17	39	16	35
Total Organic Carbon	30	13	3.4	7.3	5.8	4.9
Total Suspended Solids	1100	32	94	5	26	7

Notes:
mg/L - milligram per liter
U - Not detected, value is reporting limit
J - Value is estimated
R - Value is rejected

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD2 SD-SD2 11/16/2007	OC-SD-SD2 SD-SD2 11/16/2012 0-0.5 ft	OC-SD-SD2 SD-SD2 11/19/2008 0-0.4 ft	OC-SD-SD2-0.0/0.5 SD-SD2 11/11/2011 0-0.5 ft	OC-SD-SD2-0.0/0.5-RISK SD-SD2 11/15/2010 0-0.5 ft	OC-SD-SD3 SD-SD3 11/16/2007	OC-SD-SD3 SD-SD3 11/16/2012 0-0.5 ft	OC-SD-SD3 SD-SD3 11/19/2008 0-0.4 ft	OC-SD-SD3-0.0/0.5-RISK SD-SD3 11/11/2011 0-0.5 ft	OC-SD-SD3-0.0/0.5 SD-SD3 11/15/2010 0-0.5 ft	OC-SD-SD5 SD-SD5 11/16/2007	OC-SD-SD5-RISK SD-SD5 11/16/2012 0-0.5 ft	OC-SD-SD5 SD-SD5 11/19/2008 0-0.4 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/11/2011 0-0.5 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/15/2010 0-0.5 ft	OC-SD-SD-SD2-0.0/0.5 SD-SD2 11/11/2009 0-0.5 ft	OC-SD-SD-SD2-RISK SD-SD2 12/10/2010 0-0.5 ft
Volatile Organic Compounds (mg/kg)																	
1,1,1,2-Tetrachloroethane																	0.0034 UJ
1,1,1-Trichloroethane																	0.0034 UJ
1,1,2,2-Tetrachloroethane																	0.0034 UJ
1,1,2-Trichloro-1,2,2-Trifluoroethane																	0.017 UJ
1,1,2-Trichloroethane																	0.0034 UJ
1,1-Dichloroethane																	0.0034 UJ
1,1-Dichloroethene																	0.0034 UJ
1,1-Dichloropropene																	0.0034 UJ
1,2,3-Trichlorobenzene																	0.0034 UJ
1,2,3-Trichloropropane																	0.0034 UJ
1,2,4-Trichlorobenzene																	0.0034 UJ
1,2,4-Trimethylbenzene																	0.0034 UJ
1,2-Dibromo-3-chloropropane																	0.034 UJ
1,2-Dibromoethane																	0.0034 UJ
1,2-Dichlorobenzene																	0.0034 UJ
1,2-Dichloroethane																	0.0034 UJ
1,2-Dichloropropane																	0.0034 UJ
1,3,5-Trimethylbenzene																	0.0034 UJ
1,3-Dichlorobenzene																	0.0034 UJ
1,3-Dichloropropane																	0.0034 UJ
1,4-Dichlorobenzene																	0.0034 UJ
1,4-Dioxane																	0.34 UJ
2,2-Dichloropropane																	0.0034 UJ
2,4,4-Trimethyl-1-pentene																	0.03 J
2,4,4-Trimethyl-2-pentene																	0.003 J
2-Butanone																	0.021 J
2-Chlorotoluene																	0.0034 UJ
2-Hexanone																	0.034 UJ
4-Chlorotoluene																	0.0034 UJ
4-iso-Propyltoluene																	0.0034 UJ
4-Methyl-2-pentanone																	0.034 UJ
Acetaldehyde																	0.083 J
Acetic acid, methyl ester																	0.068 UJ
Acetone																	0.34 UJ
Benzene																	0.0034 UJ
Bromobenzene																	0.0034 UJ
Bromochloromethane																	0.0034 UJ
Bromodichloromethane																	0.0034 UJ
Bromoform																	0.0034 UJ
Bromomethane																	0.0068 UJ
Butane, 2-methoxy-2-methyl-																	0.0034 UJ
Carbon disulfide																	0.0034 UJ
Carbon tetrachloride																	0.0034 UJ
Chlorobenzene																	0.0034 UJ
Chlorodibromomethane																	0.0034 UJ
Chloroethane																	0.0068 UJ
Chloroform																	0.0034 UJ
Chloromethane																	0.0068 UJ
Cis-1,2-Dichloroethene																	0.0034 UJ
cis-1,3-Dichloropropene																	0.0034 UJ
Cyclohexane																	0.034 UJ
Dibromomethane																	0.0034 UJ
Dichlorodifluoromethane																	0.0068 UJ

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD2 SD-SD2 11/16/2007	OC-SD-SD2 SD-SD2 11/16/2012 0-0.5 ft	OC-SD-SD2 SD-SD2 11/19/2008 0-0.4 ft	OC-SD-SD2-0.0/0.5 SD-SD2 11/11/2011 0-0.5 ft	OC-SD-SD2-0.0/0.5-RISK SD-SD2 11/15/2010 0-0.5 ft	OC-SD-SD3 SD-SD3 11/16/2007	OC-SD-SD3 SD-SD3 11/16/2012 0-0.5 ft	OC-SD-SD3 SD-SD3 11/19/2008 0-0.4 ft	OC-SD-SD3-0.0/0.5-RISK SD-SD3 11/11/2011 0-0.5 ft	OC-SD-SD3-0.0/0.5 SD-SD3 11/15/2010 0-0.5 ft	OC-SD-SD5 SD-SD5 11/16/2007	OC-SD-SD5-RISK SD-SD5 11/16/2012 0-0.5 ft	OC-SD-SD5 SD-SD5 11/19/2008 0-0.4 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/11/2011 0-0.5 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/15/2010 0-0.5 ft	OC-SD-SD-SD2-0.0/0.5 SD-SD2 11/11/2009 0-0.5 ft	OC-SD-SD-SD2-RISK SD-SD2 12/10/2010 0-0.5 ft
Diethyl ether																	0.0034 UJ
Ethyl benzene																	0.0034 UJ
Ethyl-t-Butyl Ether																	0.0034 UJ
Formaldehyde																	1.09 J
Hexachlorobutadiene																	0.0034 UJ
Isopropyl ether																	0.0034 UJ
Isopropylbenzene																	0.0034 UJ
Methyl cyclohexane																	0.0034 UJ
Methyl Tertbutyl Ether																	0.0034 UJ
Methylene chloride																	0.014 UJ
Naphthalene																	0.034 UJ
n-Butylbenzene																	0.0034 UJ
Propylbenzene																	0.0034 UJ
sec-Butylbenzene																	0.0034 UJ
Styrene																	0.0034 UJ
tert-Butylbenzene																	0.0034 UJ
Tetrachloroethene																	0.0034 UJ
Tetrahydrofuran																	0.034 UJ
Toluene																	0.0034 UJ
trans-1,2-Dichloroethene																	0.0034 UJ
trans-1,3-Dichloropropene																	0.0034 UJ
Trichloroethene																	0.0034 UJ
Trichlorofluoromethane																	0.0068 UJ
Vinyl chloride																	0.0034 UJ
Xylene, o																	0.0034 UJ
Xylenes (m&p)																	0.0068 UJ
Semivolatile Organic Compounds (mg/kg)																	
1,2,4,5-Tetrachlorobenzene																	0.055 U
1,2,4-Trichlorobenzene																	0.055 U
1,2-Dichlorobenzene																	0.055 U
1,3-Dichlorobenzene																	0.0315 J
1,4-Dichlorobenzene																	0.055 U
1-Methylnaphthalene																	0.055 U
2,3,4,6-Tetrachlorophenol																	0.055 U
2,4,5-Trichlorophenol																	0.055 U
2,4,6-Trichlorophenol																	0.055 U
2,4-Dichlorophenol																	0.055 U
2,4-Dimethylphenol																	0.055 U
2,4-Dinitrophenol																	0.055 U
2,4-Dinitrotoluene																	0.055 U
2,6-Dinitrotoluene																	0.055 U
2-Chloronaphthalene																	0.055 U
2-Chlorophenol																	0.055 U
2-Methylnaphthalene																	0.055 U
2-Methylphenol																	0.055 U
2-Nitroaniline																	0.27 U
2-Nitrophenol																	0.055 U
3 & 4 Methylphenol																	1.9
3,3'-Dichlorobenzidine																	0.11 U
3-Nitroaniline																	0.27 U
4,6-Dinitro-2-methylphenol																	0.27 U
4-Bromophenyl phenyl ether																	0.055 U
4-Chloro-3-methylphenol																	0.11 U
4-Chloroaniline																	0.11 UJ

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD2 SD-SD2 11/16/2007	OC-SD-SD2 SD-SD2 11/16/2012 0-0.5 ft	OC-SD-SD2 SD-SD2 11/19/2008 0-0.4 ft	OC-SD-SD2-0.0/0.5 SD-SD2 11/11/2011 0-0.5 ft	OC-SD-SD2-0.0/0.5-RISK SD-SD2 11/15/2010 0-0.5 ft	OC-SD-SD3 SD-SD3 11/16/2007	OC-SD-SD3 SD-SD3 11/16/2012 0-0.5 ft	OC-SD-SD3 SD-SD3 11/19/2008 0-0.4 ft	OC-SD-SD3-0.0/0.5-RISK SD-SD3 11/11/2011 0-0.5 ft	OC-SD-SD3-0.0/0.5 SD-SD3 11/15/2010 0-0.5 ft	OC-SD-SD5 SD-SD5 11/16/2007	OC-SD-SD5-RISK SD-SD5 11/16/2012 0-0.5 ft	OC-SD-SD5 SD-SD5 11/19/2008 0-0.4 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/11/2011 0-0.5 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/15/2010 0-0.5 ft	OC-SD-SD-SD2-0.0/0.5 SD-SD2 11/11/2009 0-0.5 ft	OC-SD-SD-SD2-RISK SD-SD2 12/10/2010 0-0.5 ft
4-Chlorophenyl phenyl ether																	0.055 U
4-Nitroaniline																	0.27 U
4-Nitrophenol																	0.27 U
Acenaphthene																	0.055 U
Acenaphthylene																	0.055 U
Acetophenone																	0.09
Aniline																	0.055 UJ
Anthracene																	0.0195 J
Atrazine																	0.055 U
Azobenzene																	0.055 U
Benzaldehyde																	0.445
Benzo(a)anthracene																	0.0665
Benzo(a)pyrene																	0.1
Benzo(b)fluoranthene																	0.0845
Benzo(ghi)perylene																	0.0545 J
Benzo(k)fluoranthene																	0.083 J
Benzoic Acid																	0.047 J
Benzyl alcohol																	0.071 J
Biphenyl																	0.016 J
Bis(2-Chloroethoxy)methane																	0.055 U
Bis(2-Chloroethyl)ether																	0.055 U
Bis(2-Chloroisopropyl)ether																	0.055 U
Bis(2-Ethylhexyl)phthalate																	0.46 J
Butylbenzylphthalate																	0.055 U
Caprolactam																	0.053 J
Carbazole																	0.055 U
Chrysene																	0.069 J
Dibenz(a,h)anthracene																	0.031 J
Dibenzofuran																	0.055 U
Diethylphthalate																	0.055 U
Dimethylphthalate																	0.055 U
Di-n-butylphthalate																	0.055 U
Di-n-octylphthalate																	0.055 U
Diphenyl ether																	0.17
Diphenylamine																	0.055 U
Diphenylmethanone																	0.0305 J
Fluoranthene																	0.14
Fluorene																	0.055 U
Hexachlorobenzene																	0.055 U
Hexachlorobutadiene																	0.055 U
Hexachlorocyclopentadiene																	0.11 U
Hexachloroethane																	0.055 U
Indeno(1,2,3-cd)pyrene																	0.0615
Isophorone																	0.055 UJ
Naphthalene																	0.13 U
Nitrobenzene																	0.055 U
N-Nitrosodimethylamine																	0.055 U
N-Nitrosodi-n-propylamine																	0.055 U
N-Nitrosodiphenylamine																	0.285
Pentachlorophenol																	0.055 U
Phenanthrene																	0.0905
Phenol																	0.96 J
Pyrene																	0.135

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD2 SD-SD2 11/16/2007	OC-SD-SD2 SD-SD2 11/16/2012 0-0.5 ft	OC-SD-SD2 SD-SD2 11/19/2008 0-0.4 ft	OC-SD-SD2-0.0/0.5 SD-SD2 11/11/2011 0-0.5 ft	OC-SD-SD2-0.0/0.5-RISK SD-SD2 11/15/2010 0-0.5 ft	OC-SD-SD3 SD-SD3 11/16/2007	OC-SD-SD3 SD-SD3 11/16/2012 0-0.5 ft	OC-SD-SD3 SD-SD3 11/19/2008 0-0.4 ft	OC-SD-SD3-0.0/0.5-RISK SD-SD3 11/11/2011 0-0.5 ft	OC-SD-SD3-0.0/0.5 SD-SD3 11/15/2010 0-0.5 ft	OC-SD-SD5 SD-SD5 11/16/2007	OC-SD-SD5-RISK SD-SD5 11/16/2012 0-0.5 ft	OC-SD-SD5 SD-SD5 11/19/2008 0-0.4 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/11/2011 0-0.5 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/15/2010 0-0.5 ft	OC-SD-SD-SD2-0.0/0.5 SD-SD2 11/11/2009 0-0.5 ft	OC-SD-SD-SD2-RISK SD-SD2 12/10/2010 0-0.5 ft
EPH/VPH (mg/kg)																	
C5-C8 Aliphatics																	3.7 U
C5-C8 Aliphatics (unadj.)																	3.7 U
C9-C10 Aromatics																	3.7 U
C9-C12 Aliphatics																	3.7 U
C9-C12 Aliphatics (unadj.)																	3.7 U
C11-C22 Aromatics																	16.5
C11-C22 Aromatics (unadj.)																	16.5
C19-C36 Aliphatics																	30
C9-C18 Aliphatics																	5.4 U
Extractable Petroleum Hydrocarbons, Total																	46.5
Volatile Petroleum Hydrocarbons, Total																	3.7 U
Metals (mg/kg)																	
Aluminum	8200	5100 J	15000	11000 J	3500	6900	6600 J	9200	9750 J	8200	17000	10400 J	11000	11000 J	16000	11000	10350
Antimony																	0.91 UJ
Arsenic																	13
Barium																	86 J
Beryllium																	0.335 J
Cadmium																	0.295 J
Calcium																	4750 J
Chromium	110	430	620 J	130	260 J	120	41	130 J	40	20	1600	455	340 J	59	1800	77	270
Chromium, Hexavalent																	3.3 U
Cobalt																	5.3
Copper																	24
Iron	11000	6200	23000	14000 J	10050	9400	9600	12000	14000 J	9600	19000	12500	14000	15000 J	16000	17000	15500
Lead																	32.5
Magnesium																	2350 J
Manganese																	270 J
Mercury																	0.1 U
Nickel																	11
Potassium																	925
Selenium																	0.91 U
Silver																	4.7
Sodium																	105 J
Thallium																	1.8 U
Tin																	9.1 U
Vanadium																	18
Zinc																	61 J
Inorganics (mg/kg)																	
Chloride																	41.5
Nitrate as N																	8 U
Nitrite as N																	1.6 U
Nitrogen, as Ammonia																	235 J
Oxidation Reduction Potential (mV)																	
pH (units)																	7.675 HF
Sulfate																	605
Total Organic Carbon																	30000
Specialty Compounds (mg/kg)																	
Hydrazine																	0.00091 J
Monomethylhydrazine (MMH)																	0.0073 UJ
UDMH																	0.0073 U
Dimethylformamide																	0.3 J
Phthalic Acid/Phthalic anhydride																	0.16 U

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-SD3-0.0/0.5 SD-SD3 11/11/2009 0-0.5 ft	OC-SD-SD-SD3-XXX SD-SD3 12/9/2010 0-0.5 ft	OC-SD-SD-SD5-0.0/0.5 SD-SD5 11/11/2009 0-0.5 ft	OC-SD-SDSW-E-XXX SDSW-E 12/9/2010 0-0.5 ft	SD-SD2-03-03 SD-SD2 5/19/2005 0-0.25	SD-SD3-03-03 SD-SD3 5/19/2005 0-0.25	SD-SD5-03-03 SD-SD5 5/19/2005 0-0.25
Volatile Organic Compounds (mg/kg)							
1,1,1,2-Tetrachloroethane		0.0033 U		0.0023 U			
1,1,1-Trichloroethane		0.0033 U		0.0023 U			
1,1,2,2-Tetrachloroethane		0.0033 U		0.0023 U			
1,1,2-Trichloro-1,2,2-Trifluoroethane		0.017 U		0.012 U			
1,1,2-Trichloroethane		0.0033 U		0.0023 U			
1,1-Dichloroethane		0.0033 U		0.0023 U			
1,1-Dichloroethene		0.0033 U		0.0023 U			
1,1-Dichloropropene		0.0033 U		0.0023 U			
1,2,3-Trichlorobenzene		0.0033 U		0.0023 U			
1,2,3-Trichloropropane		0.0033 U		0.0023 U			
1,2,4-Trichlorobenzene		0.0033 U		0.0023 U			
1,2,4-Trimethylbenzene		0.0033 U		0.0023 U			
1,2-Dibromo-3-chloropropane		0.033 U		0.023 U			
1,2-Dibromoethane		0.0033 U		0.0023 U			
1,2-Dichlorobenzene		0.0033 U		0.0023 U			
1,2-Dichloroethane		0.0033 U		0.0023 U			
1,2-Dichloropropane		0.0033 U		0.0023 U			
1,3,5-Trimethylbenzene		0.0033 U		0.0023 U			
1,3-Dichlorobenzene		0.0033 U		0.0023 U			
1,3-Dichloropropane		0.0033 U		0.0023 U			
1,4-Dichlorobenzene		0.0033 U		0.0023 U			
1,4-Dioxane		0.33 UJ		0.23 UJ			
2,2-Dichloropropane		0.0033 U		0.0023 U			
2,4,4-Trimethyl-1-pentene		0.0066 U		0.0046 U			
2,4,4-Trimethyl-2-pentene		0.0066 U		0.0046 U			
2-Butanone		0.033 U		0.023 U			
2-Chlorotoluene		0.0033 U		0.0023 U			
2-Hexanone		0.033 U		0.023 U			
4-Chlorotoluene		0.0033 U		0.0023 U			
4-iso-Propyltoluene		0.0026 J		0.0023 U			
4-Methyl-2-pentanone		0.033 U		0.023 U			
Acetaldehyde		0.052 J		0.26 U			
Acetic acid, methyl ester		0.066 UJ		0.046 UJ			
Acetone		0.33 UJ		0.23 UJ			
Benzene		0.0033 U		0.0023 U			
Bromobenzene		0.0033 U		0.0023 U			
Bromochloromethane		0.0033 U		0.0023 U			
Bromodichloromethane		0.0033 U		0.0023 U			
Bromoform		0.0033 U		0.0023 U			
Bromomethane		0.0066 U		0.0046 U			
Butane, 2-methoxy-2-methyl-		0.0033 U		0.0023 U			
Carbon disulfide		0.0033 U		0.0023 U			
Carbon tetrachloride		0.0033 U		0.0023 U			
Chlorobenzene		0.0033 U		0.0023 U			
Chlorodibromomethane		0.0033 U		0.0023 U			
Chloroethane		0.0066 U		0.0046 U			
Chloroform		0.0033 U		0.0023 U			
Chloromethane		0.0066 U		0.0046 U			
Cis-1,2-Dichloroethene		0.0033 U		0.0023 U			
cis-1,3-Dichloropropene		0.0033 U		0.0023 U			
Cyclohexane		0.033 U		0.023 U			
Dibromomethane		0.0033 U		0.0023 U			
Dichlorodifluoromethane		0.0066 UJ		0.0046 UJ			

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-SD3-0.0/0.5 SD-SD3 11/11/2009 0-0.5 ft	OC-SD-SD-SD3-XXX SD-SD3 12/9/2010 0-0.5 ft	OC-SD-SD-SD5-0.0/0.5 SD-SD5 11/11/2009 0-0.5 ft	OC-SD-SDSW-E-XXX SDSW-E 12/9/2010 0-0.5 ft	SD-SD2-03-03 SD-SD2 5/19/2005 0-0.25	SD-SD3-03-03 SD-SD3 5/19/2005 0-0.25	SD-SD5-03-03 SD-SD5 5/19/2005 0-0.25
Diethyl ether		0.0033 U		0.0023 U			
Ethyl benzene		0.0033 U		0.0023 U			
Ethyl-t-Butyl Ether		0.0033 U		0.0023 U			
Formaldehyde		0.58		0.33			
Hexachlorobutadiene		0.0033 U		0.0023 U			
Isopropyl ether		0.0033 U		0.0023 U			
Isopropylbenzene		0.0033 U		0.0023 U			
Methyl cyclohexane		0.0033 U		0.0023 U			
Methyl Tertbutyl Ether		0.0033 U		0.0023 U			
Methylene chloride		0.013 U		0.0092 U			
Naphthalene		0.033 U		0.023 U			
n-Butylbenzene		0.0033 U		0.0023 U			
Propylbenzene		0.0033 U		0.0023 U			
sec-Butylbenzene		0.0033 U		0.0023 U			
Styrene		0.0033 U		0.0023 U			
tert-Butylbenzene		0.0033 U		0.0023 U			
Tetrachloroethene		0.0033 U		0.0023 U			
Tetrahydrofuran		0.033 UJ		0.023 UJ			
Toluene		0.0033 U		0.0023 U			
trans-1,2-Dichloroethene		0.0033 U		0.0023 U			
trans-1,3-Dichloropropene		0.0033 U		0.0023 U			
Trichloroethene		0.0033 U		0.0023 U			
Trichlorofluoromethane		0.0066 U		0.0046 U			
Vinyl chloride		0.0033 U		0.0023 U			
Xylene, o		0.0033 U		0.0023 U			
Xylenes (m&p)		0.0066 U		0.0046 U			
Semivolatile Organic Compounds (mg/kg)							
1,2,4,5-Tetrachlorobenzene		0.22 U		0.21 U			
1,2,4-Trichlorobenzene		0.22 U		0.21 U			
1,2-Dichlorobenzene		0.22 U		0.21 U			
1,3-Dichlorobenzene		0.22 U		0.21 U			
1,4-Dichlorobenzene		0.22 U		0.21 U			
1-Methylnaphthalene		0.22 U		0.21 U			
2,3,4,6-Tetrachlorophenol		0.22 U		0.21 U			
2,4,5-Trichlorophenol		0.22 U		0.21 U			
2,4,6-Trichlorophenol		0.22 U		0.21 U			
2,4-Dichlorophenol		0.22 U		0.21 U			
2,4-Dimethylphenol		0.22 U		0.21 U			
2,4-Dinitrophenol		0.22 U		0.21 U			
2,4-Dinitrotoluene		0.22 U		0.21 U			
2,6-Dinitrotoluene		0.22 U		0.21 U			
2-Chloronaphthalene		0.22 U		0.21 U			
2-Chlorophenol		0.22 U		0.21 U			
2-Methylnaphthalene		0.22 U		0.21 U			
2-Methylphenol		0.22 U		0.21 U			
2-Nitroaniline		1.1 U		1.1 U			
2-Nitrophenol		0.22 U		0.21 U			
3 & 4 Methylphenol		3		0.61			
3,3'-Dichlorobenzidine		0.44 U		0.43 U			
3-Nitroaniline		1.1 U		1.1 U			
4,6-Dinitro-2-methylphenol		1.1 U		1.1 U			
4-Bromophenyl phenyl ether		0.22 U		0.21 U			
4-Chloro-3-methylphenol		0.44 U		0.43 U			
4-Chloroaniline		0.44 U		0.43 U			

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-SD3-0.0/0.5 SD-SD3 11/11/2009 0-0.5 ft	OC-SD-SD-SD3-XXX SD-SD3 12/9/2010 0-0.5 ft	OC-SD-SD-SD5-0.0/0.5 SD-SD5 11/11/2009 0-0.5 ft	OC-SD-SDSW-E-XXX SDSW-E 12/9/2010 0-0.5 ft	SD-SD2-03-03 SD-SD2 5/19/2005 0-0.25	SD-SD3-03-03 SD-SD3 5/19/2005 0-0.25	SD-SD5-03-03 SD-SD5 5/19/2005 0-0.25
4-Chlorophenyl phenyl ether		0.22 U		0.21 U			
4-Nitroaniline		1.1 U		1.1 U			
4-Nitrophenol		1.1 U		1.1 U			
Acenaphthene		0.22 U		0.21 U			
Acenaphthylene		0.22 U		0.21 U			
Acetophenone		0.22 U		0.21 U			
Aniline		0.22 U		0.21 U			
Anthracene		0.22 U		0.21 U			
Atrazine		0.22 U		0.21 U			
Azobenzene		0.22 U		0.21 U			
Benzaldehyde		0.62		0.2 J			
Benzo(a)anthracene		0.12 J		0.21 U			
Benzo(a)pyrene		0.13 J		0.11 J			
Benzo(b)fluoranthene		0.16 J		0.093 J			
Benzo(ghi)perylene		0.096 J		0.073 J			
Benzo(k)fluoranthene		0.087 J		0.21 U			
Benzoic Acid		0.22 J		1.1 U			
Benzyl alcohol		0.44 U		0.43 U			
Biphenyl		0.22 U		0.21 U			
Bis(2-Chloroethoxy)methane		0.22 U		0.21 U			
Bis(2-Chloroethyl)ether		0.22 U		0.21 U			
Bis(2-Chloroisopropyl)ether		0.22 U		0.21 U			
Bis(2-Ethylhexyl)phthalate		0.27		0.72			
Butylbenzylphthalate		0.22 U		0.21 U			
Caprolactam		0.22 UJ		0.21 UJ			
Carbazole		0.22 U		0.21 U			
Chrysene		0.14 J		0.068 J			
Dibenz(a,h)anthracene		0.22 U		0.21 U			
Dibenzofuran		0.22 U		0.21 U			
Diethylphthalate		0.22 U		0.21 U			
Dimethylphthalate		0.22 U		0.21 U			
Di-n-butylphthalate		0.22 UJ		0.21 U			
Di-n-octylphthalate		0.22 U		0.21 U			
Diphenyl ether		0.22 U		0.21 U			
Diphenylamine		0.22 U		0.21 U			
Diphenylmethanone		0.22 U		0.21 U			
Fluoranthene		0.3		0.12 J			
Fluorene		0.22 U		0.21 U			
Hexachlorobenzene		0.22 U		0.21 U			
Hexachlorobutadiene		0.22 U		0.21 U			
Hexachlorocyclopentadiene		0.44 U		0.43 U			
Hexachloroethane		0.22 U		0.21 U			
Indeno(1,2,3-cd)pyrene		0.087 J		0.077 J			
Isophorone		0.22 U		0.21 U			
Naphthalene		0.53 U		0.51 U			
Nitrobenzene		0.22 U		0.21 U			
N-Nitrosodimethylamine		0.22 U		0.21 U			
N-Nitrosodi-n-propylamine		0.22 U		0.21 U			
N-Nitrosodiphenylamine		0.22 U		0.21 U			
Pentachlorophenol		0.22 U		0.21 U			
Phenanthrene		0.16 J		0.25 U			
Phenol		0.92		0.22			
Pyrene		0.25		0.12 J			

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-SD3-0.0/0.5 SD-SD3 11/11/2009 0-0.5 ft	OC-SD-SD-SD3-XXX SD-SD3 12/9/2010 0-0.5 ft	OC-SD-SD-SD5-0.0/0.5 SD-SD5 11/11/2009 0-0.5 ft	OC-SD-SDSW-E-XXX SDSW-E 12/9/2010 0-0.5 ft	SD-SD2-03-03 SD-SD2 5/19/2005 0-0.25	SD-SD3-03-03 SD-SD3 5/19/2005 0-0.25	SD-SD5-03-03 SD-SD5 5/19/2005 0-0.25
EPH/VPH (mg/kg)							
C5-C8 Aliphatics		3.3 U		2.7 U			
C5-C8 Aliphatics (unadj.)		3.3 U		2.7 U			
C9-C10 Aromatics		3.3 U		2.7 U			
C9-C12 Aliphatics		3.3 U		2.7 U			
C9-C12 Aliphatics (unadj.)		3.3 U		2.7 U			
C11-C22 Aromatics		24		11			
C11-C22 Aromatics (unadj.)		24		11			
C19-C36 Aliphatics		43		14			
C9-C18 Aliphatics		4.4 U		4.2 U			
Extractable Petroleum Hydrocarbons, Total		67		25			
Volatile Petroleum Hydrocarbons, Total		3.3 U		2.7 U			
Metals (mg/kg)							
Aluminum	9900	7600	13000	4500	7800	4800	14000
Antimony		0.69 UJ		0.68 UJ			
Arsenic		5.3		3.2			
Barium		33 J		14 J			
Beryllium		0.3		0.21 J			
Cadmium		0.25 J		0.16 J			
Calcium		2400 J		930 J			
Chromium	20	130	320	100	25	190	1400
Chromium, Hexavalent		2.6 U		2.6			
Cobalt		3.9		4.4			
Copper		21		19			
Iron	14000	11000	18000	7000	11000	8900	21000
Lead		31		20			
Magnesium		1900 J		1200 J			
Manganese		250 J		80 J			
Mercury		0.11 U		0.11 U			
Nickel		9.3		8.4			
Potassium		910		680			
Selenium		0.69 U		0.68 U			
Silver		2		1.6			
Sodium		82 J		65 J			
Thallium		1.4 U		1.4 U			
Tin		6.9 U		6.8 U			
Vanadium		15		9.2			
Zinc		60 J		35 J			
Inorganics (mg/kg)							
Chloride		64		52			
Nitrate as N		6.5 U		6.3 U			
Nitrite as N		1.3 U		1.3 U			
Nitrogen, as Ammonia		170 J		130 J			
Oxidation Reduction Potential (mV)		150		280			
pH (units)		7.51 HF		6.82 HF			
Sulfate		360		210			
Total Organic Carbon		30000		7500			
Specialty Compounds (mg/kg)							
Hydrazine		0.0029 U		0.0029 U			
Monomethylhydrazine (MMH)		0.0072 U		0.0071 U			
UDMH		0.0072 U		0.0071 U			
Dimethylformamide		0.11 U		0.12 U			
Phthalic Acid/Phthalic anhydride		0.13 U		0.13 U			

Attachment 1-11
Sediment Data Summary - Upper South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD2 SD-SD2 11/16/2007	OC-SD-SD2 SD-SD2 11/16/2012 0-0.5 ft	OC-SD-SD2 SD-SD2 11/19/2008 0-0.4 ft	OC-SD-SD2-0.0/0.5 SD-SD2 11/11/2011 0-0.5 ft	OC-SD-SD2-0.0/0.5-RISK SD-SD2 11/15/2010 0-0.5 ft	OC-SD-SD3 SD-SD3 11/16/2007	OC-SD-SD3 SD-SD3 11/16/2012 0-0.5 ft	OC-SD-SD3 SD-SD3 11/19/2008 0-0.4 ft	OC-SD-SD3-0.0/0.5-RISK SD-SD3 11/11/2011 0-0.5 ft	OC-SD-SD3-0.0/0.5 SD-SD3 11/15/2010 0-0.5 ft	OC-SD-SD5 SD-SD5 11/16/2007	OC-SD-SD5-RISK SD-SD5 11/16/2012 0-0.5 ft	OC-SD-SD5 SD-SD5 11/19/2008 0-0.4 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/11/2011 0-0.5 ft	OC-SD-SD5-0.0/0.5 SD-SD5 11/15/2010 0-0.5 ft	OC-SD-SD-SD2-0.0/0.5 SD-SD2 11/11/2009 0-0.5 ft	OC-SD-SD-SD2-RISK SD-SD2 12/10/2010 0-0.5 ft

Notes:
mg/kg - milligram per kilogram
mV - millivolts
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
HF - Field parameter, exceeded holding time of 15 minutes

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
Volatile Organic Compounds (mg/kg)						
1,1,1,2-Tetrachloroethane				0.004 U	0.0039 U	0.0037 U
1,1,1-Trichloroethane				0.004 U	0.0039 U	0.0037 U
1,1,2,2-Tetrachloroethane				0.004 U	0.0039 U	0.0037 U
1,1,2-Trichloro-1,2,2-Trifluoroethane				0.02 U	0.019 U	0.019 U
1,1,2-Trichloroethane				0.004 U	0.0039 U	0.0037 U
1,1-Dichloroethane				0.004 U	0.0039 U	0.0037 U
1,1-Dichloroethene				0.004 U	0.0039 U	0.0037 U
1,1-Dichloropropene				0.004 U	0.0039 U	0.0037 U
1,2,3-Trichlorobenzene				0.004 U	0.0039 U	0.0037 U
1,2,3-Trichloropropane				0.004 U	0.0039 U	0.0037 U
1,2,4-Trichlorobenzene				0.004 U	0.0039 U	0.0037 U
1,2,4-Trimethylbenzene				0.004 U	0.0039 U *	0.0037 U
1,2-Dibromo-3-chloropropane				0.04 U	0.039 U	0.037 U
1,2-Dibromoethane				0.004 U	0.0039 U	0.0037 U
1,2-Dichlorobenzene				0.004 U	0.0039 U	0.0037 U
1,2-Dichloroethane				0.004 U	0.0039 U	0.0037 U
1,2-Dichloropropane				0.004 U	0.0039 U	0.0037 U
1,3,5-Trimethylbenzene				0.004 U	0.0039 U	0.0037 U
1,3-Dichlorobenzene				0.004 U	0.0039 U	0.0037 U
1,3-Dichloropropane				0.004 U	0.0039 U	0.0037 U
1,4-Dichlorobenzene				0.004 U	0.0039 U	0.0037 U
1,4-Dioxane				0.4 UJ	0.39 U	0.37 UJ
2,2-Dichloropropane				0.004 U	0.0039 U	0.0037 U
2,4,4-Trimethyl-1-pentene				0.0096	0.02	0.0075 U
2,4,4-Trimethyl-2-pentene				0.0035 J	0.0078 U	0.0075 U
2-Butanone				0.032 J	0.038 J	0.037 U
2-Chlorotoluene				0.004 U	0.0039 U	0.0037 U
2-Hexanone				0.04 U	0.039 U	0.037 U
4-Chlorotoluene				0.004 U	0.0039 U	0.0037 U
4-iso-Propyltoluene				0.004 U	0.0039 U	0.0037 U
4-Methyl-2-pentanone				0.04 U	0.039 U	0.037 U
Acetaldehyde				0.063 J		0.33 U
Acetic acid, methyl ester				0.08 UJ	0.078 U	0.075 UJ
Acetone				0.4 UJ	0.12 J *	0.37 UJ
Benzene				0.004 U	0.0039 U	0.0037 U
Bromobenzene				0.004 U	0.0039 U	0.0037 U
Bromochloromethane				0.004 U	0.0039 U	0.0037 U

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
Bromodichloromethane				0.004 U	0.0039 U	0.0037 U
Bromoform				0.004 U	0.0039 U	0.0037 U
Bromomethane				0.008 U	0.0078 U	0.0075 U
Butane, 2-methoxy-2-methyl-				0.004 U	0.0039 U	0.0037 U
Carbon disulfide				0.004 U	0.0039 U	0.0037 U
Carbon tetrachloride				0.004 U	0.0039 U	0.0037 U
Chlorobenzene				0.004 U	0.0039 U	0.0037 U
Chlorodibromomethane				0.004 U	0.0039 U	0.0037 U
Chloroethane				0.008 U	0.0078 U	0.0075 U
Chloroform				0.004 U	0.0039 U	0.0037 U
Chloromethane				0.008 U	0.0078 U	0.0075 U
Cis-1,2-Dichloroethene				0.0024 J	0.0039 U	0.0037 U
cis-1,3-Dichloropropene				0.004 U	0.0039 U	0.0037 U
Cyclohexane				0.04 U	0.039 U	0.037 U
Dibromomethane				0.004 U	0.0039 U	0.0037 U
Dichlorodifluoromethane				0.008 UJ	0.0078 U	0.0075 UJ
Diethyl ether				0.004 U	0.0039 U	0.0037 U
Ethyl benzene				0.004 U	0.0039 U	0.0037 U
Ethyl-t-Butyl Ether				0.004 U	0.0039 U	0.0037 U
Formaldehyde				0.6		0.27
Hexachlorobutadiene				0.004 U	0.0039 U	0.0037 U
Isopropyl ether				0.004 U	0.0039 U	0.0037 U
Isopropylbenzene				0.004 U	0.0039 U	0.0037 U
Methyl cyclohexane				0.004 U	0.0039 U	0.0037 U
Methyl Tertbutyl Ether				0.004 U	0.0039 U	0.0037 U
Methylene chloride				0.016 U	0.016 U	0.015 U
Naphthalene				0.04 U	0.039 U	0.037 U
n-Butylbenzene				0.004 U	0.0039 U	0.0037 U
Propylbenzene				0.004 U	0.0039 U	0.0037 U
sec-Butylbenzene				0.004 U	0.0039 U	0.0037 U
Styrene				0.004 U	0.0039 U	0.0037 U
tert-Butylbenzene				0.004 U	0.0039 U	0.0037 U
Tetrachloroethene				0.004 U	0.0039 U	0.0037 U
Tetrahydrofuran				0.04 UJ	0.039 U	0.037 UJ
Toluene				0.004 U	0.0039 U	0.0037 U
trans-1,2-Dichloroethene				0.0045	0.0039 U	0.0037 U
trans-1,3-Dichloropropene				0.004 U	0.0039 U	0.0037 U
Trichloroethene				0.004 U	0.0039 U	0.0037 U

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
Trichlorofluoromethane				0.008 U	0.0078 U	0.0075 U
Vinyl chloride				0.004 U	0.0039 U	0.0037 U
Xylene, o				0.004 U	0.0039 U	0.0037 U
Xylenes (m&p)				0.008 U	0.0078 U	0.0075 U
Semivolatile Organic Compounds (mg/kg)						
1,2,4,5-Tetrachlorobenzene				0.31 U	5.4 U	0.29 U
1,2,4-Trichlorobenzene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
1,2-Dichlorobenzene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
1,3-Dichlorobenzene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
1,4-Dichlorobenzene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
1-Methylnaphthalene				0.31 U	5.4 U	0.29 U
2,2'-Dichlorodiisopropylether	3.4 U	2 U	2.2 U			
2,3,4,6-Tetrachlorophenol				0.31 U	5.4 U	0.29 U
2,4,5-Trichlorophenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2,4,6-Trichlorophenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2,4-Dichlorophenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2,4-Dimethylphenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2,4-Dinitrophenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2,4-Dinitrotoluene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2,6-Dinitrotoluene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2-Chloronaphthalene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2-Chlorophenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2-Methylnaphthalene	1.7 U	0.99 U	1.1 U	0.31 U	5.4 U	0.29 U
2-Methylphenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
2-Nitroaniline	17 U	9.9 U	11 U	1.6 U	27 U	1.4 U
2-Nitrophenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
3 & 4 Methylphenol	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
3,3'-Dichlorobenzidine	6.9 UJ	4 U	4.3 U	0.62 U	11 U	0.58 U
3-Nitroaniline	17 U	9.9 U	11 U	1.6 U	27 U	1.4 U
4,6-Dinitro-2-methylphenol	17 U	9.9 U	11 U	1.6 U	27 U	1.4 U
4-Bromophenyl phenyl ether	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
4-Chloro-3-methylphenol	6.9 U	4 U	4.3 U	0.62 U	11 U	0.58 U
4-Chloroaniline	6.9 U	4 U	4.3 U	0.62 U	11 U	0.58 U
4-Chlorophenyl phenyl ether	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
4-Nitroaniline	17 U	9.9 U	11 U	1.6 U	27 U	1.4 U
4-Nitrophenol	17 U	9.9 U	11 U	1.6 U	27 U	1.4 U
Acenaphthene	1.7 U	0.51 U	0.6 U	0.31 U	5.4 U	0.29 U
Acenaphthylene	1.7 U	0.26 U	0.3 U	0.31 U	5.4 U	0.29 U

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
Acetophenone	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Aniline	17 U	9.9 U	11 U	0.23 J	5.4 U *	0.29 U
Anthracene	0.088 U	0.01 U	0.012 U	0.31 U	5.4 U	0.29 U
Atrazine				0.31 U	5.4 U *	0.29 U
Azobenzene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Benzaldehyde				0.12 J	5.4 U	0.29 U
Benzo(a)anthracene	3.1	0.31 J	0.51	0.31 U	5.4 U	0.29 U
Benzo(a)pyrene	0.099 J	0.032	0.05	0.31 U	5.4 U	0.29 U
Benzo(b)fluoranthene	0.088 U	0.046	0.067	0.31 U	5.4 U	0.29 U
Benzo(ghi)perylene	0.64	0.13 J	0.13	0.31 U	5.4 U	0.29 U
Benzo(k)fluoranthene	0.088 U	0.014	0.025	0.31 U	5.4 U	0.29 U
Benzoic Acid	17 U	9.9 U	11 U	0.43 J	27 U	1.4 U
Benzyl alcohol	6.9 U	4 U	4.3 U	0.62 U	11 U	0.58 U
Biphenyl				0.32	5.4 U	0.29 U
Bis(2-Chloroethoxy)methane	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Bis(2-Chloroethyl)ether	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Bis(2-Chloroisopropyl)ether				0.31 U	5.4 U	0.29 U
Bis(2-Ethylhexyl)phthalate	920	11	31	280	480	210
Butylbenzylphthalate	3.4 UJ	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Caprolactam				0.31 UJ	5.4 U	0.29 UJ
Carbazole				0.31 U	5.4 U	0.29 U
Chrysene	0.44	0.061 J	0.064	0.31 U	5.4 U	0.29 U
Dibenz(a,h)anthracene	0.26 J	0.048 J	0.028 J	0.31 U	5.4 U	0.29 U
Dibenzofuran	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Diethylphthalate	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Dimethylphthalate	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Di-n-butylphthalate	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Di-n-octylphthalate	3.4 UJ	2 U	2.2 UJ	0.31 U	5.4 U	0.15 J
Diphenyl ether				2.6	5.4 U	0.22 J
Diphenylamine				0.095		0.058 U
Diphenylmethanone				0.31 U	5.4 U	0.29 U
Fluoranthene	1.8	0.19 J	0.13	0.31 U	5.4 U	0.29 U
Fluorene	0.43 U	0.051 U	0.06 U	0.31 U	5.4 U	0.29 U
Hexachlorobenzene				0.31 U	5.4 U	0.29 U
Hexachlorobutadiene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Hexachlorocyclopentadiene	3.4 U	2 U	2.2 U	0.62 U	11 U	0.58 U
Hexachloroethane	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Indeno(1,2,3-cd)pyrene	0.19 J	0.026 UJ	0.03 U	0.31 U	5.4 U	0.29 U

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
Isophorone	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
Naphthalene	1.7 U	0.3 J	0.3 U	0.75 U	13 U	0.7 U
Nitrobenzene	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
N-Nitrosodimethylamine				0.31 U	5.4 U	0.29 U
N-Nitrosodi-n-propylamine	3.4 U	2 U	2.2 U	0.31 U	5.4 U	0.29 U
N-Nitrosodiphenylamine	1.4 J	0.13 J	2.2 U	1.6	5.4 U	0.065
Pentachlorophenol	17 U	9.9 U	11 U	0.31 U	5.4 U	0.29 U
Phenanthrene	0.1 J	0.056 J	0.038	0.37 U	6.4 U	0.35 U
Phenol	3.4 U	2 U	2.2 U	0.13 J	5.4 U	0.29 U
Pyrene	0.16 J	0.052	0.079	0.31 U	5.4 U	0.29 U
EPH/VPH (mg/kg)						
C5-C8 Aliphatics				4.9 U		4.5 U
C5-C8 Aliphatics (unadj.)				4.9 U		4.5 U
C9-C10 Aromatics				4.9 U		4.5 U
C9-C12 Aliphatics				4.9 U		4.5 U
C9-C12 Aliphatics (unadj.)				4.9 U		4.5 U
C11-C22 Aromatics				9400		1100
C11-C22 Aromatics (unadj.)				9400		1100
C19-C36 Aliphatics				6400		690
C9-C18 Aliphatics				770		96
Extractable Petroleum Hydrocarbons, Total				17000		1900
Volatile Petroleum Hydrocarbons, Total				4.9 U		4.5 U
Pesticides (mg/kg)						
4,4'-DDD	0.02 U	0.011 U	0.013 U			
4,4'-DDE	0.02 U	0.011 U	0.013 U			
4,4'-DDT	0.062	0.011 U	0.013 U			
Aldrin	0.02 U	0.011 U	0.013 U			
Alpha-BHC	0.02 U	0.011 U	0.013 U			
Beta-BHC	0.02 U	0.011 U	0.013 U			
Chlordane	0.098 U	0.055 U	0.063 U			
Delta-BHC	0.02 U	0.011 U	0.013 U			
Dieldrin	0.02 U	0.011 U	0.013 U			
Endosulfan I	0.02 U	0.011 U	0.013 U			
Endosulfan II	0.02 U	0.011 U	0.013 U			
Endosulfan sulfate	0.02 U	0.011 U	0.013 U			
Endrin	0.02 U	0.011 U	0.013 U			
Endrin ketone	0.02 U	0.011 U	0.013 U			
Gamma-BHC/Lindane	0.02 U	0.011 U	0.013 U			

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
Heptachlor	0.02 U	0.011 U	0.013 U			
Heptachlor epoxide	0.02 U	0.011 U	0.013 U			
Hexachlorobenzene	0.037	0.011 U	0.013 U			
Methoxychlor	0.039 U	0.022 U	0.025 U			
Metals (mg/kg)						
Aluminum	15000	3900	6300	10000	8100	7900
Antimony	5.1 U	3 U	2.8 U	0.98 UJ	0.89 U	0.91 UJ
Arsenic	6.3	2.1	3.4	6.2	6.7	5
Barium	23	7	10	11 J	14	12 J
Beryllium	1.9	0.3 U	0.64	1.3	0.77	1
Cadmium	0.94	0.3 U	0.28 U	1.2	0.58	0.32 J
Calcium	1900	840	890	1300	1100 B	820 J
Chromium	2800	570	860	2500	3000	1800
Chromium, Hexavalent	8	7.9	6.9 U	28		25
Cobalt	8.7	5.5	3.3	21	17	4.7
Copper	22	5.9	9.5	21	20	17
Iron	8100	4200	6000	4700	4300 B	4400
Lead	18	5.1	6	11	11	9.4
Magnesium	600	620	660	480 J	410 B	470 J
Manganese	87	51	38	67 J	49 B	38 J
Mercury	0.39	0.11	0.045	0.24	0.22 B	0.12 U
Nickel	18	7.3	7.5	24	17	11
Potassium	1000 U	610 U	560 U	1700	1500	1400
Selenium	2.6 U	1.5 U	1.4 U	0.72 J	0.89 U	0.91 U
Silver	2.6 U	1.5 U	1.4 U	51	62 ^	35
Sodium	510 U	300 U	280 U	95 J	110 J	160 J
Thallium	2.6 U	1.5 U	1.4 U	2 U	1.8 U	1.8 U
Tin				9.8 U	1.6 J B	9.1 U
Vanadium	14	5.4	6.6	9.4	8	8.5
Zinc	57	20	23	45 J	30	33 J
Inorganics (mg/kg)						
Chloride				130	130	140
Cyanide, Available	1.4 U	1.1 U	1.1 U			
Cyanide, Total	2 U	1.1 U	1.1 U			
Nitrate as N				9.4 U	7.3 U	8.6 U
Nitrite as N				1.9 U	1.5 U	1.7 U
Nitrogen, as Ammonia	220	60	54	290 J	170	240 J
Oxidation Reduction Potential (mV)				200		360

Attachment 1-12
Sediment Data Summary - Lower South Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	BS030LSD-02 BS030 8/22/2005 0-0.5 ft	BS031LSD-02 BS031 8/22/2005 0-0.5 ft	BS032LSD-02 BS032 8/22/2005 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 12/9/2010 0-0.5 ft	OC-SD-ISCO-2-XXX ISCO2 2/17/2011	OC-SD-SD-1-XXX SD-1 12/9/2010 0-0.5 ft
pH (units)				6.88 HF		5.83 HF
Sulfate				600	830	640
Total Organic Carbon				52000	44000	48000
Total Organic Carbon (%)	11	0.87	1.3			
Hydrazines (mg/kg)						
Hydrazine				0.0024 J		0.0013 J
Monomethylhydrazine (MMH)				0.0084 U		0.0089 U
UDMH				0.0084 U		0.0089 U
Dimethylformamide (mg/kg)						
Dimethylformamide				0.14 U		0.18 U
Phthalic Anhydride (mg/kg)						
Phthalic Acid/Phthalic anhydride				0.19 U		0.17 U

Notes:
mg/kg - milligram per kilogram
mV - millivolts
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
HF - Field parameter, exceeded holding time of 15 minutes
B - Parameter found in both the associated blank and the sample
^ - Instrument related QC exceeds the control limits
* - Duplicate analysis is not within control limits

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-12S (0-6) WDW-12 8/30/2000 0-0.5 ft	1120-WDW-13S (0-6) WDW-13 8/30/2000 0-0.5 ft	1120-WDW-14S (0-6) WDW-14 8/31/2000 0-0.5 ft	1120-WDW-16S (0-6) WDW-16 8/31/2000 0-0.5 ft	1120-WDW-17S (0-6) WDW-17 8/30/2000 0-0.5 ft	1120-WDW-19S (0-6) WDW-19 8/30/2000 0-0.5 ft	1120-WDW-20S (0-6) WDW-20 8/31/2000 0-0.5 ft	1120-WDW-21AS (0-6) WDW-21A 8/30/2000 0-0.5 ft	1120-WDW-21BS (0-6) WDW-21B 8/30/2000 0-0.5 ft	1120-WDW-22S (0-6) WDW-22 8/30/2000 0-0.5 ft	1120-WDW-23S (0-6) WDW-23 8/31/2000 0-0.5 ft	1120-WDW-24S (0-6) WDW-24 8/30/2000 0-0.5 ft	1120-WDW-25S (0-6) WDW-25 8/30/2000 0-0.5 ft	1120-WDW-26S (0-6) WDW-26 8/30/2000 0-0.5 ft	1120-WDW-27S (0-6) WDW-27 8/31/2000 0-0.5 ft	1120-WDW-28S (0-6) WDW-28 8/30/2000 0-0.5 ft	1120-WDW-29S (0-6) WDW-29 8/30/2000 0-0.5 ft
Volatile Organic Compounds (mg/kg)																	
1,1,1,2-Tetrachloroethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,1,1-Trichloroethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,1,2,2-Tetrachloroethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,1,2-Trichloroethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,1-Dichloroethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,1-Dichloroethene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,1-Dichloropropene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2,3-Trichlorobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2,3-Trichloropropane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2,4-Trichlorobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2,4-Trimethylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2-Dibromo-3-chloropropane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2-Dibromoethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2-Dichlorobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2-Dichloroethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,2-Dichloropropane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,3,5-Trimethylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,3-Dichlorobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,3-Dichloropropane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
1,4-Dichlorobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
2,2-Dichloropropane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
2,4,4-Trimethyl-1-pentene																	
2,4,4-Trimethyl-2-pentene																	
2-Butanone			15 U	16 U			31 U				17 U				25 U		
2-Chlorotoluene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
2-Hexanone			2.9 U	3.2 U			6.1 U				3.4 U				5 U		
4-Chlorotoluene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
4-iso-Propyltoluene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
4-Methyl-2-pentanone			2.9 U	3.2 U			6.1 U				3.4 U				5 U		
Acetone			15 U	16 U			31 U				17 U				25 U		
Benzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Bromobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Bromochloromethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Bromodichloromethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Bromoform			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Bromomethane			1.5 U	1.6 U			3.1 U				1.7 U				2.5 U		
Carbon disulfide																	
Carbon tetrachloride			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Chlorobenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Chlorodibromomethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Chloroethane			1.5 U	1.6 U			3.1 U				1.7 U				2.5 U		
Chloroform			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Chloromethane			1.5 U	1.6 U			3.1 U				1.7 U				2.5 U		
Cis-1,2-Dichloroethene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
cis-1,3-Dichloropropene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Dibromomethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Ethyl benzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Hexachlorobutadiene			0.73 UB	0.8 UB			1.5 UB				0.84 UB				1.3 UB		
Isopropylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Methyl Tertbutyl Ether			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Methylene chloride			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Naphthalene			7.3 U	8 U			15 U				8.4 U				13 U		
n-Butylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-12S (0-6) WDW-12 8/30/2000 0-0.5 ft	1120-WDW-13S (0-6) WDW-13 8/30/2000 0-0.5 ft	1120-WDW-14S (0-6) WDW-14 8/31/2000 0-0.5 ft	1120-WDW-16S (0-6) WDW-16 8/31/2000 0-0.5 ft	1120-WDW-17S (0-6) WDW-17 8/30/2000 0-0.5 ft	1120-WDW-19S (0-6) WDW-19 8/30/2000 0-0.5 ft	1120-WDW-20S (0-6) WDW-20 8/31/2000 0-0.5 ft	1120-WDW-21AS (0-6) WDW-21A 8/30/2000 0-0.5 ft	1120-WDW-21BS (0-6) WDW-21B 8/30/2000 0-0.5 ft	1120-WDW-22S (0-6) WDW-22 8/30/2000 0-0.5 ft	1120-WDW-23S (0-6) WDW-23 8/31/2000 0-0.5 ft	1120-WDW-24S (0-6) WDW-24 8/30/2000 0-0.5 ft	1120-WDW-25S (0-6) WDW-25 8/30/2000 0-0.5 ft	1120-WDW-26S (0-6) WDW-26 8/30/2000 0-0.5 ft	1120-WDW-27S (0-6) WDW-27 8/31/2000 0-0.5 ft	1120-WDW-28S (0-6) WDW-28 8/30/2000 0-0.5 ft	1120-WDW-29S (0-6) WDW-29 8/30/2000 0-0.5 ft
Propylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
sec-Butylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Styrene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
tert-Butylbenzene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Tetrachloroethene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Toluene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
trans-1,2-Dichloroethene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
trans-1,3-Dichloropropene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Trichloroethene			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Trichlorofluoromethane			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Vinyl acetate																	
Vinyl chloride			1.5 U	1.6 U			3.1 U				1.7 U				2.5 U		
Xylene, o			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Xylenes (m&p)			0.73 U	0.8 U			1.5 U				0.84 U				1.3 U		
Xylenes, Total																	
Semivolatile Organic Compounds (mg/kg)																	
1,2,4-Trichlorobenzene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
1,2-Dichlorobenzene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
1,2-Diphenylhydrazine	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
1,3-Dichlorobenzene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
1,4-Dichlorobenzene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2,2'-Dichlorodiisopropylether	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2,4,5-Trichlorophenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 U	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 U	2.2 U	4.6 U
2,4,6-Trichlorophenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 U	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 U	2.2 U	4.6 U
2,4-Dichlorophenol	3.9 U	22 U	11 U	10 U	9.8 U	23 U	8.3 U	4.4 U	9.1 UC	5.7 U	6.8 U	7.4 U	4.4 U	4.2 U	11 UC	4.3 U	9.2 U
2,4-Dimethylphenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2,4-Dinitrophenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2,4-Dinitrotoluene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 U	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 U	2.2 U	4.6 U
2,6-Dinitrotoluene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2-Chloronaphthalene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2-Chlorophenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2-Methylnaphthalene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2-Methylphenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
2-Nitroaniline	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
2-Nitrophenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
3 & 4 Methylphenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
3,3'-Dichlorobenzidine	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
3-Nitroaniline	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
4,6-Dinitro-2-methylphenol	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
4-Bromophenyl phenyl ether	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
4-Chloro-3-methylphenol	3.9 U	22 U	11 U	10 U	9.8 U	23 U	8.3 U	4.4 U	9.1 UC	5.7 U	6.8 U	7.4 U	4.4 U	4.2 U	11 UC	4.3 U	9.2 U
4-Chloroaniline	3.9 U	22 U	11 U	10 U	9.8 U	23 U	8.3 U	4.4 U	9.1 UC	5.7 U	6.8 U	7.4 U	4.4 U	4.2 U	11 UC	4.3 U	9.2 U
4-Chlorophenyl phenyl ether	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
4-Methylphenol																	
4-Nitroaniline	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
4-Nitrophenol	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
Acenaphthene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Acenaphthylene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Aniline	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
Anthracene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Benzo(a)anthracene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Benzo(a)pyrene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Benzo(b)fluoranthene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	3 JC	2.2 U	4.6 U
Benzo(ghi)perylene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-12S (0-6) WDW-12 8/30/2000 0-0.5 ft	1120-WDW-13S (0-6) WDW-13 8/30/2000 0-0.5 ft	1120-WDW-14S (0-6) WDW-14 8/31/2000 0-0.5 ft	1120-WDW-16S (0-6) WDW-16 8/31/2000 0-0.5 ft	1120-WDW-17S (0-6) WDW-17 8/30/2000 0-0.5 ft	1120-WDW-19S (0-6) WDW-19 8/30/2000 0-0.5 ft	1120-WDW-20S (0-6) WDW-20 8/31/2000 0-0.5 ft	1120-WDW-21AS (0-6) WDW-21A 8/30/2000 0-0.5 ft	1120-WDW-21BS (0-6) WDW-21B 8/30/2000 0-0.5 ft	1120-WDW-22S (0-6) WDW-22 8/30/2000 0-0.5 ft	1120-WDW-23S (0-6) WDW-23 8/31/2000 0-0.5 ft	1120-WDW-24S (0-6) WDW-24 8/30/2000 0-0.5 ft	1120-WDW-25S (0-6) WDW-25 8/30/2000 0-0.5 ft	1120-WDW-26S (0-6) WDW-26 8/30/2000 0-0.5 ft	1120-WDW-27S (0-6) WDW-27 8/31/2000 0-0.5 ft	1120-WDW-28S (0-6) WDW-28 8/30/2000 0-0.5 ft	1120-WDW-29S (0-6) WDW-29 8/30/2000 0-0.5 ft
Benzo(k)fluoranthene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Benzoic Acid	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 UC	14 U	17 U	19 U	11 U	10 U	28 UC	11 U	23 U
Benzyl alcohol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Bis(2-Chloroethoxy)methane	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Bis(2-Chloroethyl)ether	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Bis(2-Ethylhexyl)phthalate	2 U	11 J	5.3 U	5.2 U	4.9 U	12 UB	4.2 UB	2.2 U	4.6 UC	3.8	6.6	8.2	2.2 U	9.3	5.6 UC	2.9	4.9
Butylbenzylphthalate	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Carbazole																	
Chrysene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Dibenz(a,h)anthracene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Dibenzofuran	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Diethylphthalate	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Dimethylphthalate	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Di-n-butylphthalate	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Di-n-octylphthalate	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Fluoranthene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	6.1 C	2.2 U	4.6 U
Fluorene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Hexachlorobenzene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Hexachlorobutadiene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Hexachlorocyclopentadiene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Hexachloroethane	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 U	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 U	2.2 U	4.6 U
Indeno(1,2,3-cd)pyrene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Isophorone	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Naphthalene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Nitrobenzene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
N-Nitrosodimethylamine																	
N-Nitrosodi-n-propylamine	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
N-Nitrosodiphenylamine	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Pentachlorophenol	9.8 U	55 U	26 U	26 U	24 U	58 U	21 U	11 U	23 U	14 U	17 U	19 U	11 U	10 U	28 U	11 U	23 U
Phenanthrene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	3.2 JC	2.2 U	4.6 U
Phenol	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	5.6 UC	2.2 U	4.6 U
Pyrene	2 U	11 U	5.3 U	5.2 U	4.9 U	12 U	4.2 U	2.2 U	4.6 UC	2.9 U	3.4 U	3.7 U	2.2 U	2.1 U	4.2 JC	2.2 U	4.6 U
Metals (mg/kg)																	
Aluminum			4100	3700			3100				2800				3800		
Antimony																	
Arsenic			4 U	4 U			9 U				5 U				5 U		
Barium																	
Beryllium																	
Cadmium			0.9 U	0.87			2 U				1 U				1.2		
Calcium																	
Chromium	11	19	11	29	17	69	9 U	22	42	21	22	48	19	10 U	42	15	28
Cobalt																	
Copper																	
Iron			6600	8000			1300 F				5100				5000		
Lead			82	110			9 U				44				66		
Magnesium																	
Manganese																	
Mercury			0.28	0.37			0.3 U				0.23				0.44		
Nickel																	
Potassium																	
Selenium			4 U	4 U			9 U				5 U				5 U		
Silver																	
Sodium																	
Thallium																	

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-12S (0-6) WDW-12 8/30/2000 0-0.5 ft	1120-WDW-13S (0-6) WDW-13 8/30/2000 0-0.5 ft	1120-WDW-14S (0-6) WDW-14 8/31/2000 0-0.5 ft	1120-WDW-16S (0-6) WDW-16 8/31/2000 0-0.5 ft	1120-WDW-17S (0-6) WDW-17 8/30/2000 0-0.5 ft	1120-WDW-19S (0-6) WDW-19 8/30/2000 0-0.5 ft	1120-WDW-20S (0-6) WDW-20 8/31/2000 0-0.5 ft	1120-WDW-21AS (0-6) WDW-21A 8/30/2000 0-0.5 ft	1120-WDW-21BS (0-6) WDW-21B 8/30/2000 0-0.5 ft	1120-WDW-22S (0-6) WDW-22 8/30/2000 0-0.5 ft	1120-WDW-23S (0-6) WDW-23 8/31/2000 0-0.5 ft	1120-WDW-24S (0-6) WDW-24 8/30/2000 0-0.5 ft	1120-WDW-25S (0-6) WDW-25 8/30/2000 0-0.5 ft	1120-WDW-26S (0-6) WDW-26 8/30/2000 0-0.5 ft	1120-WDW-27S (0-6) WDW-27 8/31/2000 0-0.5 ft	1120-WDW-28S (0-6) WDW-28 8/30/2000 0-0.5 ft	1120-WDW-29S (0-6) WDW-29 8/30/2000 0-0.5 ft
Vanadium																	
Zinc																	
Inorganics (%)																	
Total Organic Carbon																	

Notes:
mg/kg - milligram per kilogram
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
F - The result is estimated due to matrix spike recovery outside of control limits
C - The result is estimated due to surrogate recovery outside of control limits

B - Parameter found in both the associated blank and the sample

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-30S WDW-30 8/30/2000 0-0.5 ft	1120-WDW-31S WDW-31 8/30/2000 0-0.5 ft	1120-WDW-32S (0-6) WDW-32 8/31/2000 0-0.5 ft	1140-WDW-11S WDW-11 8/25/2000 0-0.5 ft	OC-SD-SD1-RISK SD-SD1 11/16/2007 0-0.5 ft	OC-SD-SD1 SD-SD1 11/16/2012 0-0.5 ft	OC-SD-SD1 SD-SD1 11/19/2008 0-0.3 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/11/2011 0-0.5 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/15/2010 0-0.5 ft	OC-SD-SD-SD1-0.0/0.5-RISK SD-SD1 11/11/2009 0-0.5 ft	RSD-01 RSD-01 1/18/2000	RSD-02 RSD-02 1/18/2000	SD-SD1-03-01 SD-SD1 6/17/2003 0-0.25 ft	SD-SD1-03-02 SD-SD1 8/10/2004 0-0.25 ft	SD-SD1-03-03 SD-SD1 5/19/2005 0-0.25 ft
Volatile Organic Compounds (mg/kg)															
1,1,1,2-Tetrachloroethane			0.87 U												
1,1,1-Trichloroethane			0.87 U								0.018 U	0.043 U			
1,1,2,2-Tetrachloroethane			0.87 U								0.018 U	0.043 U			
1,1,2-Trichloroethane			0.87 U								0.018 U	0.043 U			
1,1-Dichloroethane			0.87 U								0.018 U	0.043 U			
1,1-Dichloroethene			0.87 U								0.018 U	0.043 U			
1,1-Dichloropropene			0.87 U												
1,2,3-Trichlorobenzene			0.87 U												
1,2,3-Trichloropropane			0.87 U												
1,2,4-Trichlorobenzene			0.87 U												
1,2,4-Trimethylbenzene			0.87 U												
1,2-Dibromo-3-chloropropane			0.87 U												
1,2-Dibromoethane			0.87 U												
1,2-Dichlorobenzene			0.87 U												
1,2-Dichloroethane			0.87 U								0.018 U	0.043 U			
1,2-Dichloropropane			0.87 U								0.018 U	0.043 U			
1,3,5-Trimethylbenzene			0.87 U												
1,3-Dichlorobenzene			0.87 U												
1,3-Dichloropropane			0.87 U												
1,4-Dichlorobenzene			0.87 U												
2,2-Dichloropropane			0.87 U												
2,4,4-Trimethyl-1-pentene											0.018 U	0.043 U			
2,4,4-Trimethyl-2-pentene											0.018 U	0.043 U			
2-Butanone			17 U								0.036 U	0.085 U			
2-Chlorotoluene			0.87 U												
2-Hexanone			3.5 U								0.036 UJ	0.085 UJ			
4-Chlorotoluene			0.87 U												
4-iso-Propyltoluene			0.87 U												
4-Methyl-2-pentanone			3.5 U								0.036 U	0.085 U			
Acetone			17 U								0.095	0.34			
Benzene			0.87 U								0.018 U	4.4 J			
Bromobenzene			0.87 U												
Bromochloromethane			0.87 U												
Bromodichloromethane			0.87 U								0.018 U	0.043 U			
Bromoform			0.87 U								0.018 U	0.043 U			
Bromomethane			1.7 U								0.036 U	0.085 U			
Carbon disulfide											0.018 U	0.043 U			
Carbon tetrachloride			0.87 U								0.018 U	0.043 U			
Chlorobenzene			0.87 U								0.018 UJ	0.11 J			
Chlorodibromomethane			0.87 U								0.018 U	0.043 U			
Chloroethane			1.7 U								0.036 U	0.085 U			
Chloroform			0.87 U								0.018 U	0.043 U			
Chloromethane			1.7 U								0.036 U	0.085 U			
Cis-1,2-Dichloroethene			0.87 U								0.018 U	0.043 U			
cis-1,3-Dichloropropene			0.87 U								0.018 U	0.043 U			
Dibromomethane			0.87 U												
Ethyl benzene			0.87 U								0.018 U	0.043 U			
Hexachlorobutadiene			0.87 UB												
Isopropylbenzene			0.87 U												
Methyl Tertbutyl Ether			0.87 U												
Methylene chloride			0.87 U								0.018 U	0.043 U			
Naphthalene			8.7 U												
n-Butylbenzene			0.87 U												

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-30S WDW-30 8/30/2000 0-0.5 ft	1120-WDW-31S WDW-31 8/30/2000 0-0.5 ft	1120-WDW-32S (0-6) WDW-32 8/31/2000 0-0.5 ft	1140-WDW-11S WDW-11 8/25/2000 0-0.5 ft	OC-SD-SD1-RISK SD-SD1 11/16/2007 0-0.5 ft	OC-SD-SD1 SD-SD1 11/16/2012 0-0.5 ft	OC-SD-SD1 SD-SD1 11/19/2008 0-0.3 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/11/2011 0-0.5 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/15/2010 0-0.5 ft	OC-SD-SD-SD1-0.0/0.5-RISK SD-SD1 11/11/2009 0-0.5 ft	RSD-01 RSD-01 1/18/2000	RSD-02 RSD-02 1/18/2000	SD-SD1-03-01 SD-SD1 6/17/2003 0-0.25 ft	SD-SD1-03-02 SD-SD1 8/10/2004 0-0.25 ft	SD-SD1-03-03 SD-SD1 5/19/2005 0-0.25 ft
Propylbenzene			0.87 U												
sec-Butylbenzene			0.87 U												
Styrene			0.87 U								0.018 U	0.043 U			
tert-Butylbenzene			0.87 U												
Tetrachloroethene			0.87 U								0.018 U	0.043 U			
Toluene			0.87 U								0.018 U	0.043 U			
trans-1,2-Dichloroethene			0.87 U								0.018 U	0.043 U			
trans-1,3-Dichloropropene			0.87 U								0.018 U	0.043 U			
Trichloroethene			0.87 U								0.018 U	0.043 U			
Trichlorofluoromethane			0.87 U												
Vinyl acetate											0.036 U	0.085 U			
Vinyl chloride			1.7 U								0.036 U	0.085 U			
Xylene, o			0.87 U												
Xylenes (m&p)			0.87 U												
Xylenes, Total											0.018 U	0.043 U			
Semivolatile Organic Compounds (mg/kg)															
1,2,4-Trichlorobenzene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
1,2-Dichlorobenzene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
1,2-Diphenylhydrazine	4.1 U	3.7 U	4.8 U	3.1 U											
1,3-Dichlorobenzene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
1,4-Dichlorobenzene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2,2'-Dichlorodiisopropylether	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2,4,5-Trichlorophenol	4.1 U	3.7 U	4.8 U	3.1 U							11 U	7.6 U			
2,4,6-Trichlorophenol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2,4-Dichlorophenol	8.2 U	7.5 U	9.7 U	6.3 U							2.3 U	1.6 U			
2,4-Dimethylphenol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2,4-Dinitrophenol	4.1 U	3.7 U	4.8 U	3.1 U							11 U	7.6 U			
2,4-Dinitrotoluene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2,6-Dinitrotoluene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2-Chloronaphthalene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2-Chlorophenol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2-Methylnaphthalene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2-Methylphenol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
2-Nitroaniline	20 U	19 U	24 U	16 U							11 U	7.6 U			
2-Nitrophenol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
3 & 4 Methylphenol	4.1 U	3.7 U	4.8 U	3.1 U											
3,3'-Dichlorobenzidine	4.1 U	3.7 U	4.8 U	3.1 U							4.6 U	3.1 U			
3-Nitroaniline	20 U	19 U	24 U	16 U							11 U	7.6 U			
4,6-Dinitro-2-methylphenol	20 U	19 U	24 U	16 U							11 U	7.6 U			
4-Bromophenyl phenyl ether	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
4-Chloro-3-methylphenol	8.2 U	7.5 U	9.7 U	6.3 U							2.3 U	1.6 U			
4-Chloroaniline	8.2 U	7.5 U	9.7 U	6.3 U							2.3 U	1.6 U			
4-Chlorophenyl phenyl ether	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
4-Methylphenol											0.22 U	1.6 U			
4-Nitroaniline	20 U	19 U	24 U	16 U							11 U	7.6 U			
4-Nitrophenol	20 U	19 U	24 U	16 U							11 U	7.6 U			
Acenaphthene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Acenaphthylene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Aniline	20 U	19 U	24 U	16 U											
Anthracene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Benzo(a)anthracene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Benzo(a)pyrene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Benzo(b)fluoranthene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Benzo(ghi)perylene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-30S WDW-30 8/30/2000 0-0.5 ft	1120-WDW-31S WDW-31 8/30/2000 0-0.5 ft	1120-WDW-32S (0-6) WDW-32 8/31/2000 0-0.5 ft	1140-WDW-11S WDW-11 8/25/2000 0-0.5 ft	OC-SD-SD1-RISK SD-SD1 11/16/2007 0-0.5 ft	OC-SD-SD1 SD-SD1 11/16/2012 0-0.5 ft	OC-SD-SD1 SD-SD1 11/19/2008 0-0.3 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/11/2011 0-0.5 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/15/2010 0-0.5 ft	OC-SD-SD-SD1-0.0/0.5-RISK SD-SD1 11/11/2009 0-0.5 ft	RSD-01 RSD-01 1/18/2000	RSD-02 RSD-02 1/18/2000	SD-SD1-03-01 SD-SD1 6/17/2003 0-0.25 ft	SD-SD1-03-02 SD-SD1 8/10/2004 0-0.25 ft	SD-SD1-03-03 SD-SD1 5/19/2005 0-0.25 ft
Benzo(k)fluoranthene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Benzoic Acid	20 U	19 U	24 U	16 U							11 U	7.6 U			
Benzyl alcohol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Bis(2-Chloroethoxy)methane	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Bis(2-Chloroethyl)ether	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Bis(2-Ethylhexyl)phthalate	4.1 U	3.7 U	4.8 UB	3.1 UB							14	4			
Butylbenzylphthalate	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Carbazole											2.3 U	1.6 U			
Chrysene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Dibenz(a,h)anthracene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Dibenzofuran	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Diethylphthalate	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Dimethylphthalate	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Di-n-butylphthalate	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Di-n-octylphthalate	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Fluoranthene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Fluorene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Hexachlorobenzene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Hexachlorobutadiene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Hexachlorocyclopentadiene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Hexachloroethane	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Indeno(1,2,3-cd)pyrene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Isophorone	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Naphthalene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Nitrobenzene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
N-Nitrosodimethylamine													0.007 U		
N-Nitrosodi-n-propylamine	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
N-Nitrosodiphenylamine	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Pentachlorophenol	20 U	19 U	24 U	16 U							11 U	7.6 U			
Phenanthrene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Phenol	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Pyrene	4.1 U	3.7 U	4.8 U	3.1 U							2.3 U	1.6 U			
Metals (mg/kg)															
Aluminum			7300		8650	7100 J	11000	11000 J	9300	10100	3600	14000	9750	6200	11000
Antimony											2 U	4 U	0.821 UJ		
Arsenic			4 U										7.77		
Barium											3.4	13	37.6		
Beryllium											0.1 U	0.61	0.164 U		
Cadmium			0.7 U								0.2 U	0.47	0.229		
Calcium											200	900			
Chromium	10	29	19	13	19	67	29 J	30	21	21.5	4.5	13	17.9	19	39
Cobalt											1 U	2 U			
Copper											2.1	17			
Iron			2800		9750	9000	14000	13000 J	11000	14500	270	2100	12200	12000	17000
Lead			100								4.6	7.3	28.8		
Magnesium											88	180			
Manganese											4	22			
Mercury			0.25								0.06 U	0.2 U			
Nickel											2 U	6.7	9.31		
Potassium											99 U	200 U			
Selenium			4 U								1 U	2 U	0.821 U		
Silver											1 U	2 U	0.821 U		
Sodium											99 U	3200			
Thallium											2 U	4 U	0.821 U		

Attachment 1-13
Sediment Data Summary - On-Property West Ditch and West Ditch Wetland
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	1120-WDW-30S WDW-30 8/30/2000 0-0.5 ft	1120-WDW-31S WDW-31 8/30/2000 0-0.5 ft	1120-WDW-32S (0-6) WDW-32 8/31/2000 0-0.5 ft	1140-WDW-11S WDW-11 8/25/2000 0-0.5 ft	OC-SD-SD1-RISK SD-SD1 11/16/2007 0-0.5 ft	OC-SD-SD1 SD-SD1 11/16/2012 0-0.5 ft	OC-SD-SD1 SD-SD1 11/19/2008 0-0.3 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/11/2011 0-0.5 ft	OC-SD-SD1-0.0/0.5 SD-SD1 11/15/2010 0-0.5 ft	OC-SD-SD-SD1-0.0/0.5-RISK SD-SD1 11/11/2009 0-0.5 ft	RSD-01 RSD-01 1/18/2000	RSD-02 RSD-02 1/18/2000	SD-SD1-03-01 SD-SD1 6/17/2003 0-0.25 ft	SD-SD1-03-02 SD-SD1 8/10/2004 0-0.25 ft	SD-SD1-03-03 SD-SD1 5/19/2005 0-0.25 ft
Vanadium											3	27	17		
Zinc											5.2	14	47.4		
Inorganics (%)															
Total Organic Carbon														1.6	

Notes:
mg/kg - milligram per kilogram
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
F - The result is estimated due to matrix spike recovery outside of control limits
C - The result is estimated due to surrogate recovery outside of control limits

B - Parameter found in both the associated blank and the sample

Attachment 1-14
Sediment Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD4 SD-SD4 11/16/2007	OC-SD-SD4 SD-SD4 11/16/2012 0-0.5 ft	OC-SD-SD4 SD-SD4 11/19/2008 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/11/2011 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/15/2010 0-0.5 ft	OC-SD-SD-501-XXX SD-501 12/17/2012	OC-SD-SD-502-XXX SD-502 12/17/2012	OC-SD-SD-SD4-0.0/0.5 SD-SD4 11/11/2009 0-0.5 ft	SD-SD4-03-03 SD-SD4 5/19/2005 0-0.25
Volatile Organic Compounds (mg/kg)									
1,1,1,2-Tetrachloroethane						0.0025 U	0.0029 U		
1,1,1-Trichloroethane						0.0025 U	0.0029 U		
1,1,2,2-Tetrachloroethane						0.0025 U	0.0029 U		
1,1,2-Trichloro-1,2,2-Trifluoroethane						0.0025 U	0.0029 U		
1,1,2-Trichloroethane						0.0025 U	0.0029 U		
1,1-Dichloroethane						0.0025 U	0.0029 U		
1,1-Dichloroethene						0.0025 U	0.0029 U		
1,1-Dichloropropene						0.0025 U	0.0029 U		
1,2,3-Trichlorobenzene						0.0025 U	0.0029 U		
1,2,3-Trichloropropane						0.0025 U	0.0029 U		
1,2,4-Trichlorobenzene						0.0025 U	0.0029 U		
1,2,4-Trimethylbenzene						0.0025 U	0.0029 U		
1,2-Dibromo-3-chloropropane						0.025 U	0.029 U		
1,2-Dibromoethane						0.0025 U	0.0029 U		
1,2-Dichlorobenzene						0.0025 U	0.0029 U		
1,2-Dichloroethane						0.0025 U	0.0029 U		
1,2-Dichloropropane						0.0025 U	0.0029 U		
1,3,5-Trimethylbenzene						0.0025 U	0.0029 U		
1,3-Dichlorobenzene						0.0025 U	0.0029 U		
1,3-Dichloropropane						0.0025 U	0.0029 U		
1,4-Dichlorobenzene						0.0025 U	0.0029 U		
1,4-Dioxane						0.25 UJ	0.29 UJ		
2,2-Dichloropropane						0.0025 U	0.0029 U		
2,4,4-Trimethyl-1-pentene						0.0051 U	0.011		
2,4,4-Trimethyl-2-pentene						0.0051 U	0.0088		
2-Butanone						0.027	0.025 J		
2-Chlorotoluene						0.0025 U	0.0029 U		
2-Hexanone						0.025 U	0.029 U		
4-Chlorotoluene						0.0025 U	0.0029 U		
4-iso-Propyltoluene						0.0025 U	0.0029 U		
4-Methyl-2-pentanone						0.025 U	0.029 U		
Acetic acid, methyl ester						0.051 U	0.058 U		
Acetone						0.12 J	0.11 J		
Benzene						0.0025 U	0.0029 U		
Bromobenzene						0.0025 U	0.0029 U		
Bromochloromethane						0.0025 U	0.0029 U		
Bromodichloromethane						0.0025 U	0.0029 U		

Attachment 1-14
Sediment Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD4 SD-SD4 11/16/2007	OC-SD-SD4 SD-SD4 11/16/2012 0-0.5 ft	OC-SD-SD4 SD-SD4 11/19/2008 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/11/2011 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/15/2010 0-0.5 ft	OC-SD-SD-501-XXX SD-501 12/17/2012	OC-SD-SD-502-XXX SD-502 12/17/2012	OC-SD-SD-SD4-0.0/0.5 SD-SD4 11/11/2009 0-0.5 ft	SD-SD4-03-03 SD-SD4 5/19/2005 0-0.25
Bromoform						0.0025 U	0.0029 U		
Bromomethane						0.0051 UJ	0.0058 UJ		
Butane, 2-methoxy-2-methyl-						0.0025 U	0.0029 U		
Carbon disulfide						0.0025 U	0.0029 U		
Carbon tetrachloride						0.0025 U	0.0029 U		
Chlorobenzene						0.0025 U	0.0029 U		
Chlorodibromomethane						0.0025 U	0.0029 U		
Chloroethane						0.0051 U	0.0058 U		
Chloroform						0.0025 U	0.0029 U		
Chloromethane						0.0051 U	0.0058 U		
Cis-1,2-Dichloroethene						0.0025 U	0.0029 U		
cis-1,3-Dichloropropene						0.0025 U	0.0029 U		
Cyclohexane						0.025 U	0.029 U		
Dibromomethane						0.0025 U	0.0029 U		
Dichlorodifluoromethane						0.0051 U	0.0058 U		
Diethyl ether						0.0025 U	0.0029 U		
Ethyl benzene						0.0025 U	0.0029 U		
Ethyl-t-Butyl Ether						0.0025 U	0.0029 U		
Hexachlorobutadiene						0.0025 U	0.0029 U		
Isopropyl ether						0.0025 U	0.0029 U		
Isopropylbenzene						0.0025 U	0.0029 U		
Methyl cyclohexane						0.0025 U	0.0029 U		
Methyl Tertbutyl Ether						0.0017 J	0.0029 U		
Methylene chloride						0.0025 U	0.0029 U		
Naphthalene						0.025 U	0.029 U		
n-Butylbenzene						0.0025 U	0.0029 U		
Propylbenzene						0.0025 U	0.0029 U		
sec-Butylbenzene						0.0025 U	0.0029 U		
Styrene						0.0025 U	0.0029 U		
tert-Butylbenzene						0.0025 U	0.0029 U		
Tetrachloroethene						0.0025 U	0.0029 U		
Tetrahydrofuran						0.051 U	0.058 U		
Toluene						0.00098 J	0.0029 U		
trans-1,2-Dichloroethene						0.0025 U	0.0029 U		
trans-1,3-Dichloropropene						0.0025 U	0.0029 U		
Trichloroethene						0.0025 U	0.0029 U		
Trichlorofluoromethane						0.0051 U	0.0058 U		
Vinyl chloride						0.0025 U	0.0029 U		

Attachment 1-14
Sediment Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD4 SD-SD4 11/16/2007	OC-SD-SD4 SD-SD4 11/16/2012 0-0.5 ft	OC-SD-SD4 SD-SD4 11/19/2008 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/11/2011 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/15/2010 0-0.5 ft	OC-SD-SD-501-XXX SD-501 12/17/2012	OC-SD-SD-502-XXX SD-502 12/17/2012	OC-SD-SD-SD4-0.0/0.5 SD-SD4 11/11/2009 0-0.5 ft	SD-SD4-03-03 SD-SD4 5/19/2005 0-0.25
Xylene, o						0.0025 U	0.0029 U		
Xylenes (m&p)						0.0051 U	0.0058 U		
Semivolatile Organic Compounds (mg/kg)									
1,2,4,5-Tetrachlorobenzene						0.46 U	0.48 U		
1,2,4-Trichlorobenzene						0.46 U	0.48 U		
1-Methylnaphthalene						0.46 U	0.48 U		
2,3,4,6-Tetrachlorophenol						0.46 U	0.48 U		
2,4,5-Trichlorophenol						0.46 U	0.48 U		
2,4,6-Trichlorophenol						0.46 U	0.48 U		
2,4-Dichlorophenol						0.46 U	0.48 U		
2,4-Dimethylphenol						0.46 U	0.48 U		
2,4-Dinitrophenol						0.46 UJ	0.48 UJ		
2,4-Dinitrotoluene						0.46 U	0.48 U		
2,6-Dinitrotoluene						0.46 U	0.48 U		
2-Chloronaphthalene						0.46 U	0.48 U		
2-Chlorophenol						0.46 U	0.48 U		
2-Methylnaphthalene						0.46 U	0.48 U		
2-Methylphenol						0.46 U	0.48 U		
2-Nitroaniline						2.3 U	2.4 U		
2-Nitrophenol						0.46 U	0.48 U		
3 & 4 Methylphenol						4.3	6.1		
3,3'-Dichlorobenzidine						0.91 U	0.95 U		
3-Nitroaniline						2.3 U	2.4 U		
4,6-Dinitro-2-methylphenol						2.3 U	2.4 U		
4-Bromophenyl phenyl ether						0.46 U	0.48 U		
4-Chloro-3-methylphenol						0.91 U	0.95 U		
4-Chloroaniline						0.91 U	0.95 U		
4-Chlorophenyl phenyl ether						0.46 U	0.48 U		
4-Nitroaniline						2.3 U	2.4 U		
4-Nitrophenol						2.3 UJ	2.4 UJ		
Acenaphthene						0.46 U	0.48 U		
Acenaphthylene						0.46 U	0.48 U		
Acetophenone						0.15 J	0.26 J		
Aniline						0.46 U	0.48 U		
Anthracene						0.46 U	0.48 U		
Atrazine						0.46 U	0.48 U		
Azobenzene						0.46 U	0.48 U		
Benzaldehyde						1.4	1.9		

Attachment 1-14
Sediment Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD4 SD-SD4 11/16/2007	OC-SD-SD4 SD-SD4 11/16/2012 0-0.5 ft	OC-SD-SD4 SD-SD4 11/19/2008 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/11/2011 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/15/2010 0-0.5 ft	OC-SD-SD-501-XXX SD-501 12/17/2012	OC-SD-SD-502-XXX SD-502 12/17/2012	OC-SD-SD-SD4-0.0/0.5 SD-SD4 11/11/2009 0-0.5 ft	SD-SD4-03-03 SD-SD4 5/19/2005 0-0.25
Benzo(a)anthracene						0.46 U	0.48 U		
Benzo(a)pyrene						0.46 U	0.48 U		
Benzo(b)fluoranthene						0.46 U	0.14 J		
Benzo(ghi)perylene						0.46 U	0.48 U		
Benzo(k)fluoranthene						0.46 U	0.48 U		
Benzoic Acid						2.3 U	2.4 U		
Benzyl alcohol						0.91 U	0.95 U		
Biphenyl						0.46 U	0.48 U		
Bis(2-Chloroethoxy)methane						0.46 U	0.48 U		
Bis(2-Chloroethyl)ether						0.46 U	0.48 U		
Bis(2-Chloroisopropyl)ether						0.46 U	0.48 U		
Bis(2-Ethylhexyl)phthalate						2.3 U	2.4 U		
Butylbenzylphthalate						0.46 U	0.48 U		
Caprolactam						0.46 U	0.48 U		
Carbazole						0.46 U	0.48 U		
Chrysene						0.46 U	0.48 U		
Dibenz(a,h)anthracene						0.46 U	0.48 U		
Dibenzofuran						0.46 U	0.48 U		
Diethylphthalate						0.46 U	0.48 U		
Dimethylphthalate						0.46 U	0.48 U		
Di-n-butylphthalate						2.3 U	2.4 U		
Di-n-octylphthalate						0.46 U	0.48 U		
Diphenyl ether						0.46 U	0.48 U		
Diphenylmethanone						0.46 U	0.48 U		
Fluoranthene						0.21 J	0.29 J		
Fluorene						0.46 U	0.48 U		
Hexachlorobenzene						0.46 U	0.48 U		
Hexachlorocyclopentadiene						0.91 U	0.95 U		
Hexachloroethane						0.46 U	0.48 U		
Indeno(1,2,3-cd)pyrene						0.46 U	0.48 U		
Isophorone						0.46 U	0.48 U		
Nitrobenzene						0.46 U	0.48 U		
N-Nitrosodimethylamine						0.0069 UJ	0.007 UJ		
N-Nitrosodi-n-propylamine						0.46 U	0.48 U		
N-Nitrosodiphenylamine						0.46 U	0.48 U		
Pentachlorophenol						0.46 U	0.48 U		
Phenanthrene						0.46 U	0.21 J		
Phenol						1.7	2.2		

Attachment 1-14
Sediment Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD4 SD-SD4 11/16/2007	OC-SD-SD4 SD-SD4 11/16/2012 0-0.5 ft	OC-SD-SD4 SD-SD4 11/19/2008 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/11/2011 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/15/2010 0-0.5 ft	OC-SD-SD-501-XXX SD-501 12/17/2012	OC-SD-SD-502-XXX SD-502 12/17/2012	OC-SD-SD-SD4-0.0/0.5 SD-SD4 11/11/2009 0-0.5 ft	SD-SD4-03-03 SD-SD4 5/19/2005 0-0.25
Pyrene						0.18 J	0.23 J		
Metals (mg/kg)									
Aluminum	8700	7700 J	10000	9900 J	9700	6500 J	6500 J	12000	9400
Antimony						0.68 U	0.72 U		
Arsenic						6.2	8.1		
Barium						45	46		
Beryllium						0.094 J	0.09 J		
Cadmium						0.21 J	0.26 J		
Calcium						3900	3800		
Chromium	18	24	26 J	140	23	19	27	25	43
Chromium, Hexavalent						0.21 J	0.27 J		
Cobalt						4	3.9		
Copper						21	21		
Iron	12000	9900	14000	17000 J	14000	9500 J	9200 J	15000	14000
Lead						51	50		
Magnesium						2000	1800		
Manganese						590	440		
Mercury						0.07 J	0.057 J		
Nickel						8.7	8.7		
Potassium						790	730		
Selenium						0.7 J	0.72 UJ		
Silver						0.68 UJ	0.72 UJ		
Sodium						140 J	150 J		
Thallium						1.4 U	1.4 U		
Tin						2.1 J	2.2 J		
Vanadium						17	16		
Zinc						65	65		
Inorganics (mg/kg)									
Chloride						24	18		
Nitrogen, as Ammonia						17	35		
Oxidation Reduction Potential (mV)						-31	-32		
pH (units)						7.32	7.23		
Sulfate						510	1200		
Total Organic Carbon						90	80		

Attachment 1-14
Sediment Data Summary - Central Pond
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD4 SD-SD4 11/16/2007	OC-SD-SD4 SD-SD4 11/16/2012 0-0.5 ft	OC-SD-SD4 SD-SD4 11/19/2008 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/11/2011 0-0.5 ft	OC-SD-SD4-0.0/0.5 SD-SD4 11/15/2010 0-0.5 ft	OC-SD-SD-501-XXX SD-501 12/17/2012	OC-SD-SD-502-XXX SD-502 12/17/2012	OC-SD-SD-SD4-0.0/0.5 SD-SD4 11/11/2009 0-0.5 ft	SD-SD4-03-03 SD-SD4 5/19/2005 0-0.25

Notes:
mg/kg - milligram per kilogram
mV - millivolts
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.

Attachment 1-15
Sediment Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-503-XXX SD-503 12/17/2012	OC-SD-SD-504-XXX SD-504 12/17/2012
Volatile Organic Compounds (mg/kg)		
1,1,1,2-Tetrachloroethane	0.0034 U	0.0038 U
1,1,1-Trichloroethane	0.0034 U	0.0038 U
1,1,2,2-Tetrachloroethane	0.0034 U	0.0038 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.0034 U	0.0038 U
1,1,2-Trichloroethane	0.0034 U	0.0038 U
1,1-Dichloroethane	0.0034 U	0.0038 U
1,1-Dichloroethene	0.0034 U	0.0038 U
1,1-Dichloropropene	0.0034 U	0.0038 U
1,2,3-Trichlorobenzene	0.0034 U	0.0038 U
1,2,3-Trichloropropane	0.0034 U	0.0038 U
1,2,4-Trichlorobenzene	0.0034 U	0.0038 U
1,2,4-Trimethylbenzene	0.0034 U	0.0038 U
1,2-Dibromo-3-chloropropane	0.034 U	0.038 U
1,2-Dibromoethane	0.0034 U	0.0038 U
1,2-Dichlorobenzene	0.0034 U	0.0038 U
1,2-Dichloroethane	0.0034 U	0.0038 U
1,2-Dichloropropane	0.0034 U	0.0038 U
1,3,5-Trimethylbenzene	0.0034 U	0.0038 U
1,3-Dichlorobenzene	0.0034 U	0.0038 U
1,3-Dichloropropane	0.0034 U	0.0038 U
1,4-Dichlorobenzene	0.0034 U	0.0038 U
1,4-Dioxane	0.34 UJ	0.38 UJ
2,2-Dichloropropane	0.0034 U	0.0038 U
2,4,4-Trimethyl-1-pentene	0.0024 J	0.0078
2,4,4-Trimethyl-2-pentene	0.0014 J	0.0039 J
2-Butanone	0.035	0.033 J
2-Chlorotoluene	0.0034 U	0.0038 U
2-Hexanone	0.034 U	0.038 U
4-Chlorotoluene	0.0034 U	0.0038 U
4-iso-Propyltoluene	0.0034 U	0.0038 U
4-Methyl-2-pentanone	0.034 U	0.038 U
Acetic acid, methyl ester	0.068 U	0.075 U
Acetone	0.15 J	0.13 J
Benzene	0.0034 U	0.0038 U
Bromobenzene	0.0034 U	0.0038 U
Bromochloromethane	0.0034 U	0.0038 U
Bromodichloromethane	0.0034 U	0.0038 U
Bromoform	0.0034 U	0.0038 U
Bromomethane	0.0068 UJ	0.0075 UJ
Butane, 2-methoxy-2-methyl-	0.0034 U	0.0038 U
Carbon disulfide	0.0034 U	0.0038 U
Carbon tetrachloride	0.0034 U	0.0038 U
Chlorobenzene	0.0034 U	0.0038 U
Chlorodibromomethane	0.0034 U	0.0038 U
Chloroethane	0.0068 U	0.0075 U
Chloroform	0.0034 U	0.0038 U
Chloromethane	0.0068 U	0.0075 U
Cis-1,2-Dichloroethene	0.0034 U	0.0038 U
cis-1,3-Dichloropropene	0.0034 U	0.0038 U
Cyclohexane	0.034 U	0.038 U
Dibromomethane	0.0034 U	0.0038 U
Dichlorodifluoromethane	0.0068 U	0.0075 U
Diethyl ether	0.0034 U	0.0038 U
Ethyl benzene	0.0034 U	0.0038 U
Ethyl-t-Butyl Ether	0.0034 U	0.0038 U

Attachment 1-15
Sediment Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-503-XXX SD-503 12/17/2012	OC-SD-SD-504-XXX SD-504 12/17/2012
Hexachlorobutadiene	0.0034 U	0.0038 U
Isopropyl ether	0.0034 U	0.0038 U
Isopropylbenzene	0.0034 U	0.0038 U
Methyl cyclohexane	0.0034 U	0.0038 U
Methyl Tertbutyl Ether	0.0034 U	0.0038 U
Methylene chloride	0.0034 U	0.0038 U
Naphthalene	0.034 U	0.038 U
n-Butylbenzene	0.0034 U	0.0038 U
Propylbenzene	0.0034 U	0.0038 U
sec-Butylbenzene	0.0034 U	0.0038 U
Styrene	0.0034 U	0.0038 U
tert-Butylbenzene	0.0034 U	0.0038 U
Tetrachloroethene	0.0034 U	0.0038 U
Tetrahydrofuran	0.068 U	0.075 U
Toluene	0.0034 U	0.0038 U
trans-1,2-Dichloroethene	0.0034 U	0.0038 U
trans-1,3-Dichloropropene	0.0034 U	0.0038 U
Trichloroethene	0.0034 U	0.0038 U
Trichlorofluoromethane	0.0068 U	0.0075 U
Vinyl chloride	0.0034 U	0.0038 U
Xylene, o	0.0034 U	0.0038 U
Xylenes (m&p)	0.0068 U	0.0075 U
Semivolatile Organic Compounds (mg/kg)		
1,2,4,5-Tetrachlorobenzene	0.52 U	0.58 U
1,2,4-Trichlorobenzene	0.52 U	0.58 U
1-Methylnaphthalene	0.52 U	0.58 U
2,3,4,6-Tetrachlorophenol	0.52 U	0.58 U
2,4,5-Trichlorophenol	0.52 U	0.58 U
2,4,6-Trichlorophenol	0.52 U	0.58 U
2,4-Dichlorophenol	0.52 U	0.58 U
2,4-Dimethylphenol	0.52 U	0.58 U
2,4-Dinitrophenol	0.52 UJ	0.58 UJ
2,4-Dinitrotoluene	0.52 U	0.58 U
2,6-Dinitrotoluene	0.52 U	0.58 U
2-Chloronaphthalene	0.52 U	0.58 U
2-Chlorophenol	0.52 U	0.58 U
2-Methylnaphthalene	0.52 U	0.58 U
2-Methylphenol	0.52 U	0.58 U
2-Nitroaniline	2.6 U	2.9 U
2-Nitrophenol	0.52 U	0.58 U
3 & 4 Methylphenol	4	1.8
3,3'-Dichlorobenzidine	1 U	1.2 U
3-Nitroaniline	2.6 U	2.9 U
4,6-Dinitro-2-methylphenol	2.6 U	2.9 U
4-Bromophenyl phenyl ether	0.52 U	0.58 U
4-Chloro-3-methylphenol	1 U	1.2 U
4-Chloroaniline	1 U	1.2 U
4-Chlorophenyl phenyl ether	0.52 U	0.58 U
4-Nitroaniline	2.6 U	2.9 U
4-Nitrophenol	2.6 UJ	2.9 UJ
Acenaphthene	0.52 U	0.58 U
Acenaphthylene	0.52 U	0.58 U
Acetophenone	0.16 J	0.58 U
Aniline	0.52 U	0.58 U
Anthracene	0.52 U	0.58 U
Atrazine	0.52 U	0.58 U

Attachment 1-15
Sediment Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-503-XXX SD-503 12/17/2012	OC-SD-SD-504-XXX SD-504 12/17/2012
Azobenzene	0.52 U	0.58 U
Benzaldehyde	1.3	0.62
Benzo(a)anthracene	0.52 U	0.58 U
Benzo(a)pyrene	0.52 U	0.22 J
Benzo(b)fluoranthene	0.52 U	0.58 U
Benzo(ghi)perylene	0.52 U	0.58 U
Benzo(k)fluoranthene	0.52 U	0.58 U
Benzoic Acid	2.6 U	2.9 U
Benzyl alcohol	1 U	1.2 U
Biphenyl	0.52 U	0.58 U
Bis(2-Chloroethoxy)methane	0.52 U	0.58 U
Bis(2-Chloroethyl)ether	0.52 U	0.58 U
Bis(2-Chloroisopropyl)ether	0.52 U	0.58 U
Bis(2-Ethylhexyl)phthalate	3.1	2.9 U
Butylbenzylphthalate	0.52 U	0.58 U
Caprolactam	0.52 U	0.58 U
Carbazole	0.52 U	0.58 U
Chrysene	0.52 U	0.58 U
Dibenz(a,h)anthracene	0.52 U	0.58 U
Dibenzofuran	0.52 U	0.58 U
Diethylphthalate	0.52 U	0.58 U
Dimethylphthalate	0.52 U	0.58 U
Di-n-butylphthalate	2.6 U	2.9 U
Di-n-octylphthalate	0.52 U	0.58 U
Diphenyl ether	0.52 U	0.58 U
Diphenylmethanone	0.52 U	0.58 U
Fluoranthene	0.52 U	0.58 U
Fluorene	0.52 U	0.58 U
Hexachlorobenzene	0.52 U	0.58 U
Hexachlorocyclopentadiene	1 U	1.2 U
Hexachloroethane	0.52 U	0.58 U
Indeno(1,2,3-cd)pyrene	0.52 U	0.58 U
Isophorone	0.52 U	0.58 U
Nitrobenzene	0.52 U	0.58 U
N-Nitrosodimethylamine	0.0076 UJ	0.0091 UJ
N-Nitrosodi-n-propylamine	0.52 U	0.58 U
N-Nitrosodiphenylamine	0.33 J	0.58 U
Pentachlorophenol	0.52 U	0.58 U
Phenanthrene	0.52 U	0.58 U
Phenol	1.9	1.4
Pyrene	0.52 U	0.58 U
Metals (mg/kg)		
Aluminum	9100 J	7800 J
Antimony	0.69 U	0.79 U
Arsenic	12	9.4
Barium	48	51
Beryllium	0.12 J	0.089 J
Cadmium	0.55	0.56
Calcium	4700	4800
Chromium	50	33
Chromium, Hexavalent	0.31 UJ	0.36 UJ
Cobalt	4.8	4.5
Copper	19	25

Attachment 1-15
Sediment Data Summary - Storm Water Detention Basin
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-SD-503-XXX SD-503 12/17/2012	OC-SD-SD-504-XXX SD-504 12/17/2012
Iron	12000 J	11000 J
Lead	26	23
Magnesium	2300	2000
Manganese	400	440
Mercury	0.075 J	0.062 J
Nickel	11	9.9
Potassium	1100	740
Selenium	0.69 UJ	0.79 UJ
Silver	0.69 UJ	0.79 UJ
Sodium	110 J	150 J
Thallium	1.4 U	1.6 U
Tin	2.2 J	2.3 J
Vanadium	22	19
Zinc	55	73
Inorganics (mg/kg)		
Chloride	6.3 J	13
Nitrogen, as Ammonia	14	22
Oxidation Reduction Potential (mV)	-32	-31
pH (units)	6.98	6.99
Sulfate	900	1900
Total Organic Carbon	110	60

Notes:
mg/kg - milligram per kilogram
mV - millivolts
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.

Attachment 1-16
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-OPWD-1-XXX OPWD-1 12/10/2010 0-0.5 ft	OC-SD-OPWD-2-XXX OPWD-2 12/10/2010 0-0.5 ft	OC-SD-OPWD-SD/SO/SW-S-XXX OPWD-SD-S 12/10/2010 0-0.5 ft
Volatile Organic Compounds (mg/kg)			
1,1,1,2-Tetrachloroethane	0.0035 U	0.0067 U	R
1,1,1-Trichloroethane	0.0035 U	0.0067 U	R
1,1,2,2-Tetrachloroethane	0.0035 U	0.0067 U	R
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.017 U	0.034 U	R
1,1,2-Trichloroethane	0.0035 U	0.0067 U	R
1,1-Dichloroethane	0.0035 U	0.0067 U	R
1,1-Dichloroethene	0.0035 U	0.0067 U	R
1,1-Dichloropropene	0.0035 U	0.0067 U	R
1,2,3-Trichlorobenzene	0.0035 U	0.0067 U	R
1,2,3-Trichloropropane	0.0035 U	0.0067 U	R
1,2,4-Trichlorobenzene	0.0035 U	0.0067 U	0.0038 J
1,2,4-Trimethylbenzene	0.0035 U	0.0067 U	R
1,2-Dibromo-3-chloropropane	0.035 U	0.067 U	R
1,2-Dibromoethane	0.0035 U	0.0067 U	R
1,2-Dichlorobenzene	0.0035 U	0.0067 U	R
1,2-Dichloroethane	0.0035 U	0.0067 U	R
1,2-Dichloropropane	0.0035 U	0.0067 U	R
1,3,5-Trimethylbenzene	0.0035 U	0.0067 U	R
1,3-Dichlorobenzene	0.0035 U	0.0067 U	R
1,3-Dichloropropane	0.0035 U	0.0067 U	R
1,4-Dichlorobenzene	0.0035 U	0.0067 U	R
1,4-Dioxane	0.35 UJ	0.67 UJ	R
2,2-Dichloropropane	0.0035 U	0.0067 U	R
2,4,4-Trimethyl-1-pentene	0.007 U	0.013 U	0.06 J
2,4,4-Trimethyl-2-pentene	0.007 U	0.013 U	0.008 J
2-Butanone	0.035 U	0.067 U	0.043 J
2-Chlorotoluene	0.0035 U	0.0067 U	R
2-Hexanone	0.035 U	0.067 U	R
4-Chlorotoluene	0.0035 U	0.0067 U	R
4-iso-Propyltoluene	0.0035 U	0.0067 U	R
4-Methyl-2-pentanone	0.035 U	0.067 U	R
Acetaldehyde	0.34 U	0.54 U	
Acetic acid, methyl ester	0.07 UJ	0.13 UJ	R
Acetone	0.35 UJ	0.67 UJ	R
Benzene	0.0035 U	0.0067 U	R
Bromobenzene	0.0035 U	0.0067 U	R
Bromochloromethane	0.0035 U	0.0067 U	R
Bromodichloromethane	0.0035 U	0.0067 U	R
Bromoform	0.0035 U	0.0067 U	R
Bromomethane	0.007 U	0.013 U	R
Butane, 2-methoxy-2-methyl-	0.0035 U	0.0067 U	R
Carbon disulfide	0.0035 U	0.0067 U	R
Carbon tetrachloride	0.0035 U	0.0067 U	R
Chlorobenzene	0.0035 U	0.0067 U	R
Chlorodibromomethane	0.0035 U	0.0067 U	R
Chloroethane	0.007 U	0.013 U	R
Chloroform	0.0035 U	0.0067 U	R
Chloromethane	0.007 U	0.013 U	R
Cis-1,2-Dichloroethene	0.0035 U	0.0067 U	R
cis-1,3-Dichloropropene	0.0035 U	0.0067 U	R
Cyclohexane	0.035 U	0.067 U	R

Attachment 1-16
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-OPWD-1-XXX OPWD-1 12/10/2010 0-0.5 ft	OC-SD-OPWD-2-XXX OPWD-2 12/10/2010 0-0.5 ft	OC-SD-OPWD-SD/SO/SW-S-XXX OPWD-SD-S 12/10/2010 0-0.5 ft
Dibromomethane	0.0035 U	0.0067 U	R
Dichlorodifluoromethane	0.007 UJ	0.013 UJ	R
Diethyl ether	0.0035 U	0.0067 U	R
Ethyl benzene	0.0035 U	0.0067 U	R
Ethyl-t-Butyl Ether	0.0035 U	0.0067 U	R
Formaldehyde	0.4	0.61	
Hexachlorobutadiene	0.0035 U	0.0067 U	R
Isopropyl ether	0.0035 U	0.0067 U	R
Isopropylbenzene	0.0035 U	0.0067 U	R
Methyl cyclohexane	0.0035 U	0.0067 U	R
Methyl Tertbutyl Ether	0.0035 U	0.0067 U	R
Methylene chloride	0.014 U	0.027 U	R
Naphthalene	0.035 U	0.067 U	R
n-Butylbenzene	0.0035 U	0.0067 U	R
Propylbenzene	0.0035 U	0.0067 U	R
sec-Butylbenzene	0.0035 U	0.0067 U	R
Styrene	0.0035 U	0.0067 U	R
tert-Butylbenzene	0.0035 U	0.0067 U	R
Tetrachloroethene	0.0035 U	0.0067 U	R
Tetrahydrofuran	0.035 UJ	0.067 UJ	R
Toluene	0.0035 U	0.0067 U	R
trans-1,2-Dichloroethene	0.0035 U	0.0067 U	R
trans-1,3-Dichloropropene	0.0035 U	0.0067 U	R
Trichloroethene	0.0035 U	0.0067 U	R
Trichlorofluoromethane	0.007 U	0.013 U	R
Vinyl chloride	0.0035 U	0.0067 U	R
Xylene, o	0.0035 U	0.0067 U	R
Xylenes (m&p)	0.007 U	0.013 U	R
Semivolatile Organic Compounds (mg/kg)			
1,2,4,5-Tetrachlorobenzene	0.056 U	0.087 U	R
1,2,4-Trichlorobenzene	0.056 U	0.027 J	0.066 J
1,2-Dichlorobenzene	0.056 U	0.087 U	R
1,3-Dichlorobenzene	0.056 U	0.087 U	R
1,4-Dichlorobenzene	0.056 U	0.087 U	R
1-Methylnaphthalene	0.056 U	0.087 U	R
2,3,4,6-Tetrachlorophenol	0.056 U	0.087 U	R
2,4,5-Trichlorophenol	0.056 U	0.087 U	R
2,4,6-Trichlorophenol	0.056 U	0.087 U	R
2,4-Dichlorophenol	0.056 U	0.087 U	R
2,4-Dimethylphenol	0.056 U	0.087 U	R
2,4-Dinitrophenol	0.056 U	0.087 U	R
2,4-Dinitrotoluene	0.056 U	0.087 U	R
2,6-Dinitrotoluene	0.056 U	0.087 U	R
2-Chloronaphthalene	0.056 U	0.087 U	R
2-Chlorophenol	0.056 U	0.087 U	R
2-Methylnaphthalene	0.056 U	0.087 U	R
2-Methylphenol	0.056 U	0.087 U	R
2-Nitroaniline	0.28 U	0.44 U	R
2-Nitrophenol	0.056 U	0.087 U	R
3 & 4 Methylphenol	0.056 U	0.087 U	R
3,3'-Dichlorobenzidine	0.11 U	0.17 U	R
3-Nitroaniline	0.28 U	0.44 U	R

Attachment 1-16
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-OPWD-1-XXX OPWD-1 12/10/2010 0-0.5 ft	OC-SD-OPWD-2-XXX OPWD-2 12/10/2010 0-0.5 ft	OC-SD-OPWD-SD/SO/SW-S-XXX OPWD-SD-S 12/10/2010 0-0.5 ft
4,6-Dinitro-2-methylphenol	0.28 U	0.44 U	R
4-Bromophenyl phenyl ether	0.056 U	0.087 U	R
4-Chloro-3-methylphenol	0.11 U	0.17 U	R
4-Chloroaniline	0.11 U	0.17 U	R
4-Chlorophenyl phenyl ether	0.056 U	0.087 U	0.061 J
4-Nitroaniline	0.28 U	0.44 U	R
4-Nitrophenol	0.28 U	0.44 U	R
Acenaphthene	0.056 U	0.087 U	R
Acenaphthylene	0.056 U	0.087 U	R
Acetophenone	0.056 U	0.087 U	R
Aniline	0.056 U	0.087 U	R
Anthracene	0.056 U	0.087 U	R
Atrazine	0.056 U	0.087 U	R
Azobenzene	0.056 U	0.087 U	R
Benzaldehyde	0.056 U	0.087 U	R
Benzo(a)anthracene	0.17	0.14	0.098 J
Benzo(a)pyrene	0.2	0.18	0.14 J
Benzo(b)fluoranthene	0.3	0.31	R
Benzo(ghi)perylene	0.12	0.15	0.14 J
Benzo(k)fluoranthene	0.18	0.16	R
Benzoic Acid	0.054 J	0.26 J	0.42 J
Benzyl alcohol	0.11 U	0.17 U	R
Biphenyl	0.056 U	0.087 U	R
Bis(2-Chloroethoxy)methane	0.056 U	0.087 U	R
Bis(2-Chloroethyl)ether	0.056 U	0.087 U	R
Bis(2-Chloroisopropyl)ether	0.056 U	0.087 U	R
Bis(2-Ethylhexyl)phthalate	0.11	0.047 J	0.12 J
Butylbenzylphthalate	0.056 U	0.087 U	R
Caprolactam	0.056 UJ	0.087 UJ	R
Carbazole	0.039 J	0.051 J	0.044 J
Chrysene	0.25	0.28	0.21 J
Dibenz(a,h)anthracene	0.035 J	0.061 J	R
Dibenzofuran	0.056 U	0.087 U	R
Diethylphthalate	0.056 U	0.087 U	R
Dimethylphthalate	0.056 U	0.087 U	R
Di-n-butylphthalate	0.056 UJ	0.087 U	R
Di-n-octylphthalate	0.056 U	0.087 U	R
Diphenyl ether	0.094	0.087 U	0.86 J
Diphenylmethanone	0.028 J	0.087 U	0.2 J
Fluoranthene	0.44	0.59	0.34 J
Fluorene	0.056 U	0.087 U	R
Hexachlorobenzene	0.056 U	0.087 U	R
Hexachlorobutadiene	0.056 U	0.087 U	R
Hexachlorocyclopentadiene	0.11 U	0.17 U	R
Hexachloroethane	0.056 U	0.087 U	R
Indeno(1,2,3-cd)pyrene	0.12	0.14	0.14 J
Isophorone	0.056 U	0.087 U	R
Naphthalene	0.13 U	0.21 U	R
Nitrobenzene	0.056 U	0.087 U	R
N-Nitrosodimethylamine	0.056 U	0.087 U	R
N-Nitrosodi-n-propylamine	0.056 U	0.087 U	R
N-Nitrosodiphenylamine	0.098	0.087 U	0.8 J

Attachment 1-16
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-OPWD-1-XXX OPWD-1 12/10/2010 0-0.5 ft	OC-SD-OPWD-2-XXX OPWD-2 12/10/2010 0-0.5 ft	OC-SD-OPWD-SD/SO/SW-S-XXX OPWD-SD-S 12/10/2010 0-0.5 ft
Pentachlorophenol	0.056 U	0.087 U	R
Phenanthrene	0.12	0.18	0.1 J
Phenol	0.056 U	0.087 U	R
Pyrene	0.42	0.44	0.35 J
Metals (mg/kg)			
Aluminum	13000	24000	14000 J
Antimony	0.95 UJ	1.4 UJ	R
Arsenic	14	9.3	6.7 J
Barium	9.1 J	16 J	10 J
Beryllium	1.1	1.4	1.1 J
Cadmium	0.33 J	0.099 J	0.62 J
Calcium	480 J	850	2000 J
Chromium	1400	250	2400 J
Chromium, Hexavalent			7.1 U
Cobalt	4.4	3.2	15 J
Copper	16	19	39 J
Iron	8400	6300	13000 J
Lead	8	14	14 J
Magnesium	830 J	1100 J	1000 J
Manganese	40 J	55 J	160 J
Mercury	0.12 U	0.17 U	R
Nickel	12	10	15 J
Potassium	1900	1200	1400 J
Selenium	0.95 U	1.4 U	R
Silver	26	3.7	41 J
Sodium	74 J	88 J	360 J
Thallium	1.9 U	2.8 U	R
Tin	9.5 U	14 U	R
Vanadium	9.2	15	11 J
Zinc	23 J	24 J	100 J
Inorganics (mg/kg)			
Chloride	110	91	240
Nitrate as N	8.4 U	13 U	17 U
Nitrite as N	1.7 U	2.6 U	3.4 U
Nitrogen, as Ammonia	93 J	130 J	540 J
Oxidation Reduction Potential (mV)			150
pH (units)			7.19 HF
Sulfate	310	280	1500
Total Organic Carbon	13000	28000	34000
Hydrazines (mg/kg)			
Hydrazine	0.0013 J	0.0041 U	
Monomethylhydrazine (MMH)	0.0083 U	0.01 U	
UDMH	0.0083 U	0.01 U	

Notes:
mg/kg - milligram per kilogram
mV - millivolts
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
HF - Field parameter, exceeded holding time of 15 minutes
R - Value is rejected

Attachment 1-17
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-1-XXX MMB-SW/SD-1 2/17/2011	OC-SD-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010 0-0.5 ft	OC-SD-SDREF-012-XXX SDREF-012 12/3/2010 0-0.5 ft
Volatile Organic Compounds (mg/kg)											
1,1,1,2-Tetrachloroethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,1,1-Trichloroethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,1,2,2-Tetrachloroethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.12 UJ	0.13 UJ	0.03 U	0.11 UJ	0.12 UJ	0.24 UJ	0.13 UJ	0.066 UJ	0.11 UJ	0.089 UJ	0.028 U
1,1,2-Trichloroethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,1-Dichloroethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,1-Dichloroethene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,1-Dichloropropene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2,3-Trichlorobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2,3-Trichloropropane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2,4-Trichlorobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2,4-Trimethylbenzene	0.024 UJ	0.026 UJ	0.0061 UJ	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 UJ
1,2-Dibromo-3-chloropropane	0.24 UJ	0.26 UJ	0.061 U	0.23 UJ	0.25 UJ	0.47 UJ	0.25 UJ	0.13 UJ	0.21 UJ	0.18 UJ	0.057 U
1,2-Dibromoethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2-Dichlorobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2-Dichloroethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,2-Dichloropropane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,3,5-Trimethylbenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,3-Dichlorobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,3-Dichloropropane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,4-Dichlorobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
1,4-Dioxane	R	R	0.61 UJ	R	R	R	R	R	R	R	0.57 UJ
2,2-Dichloropropane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
2,4,4-Trimethyl-1-pentene	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
2,4,4-Trimethyl-2-pentene	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
2-Butanone	0.29 J	0.44 J	0.086	0.34 J	0.2 J	0.5 J	0.25 J	0.14 J	0.2 J	0.265 J	0.12
2-Chlorotoluene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
2-Hexanone	0.24 UJ	0.26 UJ	0.061 U	0.23 UJ	0.25 UJ	0.47 UJ	0.25 UJ	0.13 UJ	0.21 UJ	0.18 UJ	0.057 U
4-Chlorotoluene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
4-iso-Propyltoluene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
4-Methyl-2-pentanone	0.24 UJ	0.26 UJ	0.061 U	0.23 UJ	0.25 UJ	0.47 UJ	0.25 UJ	0.13 UJ	0.21 UJ	0.18 UJ	0.057 U
Acetaldehyde	0.22 J	1.5 U		0.4 J	0.27 J	1.2 U	0.22 J	0.42 J	0.23 J	0.89 UJ	
Acetic acid, methyl ester	0.48 UJ	0.51 UJ	0.12 U	0.45 UJ	0.49 UJ	0.94 UJ	0.5 UJ	0.26 UJ	0.43 UJ	0.36 UJ	0.11 U
Acetone	0.92 J	1.3 J	0.24 J	1.1 J	0.73 J	1.7 J	0.83 J	0.49 J	0.66 J	0.91 J	0.41 J
Benzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Bromobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Bromochloromethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Bromodichloromethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Bromoform	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Bromomethane	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
Butane, 2-methoxy-2-methyl-	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Carbon disulfide	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Carbon tetrachloride	0.024 UJ	0.026 UJ	0.0061 UJ	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Chlorobenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Chlorodibromomethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Chloroethane	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
Chloroform	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Chloromethane	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
Cis-1,2-Dichloroethene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
cis-1,3-Dichloropropene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Cyclohexane	0.24 UJ	0.26 UJ	0.061 U	0.23 UJ	0.25 UJ	0.47 UJ	0.25 UJ	0.13 UJ	0.21 UJ	0.18 UJ	0.057 U
Dibromomethane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Dichlorodifluoromethane	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U

Attachment 1-17
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-1-XXX MMB-SW/SD-1 2/17/2011	OC-SD-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010 0-0.5 ft	OC-SD-SDREF-012-XXX SDREF-012 12/3/2010 0-0.5 ft
Diethyl ether	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Ethyl benzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Ethyl-t-Butyl Ether	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Formaldehyde	2.6	2.4 J		4	2.3	1.7	2.2	3.2	2.9	1.8 J	
Hexachlorobutadiene	0.024 UJ	0.026 UJ	0.0061 UJ	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Isopropyl ether	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Isopropylbenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Methyl cyclohexane	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Methyl Tertbutyl Ether	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Methylene chloride	0.096 UJ	0.1 UJ	0.024 U	0.09 UJ	0.099 UJ	0.19 UJ	0.1 UJ	0.053 UJ	0.086 UJ	0.071 UJ	0.023 U
Naphthalene	0.24 UJ	0.26 UJ	0.061 U	0.23 UJ	0.25 UJ	0.47 UJ	0.25 UJ	0.13 UJ	0.21 UJ	0.18 UJ	0.057 U
n-Butylbenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Propylbenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
sec-Butylbenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Styrene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
tert-Butylbenzene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Tetrachloroethene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Tetrahydrofuran	R	R	R	R	R	R	R	R	R	R	R
Toluene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
trans-1,2-Dichloroethene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
trans-1,3-Dichloropropene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Trichloroethene	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Trichlorofluoromethane	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
Vinyl chloride	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Xylene, o	0.024 UJ	0.026 UJ	0.0061 U	0.023 UJ	0.025 UJ	0.047 UJ	0.025 UJ	0.013 UJ	0.021 UJ	0.018 UJ	0.0057 U
Xylenes (m&p)	0.048 UJ	0.051 UJ	0.012 U	0.045 UJ	0.049 UJ	0.094 UJ	0.05 UJ	0.026 UJ	0.043 UJ	0.036 UJ	0.011 U
Semivolatile Organic Compounds (mg/kg)											
1,2,4,5-Tetrachlorobenzene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
1,2,4-Trichlorobenzene	0.24 UJ	0.23 UJ		0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
1,2-Dichlorobenzene	0.24 UJ	0.23 UJ		0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
1,3-Dichlorobenzene	0.24 UJ	0.23 UJ		0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
1,4-Dichlorobenzene	0.24 UJ	0.23 UJ		0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
1-Methylnaphthalene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,3,4,6-Tetrachlorophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,4,5-Trichlorophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,4,6-Trichlorophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,4-Dichlorophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,4-Dimethylphenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,4-Dinitrophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,4-Dinitrotoluene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2,6-Dinitrotoluene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2-Chloronaphthalene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2-Chlorophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2-Methylnaphthalene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2-Methylphenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
2-Nitroaniline	1.2 UJ	1.2 UJ	1.6 U	1.2 UJ	1.3 UJ	1 UJ	1.2 UJ	0.78 UJ	1.1 UJ	0.73 UJ	0.33 U
2-Nitrophenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
3 & 4 Methylphenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 J	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
3,3'-Dichlorobenzidine	0.48 UJ	0.47 UJ	0.62 U	0.46 UJ	0.53 UJ	0.4 UJ	0.47 UJ	0.31 UJ	0.42 UJ	R	0.13 U
3-Nitroaniline	1.2 UJ	1.2 UJ	1.6 U	1.2 UJ	1.3 UJ	1 UJ	1.2 UJ	0.78 UJ	1.1 UJ	R	0.33 U
4,6-Dinitro-2-methylphenol	1.2 UJ	1.2 UJ	1.6 U	1.2 UJ	1.3 UJ	1 UJ	1.2 UJ	0.78 UJ	1.1 UJ	0.73 UJ	0.33 U
4-Bromophenyl phenyl ether	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
4-Chloro-3-methylphenol	0.48 UJ	0.47 UJ	0.62 U	0.46 UJ	0.53 UJ	0.4 UJ	0.47 UJ	0.31 UJ	0.42 UJ	0.29 UJ	0.13 U
4-Chloroaniline	0.48 UJ	0.47 UJ	0.62 U	0.46 UJ	0.53 UJ	0.4 UJ	0.47 UJ	0.31 UJ	0.42 UJ	R	0.13 UJ

Attachment 1-17
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-1-XXX MMB-SW/SD-1 2/17/2011	OC-SD-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010 0-0.5 ft	OC-SD-SDREF-012-XXX SDREF-012 12/3/2010 0-0.5 ft
4-Chlorophenyl phenyl ether	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
4-Nitroaniline	1.2 UJ	1.2 UJ	1.6 U	1.2 UJ	1.3 UJ	1 UJ	1.2 UJ	0.78 UJ	1.1 UJ	R	0.33 U
4-Nitrophenol	1.2 UJ	1.2 UJ	1.6 U	1.2 UJ	1.3 UJ	1 UJ	0.091 J	0.78 UJ	1.1 UJ	0.73 UJ	0.33 U
Acenaphthene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Acenaphthylene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Acetophenone	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Aniline	0.24 UJ	0.23 UJ	0.31 UJ	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 UJ
Anthracene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.082 J	0.21 UJ	0.15 UJ	0.067 U
Atrazine	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Azobenzene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Benzaldehyde	0.3 J	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.13 J	0.16 UJ	0.21 UJ	0.185 J	0.056 J
Benzo(a)anthracene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.4 J	0.17 J	0.093 J	0.082
Benzo(a)pyrene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.084 J	0.2 UJ	0.08 J	0.4 J	0.22 J	0.11 J	0.1
Benzo(b)fluoranthene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.11 J	0.2 UJ	0.14 J	0.56 J	0.37 J	0.067 J	0.15
Benzo(ghi)perylene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.093 J	0.32 J	0.16 J	0.1055 J	0.092
Benzo(k)fluoranthene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.15 J	0.21 J	0.15 J	0.26 J	0.071
Benzoic Acid	0.52 J	0.83 J	1.4 J	0.27 J	0.34 J	0.97 J	0.74 J	0.6 J	0.28 J	0.87 J	0.29 J
Benzyl alcohol	0.48 UJ	0.47 UJ	0.62 U	0.46 UJ	0.53 UJ	0.4 UJ	0.47 UJ	0.35 J	0.42 UJ	0.29 UJ	0.13 U
Biphenyl	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Bis(2-Chloroethoxy)methane	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Bis(2-Chloroethyl)ether	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Bis(2-Chloroisopropyl)ether	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Bis(2-Ethylhexyl)phthalate	0.25 J	0.096 J	0.31 U	0.21 J	0.27 UJ	0.2 UJ	0.089 J	0.35 J	0.2 J	0.066 J	0.083
Butylbenzylphthalate	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Caprolactam	R	0.23 UJ	R	R	R	0.2 UJ	0.088 J	0.16 UJ	R	0.15 UJ	0.067 U
Carbazole	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.097 J	0.21 UJ	0.15 UJ	0.025 J
Chrysene	0.24 UJ	0.086 J	0.31 U	0.23 UJ	0.094 J	0.2 UJ	0.085 J	0.48 J	0.26 J	0.16 J	0.13
Dibenz(a,h)anthracene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.083 J	0.15 J	0.21 UJ	0.059 J	0.041 J
Dibenzofuran	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Diethylphthalate	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Dimethylphthalate	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Di-n-butylphthalate	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Di-n-octylphthalate	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Diphenyl ether	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Diphenylmethanone	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Fluoranthene	0.1 J	0.13 J	0.31 U	0.079 J	0.19 J	0.2 UJ	0.13 J	0.88 J	0.42 J	0.24 J	0.24
Fluorene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Hexachlorobenzene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Hexachlorobutadiene	0.24 UJ	0.23 UJ		0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Hexachlorocyclopentadiene	0.48 UJ	0.47 UJ	0.62 U	0.46 UJ	0.53 UJ	0.4 UJ	0.47 UJ	0.31 UJ	0.42 UJ	R	0.13 UJ
Hexachloroethane	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Indeno(1,2,3-cd)pyrene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.13 J	0.34 J	0.16 J	0.1175 J	0.1
Isophorone	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Naphthalene	0.57 UJ	0.56 UJ		0.55 UJ	0.64 UJ	0.48 UJ	0.56 UJ	0.12 J	0.5 UJ	0.35 UJ	0.16 U
Nitrobenzene	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
N-Nitrosodimethylamine	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	R	0.067 U
N-Nitrosodi-n-propylamine	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
N-Nitrosodiphenylamine	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Pentachlorophenol	0.24 UJ	R	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	R	R	0.21 UJ	R	R
Phenanthrene	0.29 UJ	0.28 UJ	0.37 U	0.28 UJ	0.11 J	0.24 UJ	0.079 J	0.45 J	0.17 J	0.12 J	0.13
Phenol	0.24 UJ	0.23 UJ	0.31 U	0.23 UJ	0.27 UJ	0.2 UJ	0.23 UJ	0.16 UJ	0.21 UJ	0.15 UJ	0.067 U
Pyrene	0.11 J	0.13 J	0.31 U	0.071 J	0.2 J	0.2 UJ	0.15 J	0.85 J	0.49 J	0.29 J	0.21
Metals (mg/kg)											
Aluminum	6700 J	14000 J	6000	14000 J	8300 J	8500 J	17000 J	28000 J	20000 J	25500 J	7000

Attachment 1-17
Sediment Data Summary - Off-Property West Ditch
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-MMB-SW/SD-10-XXX MMB-SW/SD-10 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-11-XXX MMB-SW/SD-11 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-1-XXX MMB-SW/SD-1 2/17/2011	OC-SD-MMB-SW/SD-2-XXX MMB-SW/SD-2 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-3-XXX MMB-SW/SD-3 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-4-XXX MMB-SW/SD-4 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-5-XXX MMB-SW/SD-5 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-6-XXX MMB-SW/SD-6 12/3/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8A-XXX MMB-SW/SD-8A 12/2/2010 0-0.5 ft	OC-SD-MMB-SW/SD-8-RISK MMB-SW/SD-8 12/2/2010 0-0.5 ft	OC-SD-SDREF-012-XXX SDREF-012 12/3/2010 0-0.5 ft
Antimony	4 UJ	4.1 UJ	1.1 U	3.6 UJ	4.2 UJ	3.4 UJ	4.3 UJ	2.4 UJ	3.4 UJ	2.5 UJ	1.2 UJ
Arsenic	15 J	22 J	3.5	20 J	14 J	8.2 J	20 J	52 J	30 J	23 J	7.2
Barium	140 J	120 J	26	130 J	96 J	68 J	150 J	190 J	150 J	165 J	43
Beryllium	0.34 J	1.5 J	0.44 U	0.72 J	0.6 J	1 J	2.1 J	0.72 J	2.4 J	2.6 J	0.25 J
Cadmium	1.9 J	4.6 J	0.31 J	1.5 J	2.4 J	0.87 J	2.8 J	2.3 J	4.6 J	4.8 J	0.45 J
Calcium	8800 J	10000 J	1500	8700 J	9700 J	9800 J	8100 J	8200 J	5300 J	5750 J	2100
Chromium	16 J	27 J	11	20 J	16 J	8.5 J	24 J	40 J	38 J	39 J	11 J
Cobalt	10 J	19 J	2.3	9.2 J	4.3 J	8.1 J	17 J	19 J	34 J	32.5 J	3.8
Copper	45 J	53 J	8.1	27 J	34 J	13 J	50 J	84 J	90 J	69.5 J	18
Iron	20000 J	36000 J	7200	39000 J	10000 J	15000 J	18000 J	95000 J	35000 J	22000 J	16000
Lead	150 J	160 J	28	64 J	120 J	31 J	280 J	170 J	330 J	415 J	35
Magnesium	940 J	2400 J	1700	1200 J	1100 J	1000 J	2200 J	3300 J	3000 J	3600 J	1200
Manganese	890 J	1400 J	110	2100 J	520 J	650 J	610 J	1900 J	690 J	580 J	560
Mercury	0.45 J	0.44 UJ	0.11 U	0.22 J	0.38 J	0.47 UJ	0.26 J	0.51 J	0.45 J	0.39 J	0.13 U
Nickel	15 J	24 J	8.5	11 J	12 J	6.4 J	22 J	28 J	44 J	42 J	7.2 J
Potassium	410 J	1100 J	730	470 J	770 J	470 J	1400 J	1500 J	1700 J	2600 J	520
Selenium	4 UJ	4.1 UJ	1.1 UJ	3.6 UJ	4.2 UJ	3.4 UJ	4.3 UJ	2.4 UJ	3.4 UJ	2 J	1.2 U
Silver	4 UJ	4.1 UJ	1.1 U	3.6 UJ	4.2 UJ	3.4 UJ	4.3 UJ	0.74 J	3.4 UJ	2.5 UJ	1.2 U
Sodium	800 J	840 J	180 J	580 J	720 J	570 J	940 J	280 J	800 J	695 J	69 J
Thallium	8 UJ	8.2 UJ	2.2 U	1.4 J	8.3 UJ	6.7 UJ	8.6 UJ	4.7 UJ	6.8 UJ	5.1 UJ	2.3 U
Tin	10 J	7.4 J	11 U	7.6 J	16 J	34 UJ	7.1 J	11 J	7.7 J	7.9 J	12 U
Vanadium	44 J	44 J	12	21 J	29 J	18 J	48 J	50 J	54 J	58 J	13
Zinc	190 J	320 J	36	160 J	190 J	59 J	240 J	500 J	430 J	410 J	96
Inorganics (mg/kg)											
Chloride	930	760	210	630	1000	480	860	150	690	405	110
Nitrate as N	35 U	35 U	9.4 U	29 U	26 U	29 U	34 U	20 U	27 U	22 U	6.4 U
Nitrite as N	7 U	7.1 U	1.9 U	5.8 U	5.1 U	5.9 U	6.8 U	3.9 U	5.4 U	4.4 U	1.3 U
Nitrogen, as Ammonia	1500 J	490 J	130 J	580 J	960 J	790 J	880 J	530 J	620 J	610 J	120 J
Sulfate	1400 J	980 J	75 U	1200 J	940 J	350 J	360 J	690 J	940 J	550 J	200 J
Total Organic Carbon	270000 J	270000 J	65000 J	260000 J	290000 J	310000 J	220000 J	140000 J	180000 J	160000 J	88000 J
Specialty Compounds (mg/kg)											
Hydrazine	0.014 U	0.016 U		0.016 U	0.02 U	0.013 U	0.015 U	0.0098 U	0.014 U	0.009 UJ	
Monomethylhydrazine (MMH)	0.036 U	0.041 U		0.039 U	0.049 U	0.033 U	0.037 U	0.024 U	0.035 U	0.022 UJ	
UDMH	0.036 U	0.041 U		0.039 U	0.049 U	0.033 U	0.037 U	0.024 U	0.035 U	0.022 UJ	

Notes:
mg/kg - milligram per kilogram
mV - millivolts
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
HF - Field parameter, exceeded holding time of 15 minutes
R - Value is rejected

Attachment 1-18
Sediment Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-LB-1-XXX LB-1 12/9/2010 0-0.5 ft	OC-SD-LB-2-XXX LB-2 12/9/2010 0-0.5 ft	OC-SD-LB-3-XXX LB-3 12/9/2010 0-0.5 ft
Volatile Organic Compounds (mg/kg)			
1,1,1,2-Tetrachloroethane	0.0044 U	0.005 U	0.0062 U
1,1,1-Trichloroethane	0.0044 U	0.005 U	0.0062 U
1,1,2,2-Tetrachloroethane	0.0044 U	0.005 U	0.0062 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.022 U	0.025 U	0.031 U
1,1,2-Trichloroethane	0.0044 U	0.005 U	0.0062 U
1,1-Dichloroethane	0.0044 U	0.005 U	0.0062 U
1,1-Dichloroethene	0.0044 U	0.005 U	0.0062 U
1,1-Dichloropropene	0.0044 U	0.005 U	0.0062 U
1,2,3-Trichlorobenzene	0.0044 U	0.005 U	0.0062 U
1,2,3-Trichloropropane	0.0044 U	0.005 U	0.0062 U
1,2,4-Trichlorobenzene	0.0044 U	0.005 U	0.0062 U
1,2,4-Trimethylbenzene	0.0044 U	0.005 U	0.0062 U
1,2-Dibromo-3-chloropropane	0.044 U	0.05 U	0.062 U
1,2-Dibromoethane	0.0044 U	0.005 U	0.0062 U
1,2-Dichlorobenzene	0.0044 U	0.005 U	0.031
1,2-Dichloroethane	0.0044 U	0.005 U	0.0062 U
1,2-Dichloropropane	0.0044 U	0.005 U	0.0062 U
1,3,5-Trimethylbenzene	0.0044 U	0.005 U	0.0062 U
1,3-Dichlorobenzene	0.0044 U	0.005 U	0.0062 U
1,3-Dichloropropane	0.0044 U	0.005 U	0.0062 U
1,4-Dichlorobenzene	0.0044 U	0.005 U	0.0062 U
1,4-Dioxane	0.44 UJ	0.5 UJ	0.62 UJ
2,2-Dichloropropane	0.0044 U	0.005 U	0.0062 U
2,4,4-Trimethyl-1-pentene	0.0087 U	0.01 U	0.012 U
2,4,4-Trimethyl-2-pentene	0.0087 U	0.01 U	0.012 U
2-Butanone	0.044 U	0.05 U	0.069
2-Chlorotoluene	0.0044 U	0.005 U	0.0062 U
2-Hexanone	0.044 U	0.05 U	0.062 U
4-Chlorotoluene	0.0044 U	0.005 U	0.0062 U
4-iso-Propyltoluene	0.0044 U	0.005 U	0.0062 U
4-Methyl-2-pentanone	0.044 U	0.05 U	0.062 U
Acetic acid, methyl ester	0.087 UJ	0.1 UJ	0.12 UJ
Acetone	0.44 UJ	0.5 UJ	0.62 UJ
Benzene	0.0044 U	0.005 U	0.0062 U
Bromobenzene	0.0044 U	0.005 U	0.0062 U
Bromochloromethane	0.0044 U	0.005 U	0.0062 U
Bromodichloromethane	0.0044 U	0.005 U	0.0062 U
Bromoform	0.0044 U	0.005 U	0.0062 U
Bromomethane	0.0087 U	0.01 U	0.012 U
Butane, 2-methoxy-2-methyl-	0.0044 U	0.005 U	0.0062 U
Carbon disulfide	0.0044 U	0.005 U	0.0062 U
Carbon tetrachloride	0.0044 U	0.005 U	0.0062 U
Chlorobenzene	0.0044 U	0.005 U	0.059
Chlorodibromomethane	0.0044 U	0.005 U	0.0062 U
Chloroethane	0.0087 U	0.01 U	0.012 U
Chloroform	0.0044 U	0.005 U	0.0062 U
Chloromethane	0.0087 U	0.01 U	0.012 U
Cis-1,2-Dichloroethene	0.0044 U	0.005 U	0.0062 U
cis-1,3-Dichloropropene	0.0044 U	0.005 U	0.0062 U
Cyclohexane	0.044 U	0.05 U	0.062 U
Dibromomethane	0.0044 U	0.005 U	0.0062 U
Dichlorodifluoromethane	0.0087 UJ	0.01 UJ	0.012 UJ
Diethyl ether	0.0044 U	0.005 U	0.0062 U
Ethyl benzene	0.0044 U	0.005 U	0.0062 U

Attachment 1-18
Sediment Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-LB-1-XXX LB-1 12/9/2010 0-0.5 ft	OC-SD-LB-2-XXX LB-2 12/9/2010 0-0.5 ft	OC-SD-LB-3-XXX LB-3 12/9/2010 0-0.5 ft
Ethyl-t-Butyl Ether	0.0044 U	0.005 U	0.0062 U
Hexachlorobutadiene	0.0044 U	0.005 U	0.0062 U
Isopropyl ether	0.0044 U	0.005 U	0.0062 U
Isopropylbenzene	0.0044 U	0.005 U	0.0062 U
Methyl cyclohexane	0.0044 U	0.005 U	0.0062 U
Methyl Tertbutyl Ether	0.0044 U	0.005 U	0.0062 U
Methylene chloride	0.017 U	0.02 U	0.025 U
Naphthalene	0.044 U	0.05 U	0.062 U
n-Butylbenzene	0.0044 U	0.005 U	0.0062 U
Propylbenzene	0.0044 U	0.005 U	0.0062 U
sec-Butylbenzene	0.0044 U	0.005 U	0.0046 J
Styrene	0.0044 U	0.005 U	0.0062 U
tert-Butylbenzene	0.0044 U	0.005 U	0.0062 U
Tetrachloroethene	0.0044 U	0.005 U	0.0062 U
Tetrahydrofuran	0.044 UJ	0.05 UJ	0.062 UJ
Toluene	0.0044 U	0.005 U	0.0062 U
trans-1,2-Dichloroethene	0.0044 U	0.005 U	0.0062 U
trans-1,3-Dichloropropene	0.0044 U	0.005 U	0.0062 U
Trichloroethene	0.0044 U	0.005 U	0.0062 U
Trichlorofluoromethane	0.0087 U	0.01 U	0.012 U
Vinyl chloride	0.0044 U	0.005 U	0.0062 U
Xylene, o	0.0044 U	0.005 U	0.0062 U
Xylenes (m&p)	0.0087 U	0.01 U	0.012 U
Semivolatile Organic Compounds (mg/kg)			
1,2,4,5-Tetrachlorobenzene	0.29 U	0.32 U	3.8 U
1,2,4-Trichlorobenzene	0.29 U	0.32 U	3.8 U
1,2-Dichlorobenzene	0.29 U	0.32 U	3.8 U
1,3-Dichlorobenzene	0.29 U	0.32 U	3.8 U
1,4-Dichlorobenzene	0.29 U	0.32 U	3.8 U
1-Methylnaphthalene	0.29 U	0.32 U	3.8 U
2,3,4,6-Tetrachlorophenol	0.29 U	0.32 U	3.8 U
2,4,5-Trichlorophenol	0.29 U	0.32 U	3.8 U
2,4,6-Trichlorophenol	0.29 U	0.32 U	3.8 U
2,4-Dichlorophenol	0.29 U	0.32 U	3.8 U
2,4-Dimethylphenol	0.29 U	0.32 U	3.8 U
2,4-Dinitrophenol	0.29 U	0.32 U	3.8 U
2,4-Dinitrotoluene	0.29 U	0.32 U	3.8 U
2,6-Dinitrotoluene	0.29 U	0.32 U	3.8 U
2-Chloronaphthalene	0.29 U	0.32 U	3.8 U
2-Chlorophenol	0.29 U	0.32 U	3.8 U
2-Methylnaphthalene	0.29 U	0.32 U	3.8 U
2-Methylphenol	0.29 U	0.32 U	3.8 U
2-Nitroaniline	1.4 U	1.6 U	19 U
2-Nitrophenol	0.29 U	0.32 U	3.8 U
3 & 4 Methylphenol	0.29 U	0.32 U	3.8 U
3,3'-Dichlorobenzidine	0.58 U	0.65 U	7.6 U
3-Nitroaniline	1.4 U	1.6 U	19 U
4,6-Dinitro-2-methylphenol	1.4 U	1.6 U	19 U
4-Bromophenyl phenyl ether	0.29 U	0.32 U	3.8 U
4-Chloro-3-methylphenol	0.58 U	0.65 U	7.6 U
4-Chloroaniline	0.58 U	0.65 U	7.6 U
4-Chlorophenyl phenyl ether	0.29 U	0.32 U	3.8 U
4-Nitroaniline	1.4 U	1.6 U	19 U
4-Nitrophenol	1.4 U	1.6 U	19 U
Acenaphthene	0.29 U	0.32 U	3.8 U

Attachment 1-18
Sediment Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-LB-1-XXX LB-1 12/9/2010 0-0.5 ft	OC-SD-LB-2-XXX LB-2 12/9/2010 0-0.5 ft	OC-SD-LB-3-XXX LB-3 12/9/2010 0-0.5 ft
Acenaphthylene	0.29 U	0.32 U	3.8 U
Acetophenone	0.29 U	0.32 U	3.8 U
Aniline	0.29 U	0.32 U	3.8 U
Anthracene	0.29 U	0.32 U	3.8 U
Atrazine	0.29 U	0.32 U	3.8 U
Azobenzene	0.29 U	0.32 U	3.8 U
Benzaldehyde	0.29 U	0.32 U	3.8 U
Benzo(a)anthracene	0.29 U	0.32 U	1.4 J
Benzo(a)pyrene	0.29 U	0.32 U	1.5 J
Benzo(b)fluoranthene	0.11 J	0.32 U	2 J
Benzo(ghi)perylene	0.096 J	0.32 U	1.6 J
Benzo(k)fluoranthene	0.29 U	0.32 U	3.8 U
Benzoic Acid	1.4 UJ	1.6 UJ	19 UJ
Benzyl alcohol	0.58 U	0.65 U	7.6 U
Biphenyl	0.29 U	0.32 U	3.8 U
Bis(2-Chloroethoxy)methane	0.29 U	0.32 U	3.8 U
Bis(2-Chloroethyl)ether	0.29 U	0.32 U	3.8 U
Bis(2-Chloroisopropyl)ether	0.29 U	0.32 U	3.8 U
Bis(2-Ethylhexyl)phthalate	0.39	0.16 J	4.7
Butylbenzylphthalate	0.29 U	0.32 U	3.8 U
Caprolactam	0.29 UJ	0.32 UJ	3.8 UJ
Carbazole	0.29 U	0.32 U	3.8 U
Chrysene	0.29 U	0.32 U	1.8 J
Dibenz(a,h)anthracene	0.29 U	0.32 U	3.8 U
Dibenzofuran	0.29 U	0.32 U	3.8 U
Diethylphthalate	0.29 U	0.32 U	3.8 U
Dimethylphthalate	0.29 U	0.32 U	3.8 U
Di-n-butylphthalate	0.29 UJ	0.32 UJ	3.8 UJ
Di-n-octylphthalate	0.29 U	0.32 U	3.8 U
Diphenyl ether	0.29 U	0.32 U	3.8 U
Diphenylmethanone	0.29 U	0.32 U	3.8 U
Fluoranthene	0.095 J	0.11 J	3.5 J
Fluorene	0.29 U	0.32 U	3.8 U
Hexachlorobenzene	0.29 U	0.32 U	3.8 U
Hexachlorobutadiene	0.29 U	0.32 U	3.8 U
Hexachlorocyclopentadiene	0.58 U	0.65 U	7.6 U
Hexachloroethane	0.29 U	0.32 U	3.8 U
Indeno(1,2,3-cd)pyrene	0.29 U	0.32 U	1.4 J
Isophorone	0.29 U	0.32 U	3.8 U
Naphthalene	0.69 U	0.77 U	9.2 U
Nitrobenzene	0.29 U	0.32 U	3.8 U
N-Nitrosodimethylamine	0.29 U	0.32 U	3.8 U
N-Nitrosodi-n-propylamine	0.29 U	0.32 U	3.8 U
N-Nitrosodiphenylamine	0.29 U	0.32 U	2 J
Pentachlorophenol	0.29 U	0.32 U	3.8 U
Phenanthrene	0.35 U	0.39 U	1.1 J
Phenol	0.29 U	0.32 U	3.8 U
Pyrene	0.12 J	0.32 U	2.9 J
Metals (mg/kg)			
Aluminum	8800	3800	12000
Antimony	1.1 UJ	1 UJ	1.4 UJ
Arsenic	5.9	5.5	35
Barium	35 J	9.4 J	94 J
Beryllium	0.25 J	0.11 J	0.3 J
Cadmium	0.76	0.15 J	1

Attachment 1-18
Sediment Data Summary - Landfill Brook
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-LB-1-XXX LB-1 12/9/2010 0-0.5 ft	OC-SD-LB-2-XXX LB-2 12/9/2010 0-0.5 ft	OC-SD-LB-3-XXX LB-3 12/9/2010 0-0.5 ft
Calcium	1600 J	1000 J	4700 J
Chromium	24	20	130
Cobalt	2.1	0.65 J	7.2
Copper	24	4.9	61
Iron	8400	3100	25000
Lead	260	19	120
Magnesium	1800 J	330 J	3700 J
Manganese	75 J	96 J	380 J
Mercury	0.14	0.12 U	1.2
Nickel	9.3	1.8 J	19
Potassium	690	240 J	1900
Selenium	1.1 U	1 U	1.4 U
Silver	0.2 J	0.23 J	1.6
Sodium	220	45 J	130 J
Thallium	2.1 U	2 U	2.7 U
Tin	11 U	10 U	6.8 J
Vanadium	22	5.5	29
Zinc	110 J	22 J	190 J
Inorganics (mg/kg)			
Chloride	110	61	150
Nitrate as N	8.8 U	9.6 U	11 U
Nitrite as N	1.8 U	1.9 U	2.3 U
Nitrogen, as Ammonia	140 J	120 J	580 J
Sulfate	78	110	310
Total Organic Carbon	33000	41000	51000

Notes:
mg/kg - milligram per kilogram
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
R - Value is rejected

ATTACHMENT 2

DOCUMENTATION OF 95% UCL CALCULATIONS

(Provided on CD ROM)

Attachment 2 – Supporting Information for Baseline Ecological Risk Assessment – Documentation of 95% UCL Calculations – ProUCL 4.1.00

List of Sections

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Section 12 Sediment – Detention Pond

Section 13 Sediment – MMB Wetland

Surface Soil – Exposure Area 2

1				General UCL Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	IncludingRS_NoIDs.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	Benzo(a)pyrene											
10												
11						General Statistics						
12						Number of Valid Data	13			Number of Detected Data	6	
13						Number of Distinct Detected Data	6			Number of Non-Detect Data	7	
14										Percent Non-Detects	53.85%	
15												
16						Raw Statistics				Log-transformed Statistics		
17						Minimum Detected	0.021			Minimum Detected	-3.863	
18						Maximum Detected	0.24			Maximum Detected	-1.427	
19						Mean of Detected	0.103			Mean of Detected	-2.617	
20						SD of Detected	0.0857			SD of Detected	0.947	
21						Minimum Non-Detect	0.077			Minimum Non-Detect	-2.564	
22						Maximum Non-Detect	1.9			Maximum Non-Detect	0.642	
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	13	
25	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	0	
26	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	100.00%	
27												
28						Warning: There are only 6 Detected Values in this data						
29						Note: It should be noted that even though bootstrap may be performed on this data set						
30						the resulting calculations may not be reliable enough to draw conclusions						
31												
32						It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.						
33												
34												
35						UCL Statistics						
36						Normal Distribution Test with Detected Values Only				Lognormal Distribution Test with Detected Values Only		
37						Shapiro Wilk Test Statistic	0.892			Shapiro Wilk Test Statistic	0.95	
38						5% Shapiro Wilk Critical Value	0.788			5% Shapiro Wilk Critical Value	0.788	
39						Data appear Normal at 5% Significance Level				Data appear Lognormal at 5% Significance Level		
40												
41						Assuming Normal Distribution				Assuming Lognormal Distribution		
42						DL/2 Substitution Method				DL/2 Substitution Method		
43						Mean	0.248			Mean	-1.966	
44						SD	0.291			SD	1.155	
45						95% DL/2 (t) UCL	0.392			95% H-Stat (DL/2) UCL	0.773	
46												
47						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
48						MLE method failed to converge properly				Mean in Log Scale	-2.728	
49										SD in Log Scale	0.668	
50										Mean in Original Scale	0.081	
51										SD in Original Scale	0.061	
52										95% t UCL	0.111	

53											95% Percentile Bootstrap UCL	0.11
54											95% BCA Bootstrap UCL	0.117
55											95% H-UCL	0.128
56												
57	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
58					k star (bias corrected)	0.922	**Data appear Normal at 5% Significance Level**					
59					Theta Star	0.111						
60					nu star	11.06						
61												
62					A-D Test Statistic	0.253	**Nonparametric Statistics**					
63					5% A-D Critical Value	0.707					Kaplan-Meier (KM) Method	
64					K-S Test Statistic	0.707					Mean	0.0937
65					5% K-S Critical Value	0.337					SD	0.076
66	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0317
67											95% KM (t) UCL	0.15
68	**Assuming Gamma Distribution**										95% KM (z) UCL	0.146
69					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.152
70					Minimum	0.021					95% KM (bootstrap t) UCL	0.215
71					Maximum	0.24					95% KM (BCA) UCL	0.153
72					Mean	0.0919					95% KM (Percentile Bootstrap) UCL	0.15
73					Median	0.0906					95% KM (Chebyshev) UCL	0.232
74					SD	0.061					97.5% KM (Chebyshev) UCL	0.292
75					k star	2.028					99% KM (Chebyshev) UCL	0.409
76					Theta star	0.0453						
77					Nu star	52.74	**Potential UCLs to Use**					
78					AppChi2	37.06					95% KM (t) UCL	0.15
79					95% Gamma Approximate UCL (Use when n >= 40)	0.131					95% KM (Percentile Bootstrap) UCL	0.15
80					95% Adjusted Gamma UCL (Use when n < 40)	0.138						
81	**Note: DL/2 is not a recommended method.**											
82												
83	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
84	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
85	**For additional insight, the user may want to consult a statistician.**											
86												
87												
88	**Diphenyl ether**											
89												
90	**General Statistics**											
91					Number of Valid Data	12					Number of Detected Data	1
92					Number of Distinct Detected Data	1					Number of Non-Detect Data	11
93											Percent Non-Detects	91.67%
94												
95	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
96	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
97												
98	**The data set for variable Diphenyl ether was not processed!**											
99												
100												
101												
102	**Arsenic**											
103												
104	**General Statistics**											

105					Number of Valid Data	14					Number of Detected Data	13
106					Number of Distinct Detected Data	13					Number of Non-Detect Data	1
107											Percent Non-Detects	7.14%
108												
109					**Raw Statistics**						**Log-transformed Statistics**	
110					Minimum Detected	1.7					Minimum Detected	0.531
111					Maximum Detected	15					Maximum Detected	2.708
112					Mean of Detected	6.969					Mean of Detected	1.703
113					SD of Detected	4.581					SD of Detected	0.759
114					Minimum Non-Detect	5					Minimum Non-Detect	1.609
115					Maximum Non-Detect	5					Maximum Non-Detect	1.609
116												
117												
118					**UCL Statistics**							
119					**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**	
120					Shapiro Wilk Test Statistic	0.911					Shapiro Wilk Test Statistic	0.924
121					5% Shapiro Wilk Critical Value	0.866					5% Shapiro Wilk Critical Value	0.866
122					**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**	
123												
124					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
125					DL/2 Substitution Method						DL/2 Substitution Method	
126					Mean	6.65					Mean	1.647
127					SD	4.56					SD	0.759
128					95% DL/2 (t) UCL	8.808					95% H-Stat (DL/2) UCL	11.52
129												
130					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
131					Mean	6.061					Mean in Log Scale	1.651
132					SD	5.332					SD in Log Scale	0.755
133					95% MLE (t) UCL	8.585					Mean in Original Scale	6.662
134					95% MLE (Tiku) UCL	8.971					SD in Original Scale	4.548
135											95% t UCL	8.815
136											95% Percentile Bootstrap UCL	8.619
137											95% BCA Bootstrap UCL	8.81
138											95% H UCL	11.49
139												
140					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
141					k star (bias corrected)	1.781					**Data appear Normal at 5% Significance Level**	
142					Theta Star	3.914						
143					nu star	46.3						
144												
145					A-D Test Statistic	0.354					**Nonparametric Statistics**	
146					5% A-D Critical Value	0.742					Kaplan-Meier (KM) Method	
147					K-S Test Statistic	0.742					Mean	6.649
148					5% K-S Critical Value	0.239					SD	4.4
149					**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean	1.225
150											95% KM (t) UCL	8.818
151					**Assuming Gamma Distribution**						95% KM (z) UCL	8.664
152					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	8.813
153					Minimum	1.7					95% KM (bootstrap t) UCL	9.113
154					Maximum	15					95% KM (BCA) UCL	8.48
155					Mean	6.652					95% KM (Percentile Bootstrap) UCL	8.607
156					Median	6					95% KM (Chebyshev) UCL	11.99

157					SD	4.558				97.5% KM (Chebyshev) UCL		14.3
158					k star	1.755				99% KM (Chebyshev) UCL		18.84
159					Theta star	3.79						
160					Nu star	49.15				**Potential UCLs to Use**		
161					AppChi2	34.06				95% KM (t) UCL		8.818
162				95% Gamma Approximate UCL (Use when n >= 40)		9.601				95% KM (Percentile Bootstrap) UCL		8.607
163				95% Adjusted Gamma UCL (Use when n < 40)		10.09						
164	**Note: DL/2 is not a recommended method.**											
165												
166	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
167	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
168	**For additional insight, the user may want to consult a statistician.**											
169												
170												
171	**Chloride**											
172												
173	**General Statistics**											
174					Number of Valid Data	12				Number of Detected Data		4
175					Number of Distinct Detected Data	4				Number of Non-Detect Data		8
176										Percent Non-Detects		66.67%
177												
178	**Raw Statistics**									**Log-transformed Statistics**		
179					Minimum Detected	25.85				Minimum Detected		3.252
180					Maximum Detected	550				Maximum Detected		6.31
181					Mean of Detected	202.7				Mean of Detected		4.691
182					SD of Detected	241				SD of Detected		1.343
183					Minimum Non-Detect	26				Minimum Non-Detect		3.258
184					Maximum Non-Detect	48				Maximum Non-Detect		3.871
185												
186	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		9
187	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		3
188	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		75.00%
189												
190	**Warning: There are only 4 Distinct Detected Values in this data**											
191	**Note: It should be noted that even though bootstrap may be performed on this data set**											
192	**the resulting calculations may not be reliable enough to draw conclusions**											
193												
194	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
195												
196												
197	**UCL Statistics**											
198	**Normal Distribution Test with Detected Values Only**									**Lognormal Distribution Test with Detected Values Only**		
199					Shapiro Wilk Test Statistic	0.834				Shapiro Wilk Test Statistic		0.978
200					5% Shapiro Wilk Critical Value	0.748				5% Shapiro Wilk Critical Value		0.748
201	**Data appear Normal at 5% Significance Level**									**Data appear Lognormal at 5% Significance Level**		
202												
203	**Assuming Normal Distribution**									**Assuming Lognormal Distribution**		
204					DL/2 Substitution Method					DL/2 Substitution Method		
205					Mean	79.03				Mean		3.441
206					SD	155.5				SD		1.177
207					95% DL/2 (t) UCL	159.7				95% H-Stat (DL/2) UCL		197.4
208												

209				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
210				**MLE yields a negative mean**						Mean in Log Scale		3.531
211										SD in Log Scale		1.17
212										Mean in Original Scale		81.6
213										SD in Original Scale		154.6
214										95% t UCL		161.7
215										95% Percentile Bootstrap UCL		163.1
216										95% BCA Bootstrap UCL		208.6
217										95% H-UCL		211.7
218												
219				**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**		
220				k star (bias corrected)	0.401					**Data appear Normal at 5% Significance Level**		
221				Theta Star	505.8							
222				nu star	3.206							
223												
224				A-D Test Statistic	0.269					**Nonparametric Statistics**		
225				5% A-D Critical Value	0.668					Kaplan-Meier (KM) Method		
226				K-S Test Statistic	0.668					Mean		84.8
227				5% K-S Critical Value	0.403					SD		146.5
228				**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean		48.84
229										95% KM (t) UCL		172.5
230				**Assuming Gamma Distribution**						95% KM (z) UCL		165.1
231				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		155.8
232				Minimum	0.000001					95% KM (bootstrap t) UCL		243.4
233				Maximum	550					95% KM (BCA) UCL		550
234				Mean	67.6					95% KM (Percentile Bootstrap) UCL		241.7
235				Median	0.116					95% KM (Chebyshev) UCL		297.7
236				SD	160.6					97.5% KM (Chebyshev) UCL		389.8
237				k star	0.124					99% KM (Chebyshev) UCL		570.8
238				Theta star	543.5							
239				Nu star	2.985					**Potential UCLs to Use**		
240				AppChi2	0.368					95% KM (t) UCL		172.5
241				95% Gamma Approximate UCL (Use when n >= 40)	548.3					95% KM (Percentile Bootstrap) UCL		241.7
242				95% Adjusted Gamma UCL (Use when n < 40)	N/A							
243	**Note: DL/2 is not a recommended method.**											
244												
245	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
246	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
247	**For additional insight, the user may want to consult a statistician.**											
248												
249												
250	**Nitrogen, as Ammonia**											
251												
252				**General Statistics**								
253				Number of Valid Observations	12					Number of Distinct Observations		12
254												
255				**Raw Statistics**						**Log-transformed Statistics**		
256				Minimum	23					Minimum of Log Data		3.135
257				Maximum	1200					Maximum of Log Data		7.09
258				Mean	439.3					Mean of log Data		5.611
259				Geometric Mean	273.4					SD of log Data		1.215
260				Median	365							

SD	357.5	
Std. Error of Mean	103.2	
Coefficient of Variation	0.814	
Skewness	0.808	

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.929	Shapiro Wilk Test Statistic	0.906
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	624.7	95% H-UCL	1928
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1385
95% Adjusted-CLT UCL (Chen-1995)	634.8	97.5% Chebyshev (MVUE) UCL	1758
95% Modified-t UCL (Johnson-1978)	628.7	99% Chebyshev (MVUE) UCL	2492
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.95	**Data appear Normal at 5% Significance Level**	
Theta Star	462.2		
MLE of Mean	439.3		
MLE of Standard Deviation	450.6		
nu star	22.81		
Approximate Chi Square Value (.05)	12.95	**Nonparametric Statistics**	
Adjusted Level of Significance	0.029	95% CLT UCL	609.1
Adjusted Chi Square Value	11.83	95% Jackknife UCL	624.7
		95% Standard Bootstrap UCL	597.2
Anderson-Darling Test Statistic	0.239	95% Bootstrap-t UCL	672
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL	646.6
Kolmogorov-Smirnov Test Statistic	0.14	95% Percentile Bootstrap UCL	606.7
Kolmogorov-Smirnov 5% Critical Value	0.251	95% BCA Bootstrap UCL	619.2
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	889.1
		97.5% Chebyshev(Mean, Sd) UCL	1084
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1466
95% Approximate Gamma UCL (Use when n >= 40)	774		
95% Adjusted Gamma UCL (Use when n < 40)	847.3		
Potential UCL to Use		Use 95% Student's-t UCL	624.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Acetaldehyde

General Statistics

Number of Valid Data	3	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	1
		Percent Non-Detects	33.33%

Warning: This data set only has 3 observations!

	A	B	C	D	E	F	G	H	I	J	K	L
313	**Data set is too small to compute reliable and meaningful statistics and estimates!**											
314	**The data set for variable Acetaldehyde was not processed!**											
315												
316	**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**											
317	**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
318												
319												
320												
321	**Benzaldehyde**											
322												
323	**General Statistics**											
324	Number of Valid Data					12	Number of Detected Data					7
325	Number of Distinct Detected Data					7	Number of Non-Detect Data					5
326							Percent Non-Detects					41.67%
327												
328	**Raw Statistics**						**Log-transformed Statistics**					
329	Minimum Detected					0.086	Minimum Detected					-2.453
330	Maximum Detected					1.9	Maximum Detected					0.642
331	Mean of Detected					0.455	Mean of Detected					-1.344
332	SD of Detected					0.647	SD of Detected					1.021
333	Minimum Non-Detect					0.43	Minimum Non-Detect					-0.844
334	Maximum Non-Detect					23	Maximum Non-Detect					3.135
335												
336	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					12
337	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					0
338	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					100.00%
339												
340	**Warning: There are only 7 Detected Values in this data**											
341	**Note: It should be noted that even though bootstrap may be performed on this data set**											
342	**the resulting calculations may not be reliable enough to draw conclusions**											
343												
344	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
345												
346												
347	**UCL Statistics**											
348	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
349	Shapiro Wilk Test Statistic					0.61	Shapiro Wilk Test Statistic					0.909
350	5% Shapiro Wilk Critical Value					0.803	5% Shapiro Wilk Critical Value					0.803
351	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
352												
353	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
354	DL/2 Substitution Method						DL/2 Substitution Method					
355	Mean					2.183	Mean					-0.491
356	SD					3.765	SD					1.636
357	95% DL/2 (t) UCL					4.135	95% H-Stat (DL/2) UCL					18.35
358												
359	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
360	**MLE method failed to converge properly**						Mean in Log Scale					-1.407
361							SD in Log Scale					0.76
362							Mean in Original Scale					0.359
363							SD in Original Scale					0.492
364							95% t UCL					0.614

365											95% Percentile Bootstrap UCL	0.632
366											95% BCA Bootstrap UCL	0.781
367											95% H-UCL	0.581
368												
369	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
370				k star (bias corrected)	0.685		**Data appear Gamma Distributed at 5% Significance Level**					
371				Theta Star	0.664							
372				nu star	9.595							
373												
374				A-D Test Statistic	0.678		**Nonparametric Statistics**					
375				5% A-D Critical Value	0.727						Kaplan-Meier (KM) Method	
376				K-S Test Statistic	0.727						Mean	0.402
377				5% K-S Critical Value	0.319						SD	0.54
378	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.196
379											95% KM (t) UCL	0.753
380	**Assuming Gamma Distribution**										95% KM (z) UCL	0.723
381				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	0.753
382				Minimum	0.086						95% KM (bootstrap t) UCL	1.961
383				Maximum	1.9						95% KM (BCA) UCL	0.791
384				Mean	0.401						95% KM (Percentile Bootstrap) UCL	0.758
385				Median	0.277						95% KM (Chebyshev) UCL	1.254
386				SD	0.483						97.5% KM (Chebyshev) UCL	1.623
387				k star	1.257						99% KM (Chebyshev) UCL	2.347
388				Theta star	0.319							
389				Nu star	30.17		**Potential UCLs to Use**					
390				AppChi2	18.63						95% KM (BCA) UCL	0.791
391				95% Gamma Approximate UCL (Use when n >= 40)	0.649							
392				95% Adjusted Gamma UCL (Use when n < 40)	0.7							
393	**Note: DL/2 is not a recommended method.**											
394												
395	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
396	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
397	**For additional insight, the user may want to consult a statistician.**											
398												
399												
400	**Bis(2-Ethylhexyl)phthalate**											
401												
402	**General Statistics**											
403				Number of Valid Data	17						Number of Detected Data	12
404				Number of Distinct Detected Data	11						Number of Non-Detect Data	5
405											Percent Non-Detects	29.41%
406												
407	**Raw Statistics**						**Log-transformed Statistics**					
408				Minimum Detected	0.022						Minimum Detected	-3.817
409				Maximum Detected	340						Maximum Detected	5.829
410				Mean of Detected	31.56						Mean of Detected	0.295
411				SD of Detected	97.27						SD of Detected	2.712
412				Minimum Non-Detect	0.36						Minimum Non-Detect	-1.022
413				Maximum Non-Detect	4						Maximum Non-Detect	1.386
414												
415	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	13
416	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	4

417	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	76.47%
418												
419	**UCL Statistics**											
420	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
421	Shapiro Wilk Test Statistic					0.365	Shapiro Wilk Test Statistic					0.977
422	5% Shapiro Wilk Critical Value					0.859	5% Shapiro Wilk Critical Value					0.859
423	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
424												
425	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
426	DL/2 Substitution Method						DL/2 Substitution Method					
427	Mean					22.44	Mean					-0.12
428	SD					81.96	SD					2.399
429	95% DL/2 (t) UCL					57.15	95% H-Stat (DL/2) UCL					343.1
430												
431	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
432	**MLE yields a negative mean**						Mean in Log Scale					-0.49
433							SD in Log Scale					2.603
434							Mean in Original Scale					22.31
435							SD in Original Scale					81.99
436							95% t UCL					57.03
437							95% Percentile Bootstrap UCL					61.93
438							95% BCA Bootstrap UCL					83.28
439							95% H-UCL					659.6
440												
441	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
442	k star (bias corrected)					0.227	**Data Follow Appr. Gamma Distribution at 5% Significance Level**					
443	Theta Star					139.1						
444	nu star					5.443						
445												
446	A-D Test Statistic					1.111	**Nonparametric Statistics**					
447	5% A-D Critical Value					0.854	Kaplan-Meier (KM) Method					
448	K-S Test Statistic					0.854	Mean					22.34
449	5% K-S Critical Value					0.269	SD					79.54
450	**Data follow Appr. Gamma Distribution at 5% Significance Level**						SE of Mean					20.15
451							95% KM (t) UCL					57.52
452	**Assuming Gamma Distribution**						95% KM (z) UCL					55.48
453	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					57.06
454	Minimum					0.000001	95% KM (bootstrap t) UCL					702.4
455	Maximum					340	95% KM (BCA) UCL					62.26
456	Mean					22.28	95% KM (Percentile Bootstrap) UCL					61.45
457	Median					0.34	95% KM (Chebyshev) UCL					110.2
458	SD					82	97.5% KM (Chebyshev) UCL					148.2
459	k star					0.134	99% KM (Chebyshev) UCL					222.8
460	Theta star					166.7						
461	Nu star					4.544	**Potential UCLs to Use**					
462	AppChi2					0.948	95% KM (Chebyshev) UCL					110.2
463	95% Gamma Approximate UCL (Use when n >= 40)					106.8						
464	95% Adjusted Gamma UCL (Use when n < 40)					127.9						
465	**Note: DL/2 is not a recommended method.**											
466												
467	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
468	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											

	A	B	C	D	E	F	G	H	I	J	K	L
469	**For additional insight, the user may want to consult a statistician.**											
470												
471												
472	**Fluoranthene**											
473												
474	**General Statistics**											
475	Number of Valid Data					17	Number of Detected Data					9
476	Number of Distinct Detected Data					9	Number of Non-Detect Data					8
477							Percent Non-Detects					47.06%
478												
479	**Raw Statistics**						**Log-transformed Statistics**					
480	Minimum Detected					0.037	Minimum Detected					-3.297
481	Maximum Detected					0.94	Maximum Detected					-0.0619
482	Mean of Detected					0.279	Mean of Detected					-1.674
483	SD of Detected					0.271	SD of Detected					1.009
484	Minimum Non-Detect					0.36	Minimum Non-Detect					-1.022
485	Maximum Non-Detect					23	Maximum Non-Detect					3.135
486												
487	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					17
488	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					0
489	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					100.00%
490												
491	**Warning: There are only 9 Detected Values in this data**											
492	**Note: It should be noted that even though bootstrap may be performed on this data set**											
493	**the resulting calculations may not be reliable enough to draw conclusions**											
494												
495	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
496												
497												
498	**UCL Statistics**											
499	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
500	Shapiro Wilk Test Statistic					0.755	Shapiro Wilk Test Statistic					0.904
501	5% Shapiro Wilk Critical Value					0.829	5% Shapiro Wilk Critical Value					0.829
502	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
503												
504	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
505	DL/2 Substitution Method						DL/2 Substitution Method					
506	Mean					1.729	Mean					-0.727
507	SD					3.242	SD					1.619
508	95% DL/2 (t) UCL					3.102	95% H-Stat (DL/2) UCL					7.997
509												
510	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
511	**MLE method failed to converge properly**						Mean in Log Scale					-1.733
512							SD in Log Scale					0.719
513							Mean in Original Scale					0.226
514							SD in Original Scale					0.2
515							95% t UCL					0.31
516							95% Percentile Bootstrap UCL					0.31
517							95% BCA Bootstrap UCL					0.358
518							95% H-UCL					0.345
519												
520	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					

521				k star (bias corrected)	1.01	**Data appear Gamma Distributed at 5% Significance Level**						
522				Theta Star	0.276							
523				nu star	18.17							
524												
525				A-D Test Statistic	0.451	**Nonparametric Statistics**						
526				5% A-D Critical Value	0.736	Kaplan-Meier (KM) Method						
527				K-S Test Statistic	0.736	Mean	0.261					
528				5% K-S Critical Value	0.285	SD	0.237					
529	**Data appear Gamma Distributed at 5% Significance Level**					SE of Mean	0.0773					
530						95% KM (t) UCL	0.396					
531	**Assuming Gamma Distribution**					95% KM (z) UCL	0.388					
532	Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL	0.398					
533				Minimum	0.037	95% KM (bootstrap t) UCL	0.515					
534				Maximum	0.94	95% KM (BCA) UCL	0.404					
535				Mean	0.266	95% KM (Percentile Bootstrap) UCL	0.386					
536				Median	0.266	95% KM (Chebyshev) UCL	0.598					
537				SD	0.193	97.5% KM (Chebyshev) UCL	0.744					
538				k star	2.089	99% KM (Chebyshev) UCL	1.03					
539				Theta star	0.127							
540				Nu star	71.03	**Potential UCLs to Use**						
541				AppChi2	52.62	95% KM (t) UCL	0.396					
542				95% Gamma Approximate UCL (Use when n >= 40)	0.359							
543				95% Adjusted Gamma UCL (Use when n < 40)	0.371							
544	**Note: DL/2 is not a recommended method.**											
545												
546	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
547	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
548	**For additional insight, the user may want to consult a statistician.**											
549												
550												
551	**Phenanthrene**											
552												
553	**General Statistics**											
554				Number of Valid Data	17	Number of Detected Data	9					
555				Number of Distinct Detected Data	9	Number of Non-Detect Data	8					
556						Percent Non-Detects	47.06%					
557												
558	**Raw Statistics**					**Log-transformed Statistics**						
559				Minimum Detected	0.026	Minimum Detected	-3.65					
560				Maximum Detected	0.68	Maximum Detected	-0.386					
561				Mean of Detected	0.188	Mean of Detected	-2.105					
562				SD of Detected	0.2	SD of Detected	1.015					
563				Minimum Non-Detect	0.36	Minimum Non-Detect	-1.022					
564				Maximum Non-Detect	23	Maximum Non-Detect	3.135					
565												
566	Note: Data have multiple DLs - Use of KM Method is recommended					Number treated as Non-Detect	17					
567	For all methods (except KM, DL/2, and ROS Methods),					Number treated as Detected	0					
568	Observations < Largest ND are treated as NDs					Single DL Non-Detect Percentage	100.00%					
569												
570	**Warning: There are only 9 Detected Values in this data**											
571	**Note: It should be noted that even though bootstrap may be performed on this data set**											
572	**the resulting calculations may not be reliable enough to draw conclusions**											

	A	B	C	D	E	F	G	H	I	J	K	L
573												
574	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
575												
576												
577	**UCL Statistics**											
578	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
579	Shapiro Wilk Test Statistic					0.745	Shapiro Wilk Test Statistic					0.959
580	5% Shapiro Wilk Critical Value					0.829	5% Shapiro Wilk Critical Value					0.829
581	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
582												
583	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
584	DL/2 Substitution Method						DL/2 Substitution Method					
585	Mean					1.843	Mean					-0.91
586	SD					3.545	SD					1.816
587	95% DL/2 (t) UCL					3.344	95% H-Stat (DL/2) UCL					13.17
588												
589	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
590	**MLE method failed to converge properly**						Mean in Log Scale					-2.149
591							SD in Log Scale					0.72
592							Mean in Original Scale					0.152
593							SD in Original Scale					0.147
594							95% t UCL					0.214
595							95% Percentile Bootstrap UCL					0.211
596							95% BCA Bootstrap UCL					0.243
597							95% H-UCL					0.228
598												
599	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
600	k star (bias corrected)					0.935	**Data appear Gamma Distributed at 5% Significance Level**					
601	Theta Star					0.201						
602	nu star					16.82						
603												
604	A-D Test Statistic					0.304	**Nonparametric Statistics**					
605	5% A-D Critical Value					0.738	Kaplan-Meier (KM) Method					
606	K-S Test Statistic					0.738	Mean					0.177
607	5% K-S Critical Value					0.285	SD					0.176
608	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.0575
609							95% KM (t) UCL					0.277
610	**Assuming Gamma Distribution**						95% KM (z) UCL					0.272
611	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.279
612	Minimum					0.026	95% KM (bootstrap t) UCL					0.383
613	Maximum					0.68	95% KM (BCA) UCL					0.274
614	Mean					0.18	95% KM (Percentile Bootstrap) UCL					0.276
615	Median					0.178	95% KM (Chebyshev) UCL					0.428
616	SD					0.142	97.5% KM (Chebyshev) UCL					0.536
617	k star					1.935	99% KM (Chebyshev) UCL					0.749
618	Theta star					0.0931						
619	Nu star					65.8	**Potential UCLs to Use**					
620	AppChi2					48.13	95% KM (BCA) UCL					0.274
621	95% Gamma Approximate UCL (Use when n >= 40)					0.246						
622	95% Adjusted Gamma UCL (Use when n < 40)					0.255						
623	**Note: DL/2 is not a recommended method.**											
624												

	A	B	C	D	E	F	G	H	I	J	K	L
625	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
626	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
627	For additional insight, the user may want to consult a statistician.											
628												
629												
630	Pyrene											
631												
632	General Statistics											
633						Number of Valid Data	17				Number of Detected Data	9
634						Number of Distinct Detected Data	9				Number of Non-Detect Data	8
635											Percent Non-Detects	47.06%
636												
637	Raw Statistics									Log-transformed Statistics		
638						Minimum Detected	0.042				Minimum Detected	-3.17
639						Maximum Detected	0.66				Maximum Detected	-0.416
640						Mean of Detected	0.223				Mean of Detected	-1.828
641						SD of Detected	0.192				SD of Detected	0.897
642						Minimum Non-Detect	0.36				Minimum Non-Detect	-1.022
643						Maximum Non-Detect	23				Maximum Non-Detect	3.135
644												
645	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	17
646	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
647	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
648												
649	Warning: There are only 9 Detected Values in this data											
650	Note: It should be noted that even though bootstrap may be performed on this data set											
651	the resulting calculations may not be reliable enough to draw conclusions											
652												
653	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
654												
655												
656	UCL Statistics											
657	Normal Distribution Test with Detected Values Only									Lognormal Distribution Test with Detected Values Only		
658						Shapiro Wilk Test Statistic	0.816				Shapiro Wilk Test Statistic	0.921
659						5% Shapiro Wilk Critical Value	0.829				5% Shapiro Wilk Critical Value	0.829
660	Data not Normal at 5% Significance Level									Data appear Lognormal at 5% Significance Level		
661												
662	Assuming Normal Distribution									Assuming Lognormal Distribution		
663						DL/2 Substitution Method					DL/2 Substitution Method	
664						Mean	1.699				Mean	-0.808
665						SD	3.253				SD	1.638
666						95% DL/2 (t) UCL	3.077				95% H-Stat (DL/2) UCL	7.857
667												
668						Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method	
669	MLE method failed to converge properly										Mean in Log Scale	-1.882
670											SD in Log Scale	0.639
671											Mean in Original Scale	0.186
672											SD in Original Scale	0.142
673											95% t UCL	0.246
674											95% Percentile Bootstrap UCL	0.248
675											95% BCA Bootstrap UCL	0.274
676											95% H-UCL	0.265

677												
678	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
679				k star (bias corrected)		1.195	**Data appear Gamma Distributed at 5% Significance Level**					
680				Theta Star		0.186						
681				nu star		21.51						
682												
683				A-D Test Statistic		0.376	**Nonparametric Statistics**					
684				5% A-D Critical Value		0.733				Kaplan-Meier (KM) Method		
685				K-S Test Statistic		0.733				Mean		0.21
686				5% K-S Critical Value		0.283				SD		0.17
687	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean		0.0557
688										95% KM (t) UCL		0.307
689	**Assuming Gamma Distribution**									95% KM (z) UCL		0.301
690				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.308
691				Minimum		0.042				95% KM (bootstrap t) UCL		0.399
692				Maximum		0.66				95% KM (BCA) UCL		0.311
693				Mean		0.216				95% KM (Percentile Bootstrap) UCL		0.303
694				Median		0.21				95% KM (Chebyshev) UCL		0.453
695				SD		0.137				97.5% KM (Chebyshev) UCL		0.558
696				k star		2.518				99% KM (Chebyshev) UCL		0.764
697				Theta star		0.086						
698				Nu star		85.6	**Potential UCLs to Use**					
699				AppChi2		65.27				95% KM (t) UCL		0.307
700				95% Gamma Approximate UCL (Use when n >= 40)		0.284						
701				95% Adjusted Gamma UCL (Use when n < 40)		0.292						
702	**Note: DL/2 is not a recommended method.**											
703												
704	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
705	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
706	**For additional insight, the user may want to consult a statistician.**											
707												
708												
709	**4,4'-DDD**											
710												
711	**General Statistics**											
712				Number of Valid Data		3				Number of Detected Data		1
713				Number of Distinct Detected Data		1				Number of Non-Detect Data		2
714										Percent Non-Detects		66.67%
715												
716	**Warning: This data set only has 3 observations!**											
717	**Data set is too small to compute reliable and meaningful statistics and estimates!**											
718	**The data set for variable 4,4'-DDD was not processed!**											
719												
720	**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**											
721	**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
722												
723												
724												
725	**4,4'-DDE**											
726												
727	**General Statistics**											
728				Number of Valid Data		3				Number of Detected Data		1

729				Number of Distinct Detected Data		1				Number of Non-Detect Data		2
730										Percent Non-Detects		66.67%
731												
732						**Warning: This data set only has 3 observations!**							
733						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
734						**The data set for variable 4,4'-DDE was not processed!**							
735												
736						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
737						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
738												
739												
740												
741	**4,4'-DDT**											
742												
743						**General Statistics**							
744				Number of Valid Data		3				Number of Detected Data		1
745				Number of Distinct Detected Data		1				Number of Non-Detect Data		2
746										Percent Non-Detects		66.67%
747												
748						**Warning: This data set only has 3 observations!**							
749						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
750						**The data set for variable 4,4'-DDT was not processed!**							
751												
752						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
753						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
754												
755												
756												
757	**Aluminum**											
758												
759						**General Statistics**							
760						Number of Valid Observations	13				Number of Distinct Observations	12
761												
762						**Raw Statistics**					**Log-transformed Statistics**	
763						Minimum	1200				Minimum of Log Data	7.09
764						Maximum	24000				Maximum of Log Data	10.09
765						Mean	8715				Mean of log Data	8.799
766						Geometric Mean	6625				SD of log Data	0.805
767						Median	5500					
768						SD	6607					
769						Std. Error of Mean	1832					
770						Coefficient of Variation	0.758					
771						Skewness	1.175					
772												
773						**Relevant UCL Statistics**							
774						**Normal Distribution Test**					**Lognormal Distribution Test**	
775						Shapiro Wilk Test Statistic	0.863				Shapiro Wilk Test Statistic	0.945
776						Shapiro Wilk Critical Value	0.866				Shapiro Wilk Critical Value	0.866
777						**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**	
778												
779						**Assuming Normal Distribution**					**Assuming Lognormal Distribution**	
780						95% Student's-t UCL	11981				95% H-UCL	16496

781	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL		18034
782			95% Adjusted-CLT UCL (Chen-1995)			12367				97.5% Chebyshev (MVUE) UCL		21993
783			95% Modified-t UCL (Johnson-1978)			12081				99% Chebyshev (MVUE) UCL		29770
784												
785	**Gamma Distribution Test**									**Data Distribution**		
786			k star (bias corrected)			1.57				**Data appear Gamma Distributed at 5% Significance Level**		
787			Theta Star			5552						
788			MLE of Mean			8715						
789			MLE of Standard Deviation			6956						
790			nu star			40.81						
791			Approximate Chi Square Value (.05)			27.17				**Nonparametric Statistics**		
792			Adjusted Level of Significance			0.0301				95% CLT UCL		11729
793			Adjusted Chi Square Value			25.6				95% Jackknife UCL		11981
794										95% Standard Bootstrap UCL		11598
795			Anderson-Darling Test Statistic			0.463				95% Bootstrap-t UCL		13278
796			Anderson-Darling 5% Critical Value			0.744				95% Hall's Bootstrap UCL		12594
797			Kolmogorov-Smirnov Test Statistic			0.213				95% Percentile Bootstrap UCL		11685
798			Kolmogorov-Smirnov 5% Critical Value			0.239				95% BCA Bootstrap UCL		12346
799	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL		16702
800										97.5% Chebyshev(Mean, Sd) UCL		20158
801	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL		26947
802			95% Approximate Gamma UCL (Use when n >= 40)			13090						
803			95% Adjusted Gamma UCL (Use when n < 40)			13897						
804												
805	**Potential UCL to Use**									Use 95% Approximate Gamma UCL		13090
806												
807	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
808	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
809	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
810												
811												
812	**Cadmium**											
813												
814	**General Statistics**											
815			Number of Valid Data			14				Number of Detected Data		9
816			Number of Distinct Detected Data			9				Number of Non-Detect Data		5
817										Percent Non-Detects		35.71%
818												
819	**Raw Statistics**									**Log-transformed Statistics**		
820			Minimum Detected			0.14				Minimum Detected		-1.966
821			Maximum Detected			1.1				Maximum Detected		0.0953
822			Mean of Detected			0.61				Mean of Detected		-0.659
823			SD of Detected			0.317				SD of Detected		0.673
824			Minimum Non-Detect			0.2				Minimum Non-Detect		-1.609
825			Maximum Non-Detect			1				Maximum Non-Detect		0
826												
827	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		13
828	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		1
829	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		92.86%
830												
831	**Warning: There are only 9 Detected Values in this data**											
832	**Note: It should be noted that even though bootstrap may be performed on this data set**											

833	the resulting calculations may not be reliable enough to draw conclusions											
834												
835	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
836												
837												
838	UCL Statistics											
839	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
840	Shapiro Wilk Test Statistic				0.971		Shapiro Wilk Test Statistic				0.903	
841	5% Shapiro Wilk Critical Value				0.829		5% Shapiro Wilk Critical Value				0.829	
842	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
843												
844	Assuming Normal Distribution						Assuming Lognormal Distribution					
845	DL/2 Substitution Method						DL/2 Substitution Method					
846	Mean				0.514		Mean				-0.88	
847	SD				0.303		SD				0.744	
848	95% DL/2 (t) UCL				0.657		95% H-Stat (DL/2) UCL				0.897	
849												
850	Maximum Likelihood Estimate(MLE) Method				N/A		Log ROS Method					
851	MLE method failed to converge properly						Mean in Log Scale				-0.865	
852							SD in Log Scale				0.642	
853							Mean in Original Scale				0.503	
854							SD in Original Scale				0.299	
855							95% t UCL				0.645	
856							95% Percentile Bootstrap UCL				0.637	
857							95% BCA Bootstrap UCL				0.642	
858							95% H-UCL				0.775	
859												
860	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
861	k star (bias corrected)				2.198		Data appear Normal at 5% Significance Level					
862	Theta Star				0.277							
863	nu star				39.57							
864												
865	A-D Test Statistic				0.306		Nonparametric Statistics					
866	5% A-D Critical Value				0.726		Kaplan-Meier (KM) Method					
867	K-S Test Statistic				0.726		Mean				0.511	
868	5% K-S Critical Value				0.281		SD				0.313	
869	Data appear Gamma Distributed at 5% Significance Level						SE of Mean				0.0973	
870							95% KM (t) UCL				0.683	
871	Assuming Gamma Distribution						95% KM (z) UCL				0.671	
872	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL				0.68	
873	Minimum				0.0123		95% KM (bootstrap t) UCL				0.684	
874	Maximum				1.1		95% KM (BCA) UCL				0.71	
875	Mean				0.505		95% KM (Percentile Bootstrap) UCL				0.688	
876	Median				0.495		95% KM (Chebyshev) UCL				0.935	
877	SD				0.322		97.5% KM (Chebyshev) UCL				1.119	
878	k star				1.227		99% KM (Chebyshev) UCL				1.479	
879	Theta star				0.411							
880	Nu star				34.36		Potential UCLs to Use					
881	AppChi2				21.95		95% KM (t) UCL				0.683	
882	95% Gamma Approximate UCL (Use when n >= 40)				0.79		95% KM (Percentile Bootstrap) UCL				0.688	
883	95% Adjusted Gamma UCL (Use when n < 40)				0.84							
884	Note: DL/2 is not a recommended method.											

	A	B	C	D	E	F	G	H	I	J	K	L
885												
886	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
887	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
888	**For additional insight, the user may want to consult a statistician.**											
889												
890												
891	**Chromium**											
892												
893	**General Statistics**											
894	Number of Valid Data					15	Number of Detected Data					14
895	Number of Distinct Detected Data					11	Number of Non-Detect Data					1
896							Percent Non-Detects					6.67%
897												
898	**Raw Statistics**						**Log-transformed Statistics**					
899	Minimum Detected					10	Minimum Detected					2.303
900	Maximum Detected					275	Maximum Detected					5.617
901	Mean of Detected					42.07	Mean of Detected					3.186
902	SD of Detected					69.64	SD of Detected					0.889
903	Minimum Non-Detect					5	Minimum Non-Detect					1.609
904	Maximum Non-Detect					5	Maximum Non-Detect					1.609
905												
906												
907	**UCL Statistics**											
908	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
909	Shapiro Wilk Test Statistic					0.476	Shapiro Wilk Test Statistic					0.801
910	5% Shapiro Wilk Critical Value					0.874	5% Shapiro Wilk Critical Value					0.874
911	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
912												
913	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
914	DL/2 Substitution Method						DL/2 Substitution Method					
915	Mean					39.43	Mean					3.035
916	SD					67.88	SD					1.038
917	95% DL/2 (t) UCL					70.3	95% H-Stat (DL/2) UCL					77.58
918												
919	Maximum Likelihood Estimate(MLE) Method						Log ROS Method					
920	Mean					36.62	Mean in Log Scale					3.054
921	SD					68.6	SD in Log Scale					0.998
922	95% MLE (t) UCL					67.81	Mean in Original Scale					39.49
923	95% MLE (Tiku) UCL					65.27	SD in Original Scale					67.85
924							95% t UCL					70.34
925							95% Percentile Bootstrap UCL					72.27
926							95% BCA Bootstrap UCL					88.67
927							95% H UCL					72.49
928												
929	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
930	k star (bias corrected)					0.864	**Data do not follow a Discernable Distribution (0.05)**					
931	Theta Star					48.68						
932	nu star					24.2						
933												
934	A-D Test Statistic					1.867	**Nonparametric Statistics**					
935	5% A-D Critical Value					0.759	Kaplan-Meier (KM) Method					
936	K-S Test Statistic					0.759	Mean					39.93

937				5% K-S Critical Value	0.235					SD	65.32
938	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean	17.5
939										95% KM (t) UCL	70.76
940	**Assuming Gamma Distribution**									95% KM (z) UCL	68.72
941	Gamma ROS Statistics using Extrapolated Data									95% KM (jackknife) UCL	70.68
942				Minimum	0.000001					95% KM (bootstrap t) UCL	239.7
943				Maximum	275					95% KM (BCA) UCL	72.87
944				Mean	39.27					95% KM (Percentile Bootstrap) UCL	72.13
945				Median	19					95% KM (Chebyshev) UCL	116.2
946				SD	67.98					97.5% KM (Chebyshev) UCL	149.2
947				k star	0.369					99% KM (Chebyshev) UCL	214.1
948				Theta star	106.4						
949				Nu star	11.07					**Potential UCLs to Use**	
950				AppChi2	4.624					95% KM (Chebyshev) UCL	116.2
951				95% Gamma Approximate UCL (Use when n >= 40)	94.04						
952				95% Adjusted Gamma UCL (Use when n < 40)	105.5						
953	**Note: DL/2 is not a recommended method.**										
954											
955	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
956	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**										
957	**For additional insight, the user may want to consult a statistician.**										
958											
959											
960	**Copper**										
961											
962	**General Statistics**										
963				Number of Valid Observations	12					Number of Distinct Observations	11
964											
965	**Raw Statistics**									**Log-transformed Statistics**	
966				Minimum	5.2					Minimum of Log Data	1.649
967				Maximum	35					Maximum of Log Data	3.555
968				Mean	17.93					Mean of log Data	2.768
969				Geometric Mean	15.93					SD of log Data	0.538
970				Median	17.5						
971				SD	8.463						
972				Std. Error of Mean	2.443						
973				Coefficient of Variation	0.472						
974				Skewness	0.443						
975											
976	**Relevant UCL Statistics**										
977	**Normal Distribution Test**									**Lognormal Distribution Test**	
978				Shapiro Wilk Test Statistic	0.977					Shapiro Wilk Test Statistic	0.961
979				Shapiro Wilk Critical Value	0.859					Shapiro Wilk Critical Value	0.859
980	**Data appear Normal at 5% Significance Level**									**Data appear Lognormal at 5% Significance Level**	
981											
982	**Assuming Normal Distribution**									**Assuming Lognormal Distribution**	
983				95% Student's-t UCL	22.32					95% H-UCL	26.26
984	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	30.8
985				95% Adjusted-CLT UCL (Chen-1995)	22.29					97.5% Chebyshev (MVUE) UCL	36.26
986				95% Modified-t UCL (Johnson-1978)	22.37					99% Chebyshev (MVUE) UCL	47
987											
988	**Gamma Distribution Test**									**Data Distribution**	

989				k star (bias corrected)	3.339		Data appear Normal at 5% Significance Level					
990				Theta Star	5.371							
991				MLE of Mean	17.93							
992				MLE of Standard Deviation	9.814							
993				nu star	80.14							
994				Approximate Chi Square Value (.05)	60.51		Nonparametric Statistics					
995				Adjusted Level of Significance	0.029					95% CLT UCL	21.95	
996				Adjusted Chi Square Value	57.91					95% Jackknife UCL	22.32	
997										95% Standard Bootstrap UCL	21.87	
998				Anderson-Darling Test Statistic	0.161					95% Bootstrap-t UCL	22.77	
999				Anderson-Darling 5% Critical Value	0.734					95% Hall's Bootstrap UCL	22.61	
1000				Kolmogorov-Smirnov Test Statistic	0.111					95% Percentile Bootstrap UCL	21.92	
1001				Kolmogorov-Smirnov 5% Critical Value	0.246					95% BCA Bootstrap UCL	22.42	
1002				Data appear Gamma Distributed at 5% Significance Level						95% Chebyshev(Mean, Sd) UCL	28.58	
1003										97.5% Chebyshev(Mean, Sd) UCL	33.19	
1004				Assuming Gamma Distribution						99% Chebyshev(Mean, Sd) UCL	42.24	
1005				95% Approximate Gamma UCL (Use when n >= 40)	23.75							
1006				95% Adjusted Gamma UCL (Use when n < 40)	24.81							
1007												
1008				Potential UCL to Use						Use 95% Student's-t UCL	22.32	
1009												
1010	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1011	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
1012	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
1013												
1014												
1015	Iron											
1016												
1017	General Statistics											
1018				Number of Valid Observations	13					Number of Distinct Observations	12	
1019												
1020	Raw Statistics						Log-transformed Statistics					
1021				Minimum	710					Minimum of Log Data	6.565	
1022				Maximum	36000					Maximum of Log Data	10.49	
1023				Mean	10908					Mean of log Data	8.955	
1024				Geometric Mean	7748					SD of log Data	0.942	
1025				Median	6900							
1026				SD	9582							
1027				Std. Error of Mean	2658							
1028				Coefficient of Variation	0.878							
1029				Skewness	1.8							
1030												
1031	Relevant UCL Statistics											
1032	Normal Distribution Test						Lognormal Distribution Test					
1033				Shapiro Wilk Test Statistic	0.77					Shapiro Wilk Test Statistic	0.86	
1034				Shapiro Wilk Critical Value	0.866					Shapiro Wilk Critical Value	0.866	
1035	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
1036												
1037	Assuming Normal Distribution						Assuming Lognormal Distribution					
1038				95% Student's-t UCL	15645					95% H-UCL	25510	
1039	95% UCLs (Adjusted for Skewness)									95% Chebyshev (MVUE) UCL	25637	
1040				95% Adjusted-CLT UCL (Chen-1995)	16697					97.5% Chebyshev (MVUE) UCL	31737	

1041	95% Modified-t UCL (Johnson-1978)					15866					99% Chebyshev (MVUE) UCL	43717
1042												
1043	**Gamma Distribution Test**						**Data Distribution**					
1044	k star (bias corrected)					1.288	**Data do not follow a Discernable Distribution (0.05)**					
1045	Theta Star					8468						
1046	MLE of Mean					10908						
1047	MLE of Standard Deviation					9611						
1048	nu star					33.49						
1049	Approximate Chi Square Value (.05)					21.26	**Nonparametric Statistics**					
1050	Adjusted Level of Significance					0.0301	95% CLT UCL					15280
1051	Adjusted Chi Square Value					19.88	95% Jackknife UCL					15645
1052							95% Standard Bootstrap UCL					15036
1053	Anderson-Darling Test Statistic					0.803	95% Bootstrap-t UCL					19389
1054	Anderson-Darling 5% Critical Value					0.749	95% Hall's Bootstrap UCL					30355
1055	Kolmogorov-Smirnov Test Statistic					0.279	95% Percentile Bootstrap UCL					15277
1056	Kolmogorov-Smirnov 5% Critical Value					0.241	95% BCA Bootstrap UCL					17215
1057	**Data not Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					22493
1058							97.5% Chebyshev(Mean, Sd) UCL					27505
1059	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					37352
1060	95% Approximate Gamma UCL (Use when n >= 40)					17185						
1061	95% Adjusted Gamma UCL (Use when n < 40)					18378						
1062												
1063	**Potential UCL to Use**						Use 95% Chebyshev (Mean, Sd) UCL					22493
1064												
1065	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1066	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1067	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1068												
1069												
1070	**Lead**											
1071												
1072	**General Statistics**											
1073	Number of Valid Data					14	Number of Detected Data					13
1074	Number of Distinct Detected Data					13	Number of Non-Detect Data					1
1075							Percent Non-Detects					7.14%
1076												
1077	**Raw Statistics**						**Log-transformed Statistics**					
1078	Minimum Detected					3.85	Minimum Detected					1.348
1079	Maximum Detected					80	Maximum Detected					4.382
1080	Mean of Detected					42.83	Mean of Detected					3.504
1081	SD of Detected					25.05	SD of Detected					0.871
1082	Minimum Non-Detect					5	Minimum Non-Detect					1.609
1083	Maximum Non-Detect					5	Maximum Non-Detect					1.609
1084												
1085												
1086	**UCL Statistics**											
1087	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1088	Shapiro Wilk Test Statistic					0.956	Shapiro Wilk Test Statistic					0.873
1089	5% Shapiro Wilk Critical Value					0.866	5% Shapiro Wilk Critical Value					0.866
1090	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1091												
1092	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					

1093				DL/2 Substitution Method							DL/2 Substitution Method	
1094				Mean	39.95						Mean	3.319
1095				SD	26.37						SD	1.085
1096				95% DL/2 (t) UCL	52.43						95% H-Stat (DL/2) UCL	120.5
1097												
1098				Maximum Likelihood Estimate(MLE) Method							Log ROS Method	
1099				Mean	38.2						Mean in Log Scale	3.393
1100				SD	28.53						SD in Log Scale	0.935
1101				95% MLE (t) UCL	51.7						Mean in Original Scale	40.27
1102				95% MLE (Tiku) UCL	52.05						SD in Original Scale	25.9
1103											95% t UCL	52.53
1104											95% Percentile Bootstrap UCL	51.86
1105											95% BCA Bootstrap UCL	52.43
1106											95% H UCL	92.35
1107												
1108				**Gamma Distribution Test with Detected Values Only**							**Data Distribution Test with Detected Values Only**	
1109				k star (bias corrected)	1.688						**Data appear Normal at 5% Significance Level**	
1110				Theta Star	25.38							
1111				nu star	43.89							
1112												
1113				A-D Test Statistic	0.344						**Nonparametric Statistics**	
1114				5% A-D Critical Value	0.743						Kaplan-Meier (KM) Method	
1115				K-S Test Statistic	0.743						Mean	40.05
1116				5% K-S Critical Value	0.239						SD	25.27
1117				**Data appear Gamma Distributed at 5% Significance Level**							SE of Mean	7.03
1118											95% KM (t) UCL	52.5
1119				**Assuming Gamma Distribution**							95% KM (z) UCL	51.61
1120				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	52.31
1121				Minimum	0.000001						95% KM (bootstrap t) UCL	53.2
1122				Maximum	80						95% KM (BCA) UCL	52.13
1123				Mean	39.78						95% KM (Percentile Bootstrap) UCL	51.64
1124				Median	38						95% KM (Chebyshev) UCL	70.69
1125				SD	26.65						97.5% KM (Chebyshev) UCL	83.95
1126				k star	0.405						99% KM (Chebyshev) UCL	110
1127				Theta star	98.14							
1128				Nu star	11.35						**Potential UCLs to Use**	
1129				AppChi2	4.801						95% KM (t) UCL	52.5
1130				95% Gamma Approximate UCL (Use when n >= 40)	94.02						95% KM (Percentile Bootstrap) UCL	51.64
1131				95% Adjusted Gamma UCL (Use when n < 40)	106.2							
1132	**Note: DL/2 is not a recommended method.**											
1133												
1134	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1135	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1136	**For additional insight, the user may want to consult a statistician.**											
1137												
1138												
1139	**Mercury**											
1140												
1141				**General Statistics**								
1142				Number of Valid Data	14						Number of Detected Data	8
1143				Number of Distinct Detected Data	8						Number of Non-Detect Data	6
1144											Percent Non-Detects	42.86%

	A	B	C	D	E	F	G	H	I	J	K	L
1145												
1146	**Raw Statistics**						**Log-transformed Statistics**					
1147					Minimum Detected	0.01					Minimum Detected	-4.605
1148					Maximum Detected	0.35					Maximum Detected	-1.05
1149					Mean of Detected	0.129					Mean of Detected	-2.373
1150					SD of Detected	0.1					SD of Detected	1.022
1151					Minimum Non-Detect	0.05					Minimum Non-Detect	-2.996
1152					Maximum Non-Detect	0.76					Maximum Non-Detect	-0.274
1153												
1154	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	14
1155	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
1156	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
1157												
1158	**Warning: There are only 8 Detected Values in this data**											
1159	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1160	**the resulting calculations may not be reliable enough to draw conclusions**											
1161												
1162	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1163												
1164												
1165	**UCL Statistics**											
1166	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1167					Shapiro Wilk Test Statistic	0.845					Shapiro Wilk Test Statistic	0.848
1168					5% Shapiro Wilk Critical Value	0.818					5% Shapiro Wilk Critical Value	0.818
1169	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1170												
1171	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1172					DL/2 Substitution Method						DL/2 Substitution Method	
1173					Mean	0.147					Mean	-2.241
1174					SD	0.109					SD	0.965
1175					95% DL/2 (t) UCL	0.199					95% H-Stat (DL/2) UCL	0.352
1176												
1177					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1178	**MLE method failed to converge properly**										Mean in Log Scale	-2.579
1179											SD in Log Scale	0.867
1180											Mean in Original Scale	0.102
1181											SD in Original Scale	0.0825
1182											95% t UCL	0.141
1183											95% Percentile Bootstrap UCL	0.139
1184											95% BCA Bootstrap UCL	0.157
1185											95% H-UCL	0.205
1186												
1187	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1188					k star (bias corrected)	1.128	**Data appear Normal at 5% Significance Level**					
1189					Theta Star	0.115						
1190					nu star	18.05						
1191												
1192					A-D Test Statistic	0.409	**Nonparametric Statistics**					
1193					5% A-D Critical Value	0.727					Kaplan-Meier (KM) Method	
1194					K-S Test Statistic	0.727					Mean	0.111
1195					5% K-S Critical Value	0.298					SD	0.0902
1196	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0302

1197											95% KM (t) UCL	0.164
1198	**Assuming Gamma Distribution**										95% KM (z) UCL	0.16
1199				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	0.163
1200					Minimum	0.000001					95% KM (bootstrap t) UCL	0.186
1201					Maximum	0.35					95% KM (BCA) UCL	0.173
1202					Mean	0.112					95% KM (Percentile Bootstrap) UCL	0.162
1203					Median	0.112					95% KM (Chebyshev) UCL	0.242
1204					SD	0.0834					97.5% KM (Chebyshev) UCL	0.299
1205					k star	0.542					99% KM (Chebyshev) UCL	0.411
1206					Theta star	0.206						
1207					Nu star	15.17	**Potential UCLs to Use**					
1208					AppChi2	7.381					95% KM (t) UCL	0.164
1209				95% Gamma Approximate UCL (Use when n >= 40)		0.23					95% KM (Percentile Bootstrap) UCL	0.162
1210				95% Adjusted Gamma UCL (Use when n < 40)		0.254						
1211	**Note: DL/2 is not a recommended method.**											
1212												
1213	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1214	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1215	**For additional insight, the user may want to consult a statistician.**											
1216												
1217												
1218	**Selenium**											
1219												
1220	**General Statistics**											
1221					Number of Valid Data	14					Number of Detected Data	4
1222					Number of Distinct Detected Data	4					Number of Non-Detect Data	10
1223											Percent Non-Detects	71.43%
1224												
1225	**Raw Statistics**						**Log-transformed Statistics**					
1226					Minimum Detected	0.93					Minimum Detected	-0.0726
1227					Maximum Detected	3.6					Maximum Detected	1.281
1228					Mean of Detected	2.108					Mean of Detected	0.636
1229					SD of Detected	1.106					SD of Detected	0.554
1230					Minimum Non-Detect	0.5					Minimum Non-Detect	-0.693
1231					Maximum Non-Detect	5					Maximum Non-Detect	1.609
1232												
1233	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	14
1234	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
1235	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
1236												
1237	**Warning: There are only 4 Distinct Detected Values in this data**											
1238	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1239	**the resulting calculations may not be reliable enough to draw conclusions**											
1240												
1241	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1242												
1243												
1244	**UCL Statistics**											
1245	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1246					Shapiro Wilk Test Statistic	0.935					Shapiro Wilk Test Statistic	0.956
1247					5% Shapiro Wilk Critical Value	0.748					5% Shapiro Wilk Critical Value	0.748
1248	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					

1249												
1250	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1251				DL/2 Substitution Method						DL/2 Substitution Method		
1252				Mean		1.112				Mean		-0.213
1253				SD		1				SD		0.801
1254				95% DL/2 (t) UCL		1.585				95% H-Stat (DL/2) UCL		1.932
1255												
1256				Maximum Likelihood Estimate(MLE) Method		N/A				Log ROS Method		
1257	**MLE method failed to converge properly**									Mean in Log Scale		-0.578
1258										SD in Log Scale		0.885
1259										Mean in Original Scale		0.862
1260										SD in Original Scale		0.981
1261										95% t UCL		1.326
1262										95% Percentile Bootstrap UCL		1.341
1263										95% BCA Bootstrap UCL		1.496
1264										95% H-UCL		1.575
1265												
1266	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1267				k star (bias corrected)		1.347	**Data appear Normal at 5% Significance Level**					
1268				Theta Star		1.565						
1269				nu star		10.77						
1270												
1271				A-D Test Statistic		0.291	**Nonparametric Statistics**					
1272				5% A-D Critical Value		0.659				Kaplan-Meier (KM) Method		
1273				K-S Test Statistic		0.659				Mean		1.292
1274				5% K-S Critical Value		0.396				SD		0.76
1275	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean		0.243
1276										95% KM (t) UCL		1.723
1277	**Assuming Gamma Distribution**									95% KM (z) UCL		1.693
1278				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		1.925
1279				Minimum		0.000001				95% KM (bootstrap t) UCL		1.629
1280				Maximum		3.6				95% KM (BCA) UCL		N/A
1281				Mean		0.602				95% KM (Percentile Bootstrap) UCL		2.382
1282				Median		0.000001				95% KM (Chebyshev) UCL		2.353
1283				SD		1.122				97.5% KM (Chebyshev) UCL		2.812
1284				k star		0.118				99% KM (Chebyshev) UCL		3.714
1285				Theta star		5.1						
1286				Nu star		3.306	**Potential UCLs to Use**					
1287				AppChi2		0.469				95% KM (t) UCL		1.723
1288				95% Gamma Approximate UCL (Use when n >= 40)		4.248				95% KM (Percentile Bootstrap) UCL		2.382
1289				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
1290	**Note: DL/2 is not a recommended method.**											
1291												
1292	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1293	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1294	**For additional insight, the user may want to consult a statistician.**											
1295												
1296												
1297	**Vanadium**											
1298												
1299	**General Statistics**											
1300				Number of Valid Observations		12				Number of Distinct Observations		9

Raw Statistics		
Minimum	14	
Maximum	44	
Mean	23.58	
Geometric Mean	21.92	
Median	19.5	
SD	10.16	
Std. Error of Mean	2.932	
Coefficient of Variation	0.431	
Skewness	1.284	

Log-transformed Statistics	
Minimum of Log Data	2.639
Maximum of Log Data	3.784
Mean of log Data	3.088
SD of log Data	0.385

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.823
Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level	
Assuming Normal Distribution	
95% Student's-t UCL	28.85
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	29.57
95% Modified-t UCL (Johnson-1978)	29.03

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.903
Shapiro Wilk Critical Value	0.859
Data appear Lognormal at 5% Significance Level	
Assuming Lognormal Distribution	
95% H-UCL	29.82
95% Chebyshev (MVUE) UCL	34.99
97.5% Chebyshev (MVUE) UCL	39.98
99% Chebyshev (MVUE) UCL	49.78

Gamma Distribution Test	
k star (bias corrected)	5.316
Theta Star	4.436
MLE of Mean	23.58
MLE of Standard Deviation	10.23
nu star	127.6
Approximate Chi Square Value (.05)	102.5
Adjusted Level of Significance	0.029
Adjusted Chi Square Value	99.07
Anderson-Darling Test Statistic	0.606
Anderson-Darling 5% Critical Value	0.731
Kolmogorov-Smirnov Test Statistic	0.2
Kolmogorov-Smirnov 5% Critical Value	0.246
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	29.36
95% Adjusted Gamma UCL (Use when n < 40)	30.37
Potential UCL to Use	

Data Distribution	
Data appear Gamma Distributed at 5% Significance Level	
Nonparametric Statistics	
95% CLT UCL	28.41
95% Jackknife UCL	28.85
95% Standard Bootstrap UCL	28.18
95% Bootstrap-t UCL	32.75
95% Hall's Bootstrap UCL	33.53
95% Percentile Bootstrap UCL	28.33
95% BCA Bootstrap UCL	29.33
95% Chebyshev(Mean, Sd) UCL	36.36
97.5% Chebyshev(Mean, Sd) UCL	41.89
99% Chebyshev(Mean, Sd) UCL	52.76
Use 95% Approximate Gamma UCL	29.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

1353	**Zinc**											
1354												
1355	**General Statistics**											
1356	Number of Valid Observations				12		Number of Distinct Observations					12
1357												
1358	**Raw Statistics**						**Log-transformed Statistics**					
1359	Minimum				6.7		Minimum of Log Data					1.902
1360	Maximum				140		Maximum of Log Data					4.942
1361	Mean				48.77		Mean of log Data					3.554
1362	Geometric Mean				34.95		SD of log Data					0.893
1363	Median				35							
1364	SD				40.42							
1365	Std. Error of Mean				11.67							
1366	Coefficient of Variation				0.829							
1367	Skewness				1.221							
1368												
1369	**Relevant UCL Statistics**											
1370	**Normal Distribution Test**						**Lognormal Distribution Test**					
1371	Shapiro Wilk Test Statistic				0.88		Shapiro Wilk Test Statistic					0.985
1372	Shapiro Wilk Critical Value				0.859		Shapiro Wilk Critical Value					0.859
1373	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1374												
1375	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1376	95% Student's-t UCL				69.72		95% H-UCL					108.4
1377	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL					109.2
1378	95% Adjusted-CLT UCL (Chen-1995)				72.35		97.5% Chebyshev (MVUE) UCL					134.9
1379	95% Modified-t UCL (Johnson-1978)				70.41		99% Chebyshev (MVUE) UCL					185.4
1380												
1381	**Gamma Distribution Test**						**Data Distribution**					
1382	k star (bias corrected)				1.291		**Data appear Normal at 5% Significance Level**					
1383	Theta Star				37.77							
1384	MLE of Mean				48.77							
1385	MLE of Standard Deviation				42.92							
1386	nu star				30.99							
1387	Approximate Chi Square Value (.05)				19.27		**Nonparametric Statistics**					
1388	Adjusted Level of Significance				0.029		95% CLT UCL					67.96
1389	Adjusted Chi Square Value				17.87		95% Jackknife UCL					69.72
1390							95% Standard Bootstrap UCL					66.81
1391	Anderson-Darling Test Statistic				0.172		95% Bootstrap-t UCL					77
1392	Anderson-Darling 5% Critical Value				0.744		95% Hall's Bootstrap UCL					77.8
1393	Kolmogorov-Smirnov Test Statistic				0.122		95% Percentile Bootstrap UCL					67.6
1394	Kolmogorov-Smirnov 5% Critical Value				0.249		95% BCA Bootstrap UCL					71.1
1395	**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					99.63
1396							97.5% Chebyshev(Mean, Sd) UCL					121.6
1397	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					164.9
1398	95% Approximate Gamma UCL (Use when n >= 40)				78.42							
1399	95% Adjusted Gamma UCL (Use when n < 40)				84.56							
1400												
1401	**Potential UCL to Use**						Use 95% Student's-t UCL					69.72
1402												
1403	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1404	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											

	A	B	C	D	E	F	G	H	I	J	K	L
1405	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
1406												

Surface Soil – Exposure Area 4

1				**General UCL Statistics for Data Sets with Non-Detects**								
2			**User Selected Options**									
3			From File	WorkSheet.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	**Benzo(a)pyrene**											
10												
11						**General Statistics**							
12						Number of Valid Data	67				Number of Detected Data	18
13						Number of Distinct Detected Data	17				Number of Non-Detect Data	49
14						Number of Missing Values	39				Percent Non-Detects	73.13%
15												
16						**Raw Statistics**					**Log-transformed Statistics**	
17						Minimum Detected	0.011				Minimum Detected	-4.51
18						Maximum Detected	3.4				Maximum Detected	1.224
19						Mean of Detected	0.657				Mean of Detected	-1.664
20						SD of Detected	0.95				SD of Detected	1.871
21						Minimum Non-Detect	0.036				Minimum Non-Detect	-3.324
22						Maximum Non-Detect	0.82				Maximum Non-Detect	-0.198
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	63
25	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	4
26	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	94.03%
27												
28						**UCL Statistics**							
29						**Normal Distribution Test with Detected Values Only**					**Lognormal Distribution Test with Detected Values Only**		
30						Shapiro Wilk Test Statistic	0.713				Shapiro Wilk Test Statistic	0.927
31						5% Shapiro Wilk Critical Value	0.897				5% Shapiro Wilk Critical Value	0.897
32						**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**	
33												
34						**Assuming Normal Distribution**					**Assuming Lognormal Distribution**	
35						DL/2 Substitution Method					DL/2 Substitution Method	
36						Mean	0.334				Mean	-1.671
37						SD	0.526				SD	1.114
38						95% DL/2 (t) UCL	0.441				95% H-Stat (DL/2) UCL	0.476
39												
40						Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method	
41						**MLE method failed to converge properly**					Mean in Log Scale	-2.764
42											SD in Log Scale	1.324
43											Mean in Original Scale	0.217
44											SD in Original Scale	0.554
45											95% t UCL	0.329
46											95% Percentile Bootstrap UCL	0.331
47											95% BCA Bootstrap UCL	0.379
48											95% H-UCL	0.216
49												
50						**Gamma Distribution Test with Detected Values Only**					**Data Distribution Test with Detected Values Only**		
51						k star (bias corrected)	0.461				**Data appear Gamma Distributed at 5% Significance Level**	
52						Theta Star	1.425					

53					nu star	16.6						
54												
55					A-D Test Statistic	0.488	**Nonparametric Statistics**					
56					5% A-D Critical Value	0.799					Kaplan-Meier (KM) Method	
57					K-S Test Statistic	0.799					Mean	0.238
58					5% K-S Critical Value	0.215					SD	0.552
59	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0727
60											95% KM (t) UCL	0.359
61	**Assuming Gamma Distribution**										95% KM (z) UCL	0.357
62				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	0.357
63					Minimum	0.000001					95% KM (bootstrap t) UCL	0.437
64					Maximum	3.4					95% KM (BCA) UCL	0.368
65					Mean	0.25					95% KM (Percentile Bootstrap) UCL	0.363
66					Median	0.011					95% KM (Chebyshev) UCL	0.554
67					SD	0.563					97.5% KM (Chebyshev) UCL	0.691
68					k star	0.132					99% KM (Chebyshev) UCL	0.961
69					Theta star	1.901						
70					Nu star	17.63	**Potential UCLs to Use**					
71					AppChi2	9.123					95% KM (t) UCL	0.359
72				95% Gamma Approximate UCL (Use when n >= 40)		0.483						
73				95% Adjusted Gamma UCL (Use when n < 40)		0.49						
74	**Note: DL/2 is not a recommended method.**											
75												
76	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
77	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
78	**For additional insight, the user may want to consult a statistician.**											
79												
80												
81	**Arsenic**											
82												
83	**General Statistics**											
84					Number of Valid Data	53					Number of Detected Data	40
85					Number of Distinct Detected Data	32					Number of Non-Detect Data	13
86					Number of Missing Values	55					Percent Non-Detects	24.53%
87												
88	**Raw Statistics**						**Log-transformed Statistics**					
89					Minimum Detected	2					Minimum Detected	0.693
90					Maximum Detected	32					Maximum Detected	3.466
91					Mean of Detected	8.89					Mean of Detected	1.949
92					SD of Detected	6.786					SD of Detected	0.692
93					Minimum Non-Detect	0.9					Minimum Non-Detect	-0.105
94					Maximum Non-Detect	21					Maximum Non-Detect	3.045
95												
96	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	51
97	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	2
98	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	96.23%
99												
100	**UCL Statistics**											
101	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
102					Shapiro Wilk Test Statistic	0.802					Shapiro Wilk Test Statistic	0.975
103					5% Shapiro Wilk Critical Value	0.94					5% Shapiro Wilk Critical Value	0.94
104	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					

	A	B	C	D	E	F	G	H	I	J	K	L
105												
106	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
107					DL/2 Substitution Method						DL/2 Substitution Method	
108					Mean	7.621					Mean	1.67
109					SD	6.527					SD	0.939
110					95% DL/2 (t) UCL	9.122					95% H-Stat (DL/2) UCL	11.07
111												
112					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
113	**MLE method failed to converge properly**										Mean in Log Scale	1.708
114											SD in Log Scale	0.778
115											Mean in Original Scale	7.445
116											SD in Original Scale	6.461
117											95% t UCL	8.931
118											95% Percentile Bootstrap UCL	8.95
119											95% BCA Bootstrap UCL	9.208
120											95% H-UCL	9.367
121												
122	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
123					k star (bias corrected)	2.119	**Data appear Gamma Distributed at 5% Significance Level**					
124					Theta Star	4.195						
125					nu star	169.5						
126												
127					A-D Test Statistic	0.372	**Nonparametric Statistics**					
128					5% A-D Critical Value	0.758					Kaplan-Meier (KM) Method	
129					K-S Test Statistic	0.758					Mean	7.569
130					5% K-S Critical Value	0.141					SD	6.412
131	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.905
132											95% KM (t) UCL	9.085
133	**Assuming Gamma Distribution**										95% KM (z) UCL	9.058
134					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	9.072
135					Minimum	0.000001					95% KM (bootstrap t) UCL	9.491
136					Maximum	32					95% KM (BCA) UCL	9.271
137					Mean	7.234					95% KM (Percentile Bootstrap) UCL	9.096
138					Median	5.8					95% KM (Chebyshev) UCL	11.51
139					SD	6.761					97.5% KM (Chebyshev) UCL	13.22
140					k star	0.337					99% KM (Chebyshev) UCL	16.57
141					Theta star	21.46						
142					Nu star	35.74	**Potential UCLs to Use**					
143					AppChi2	23.06					95% KM (Percentile Bootstrap) UCL	9.096
144					95% Gamma Approximate UCL (Use when n >= 40)	11.21						
145					95% Adjusted Gamma UCL (Use when n < 40)	11.35						
146	**Note: DL/2 is not a recommended method.**											
147												
148	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
149	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
150	**For additional insight, the user may want to consult a statistician.**											
151												
152												
153	**Chloride**											
154												
155	**General Statistics**											
156					Number of Valid Data	19					Number of Detected Data	5

157				Number of Distinct Detected Data	5					Number of Non-Detect Data	14
158				Number of Missing Values	89					Percent Non-Detects	73.68%
159											
160	**Raw Statistics**					**Log-transformed Statistics**					
161				Minimum Detected	26.3					Minimum Detected	3.27
162				Maximum Detected	560					Maximum Detected	6.328
163				Mean of Detected	174.7					Mean of Detected	4.56
164				SD of Detected	223					SD of Detected	1.199
165				Minimum Non-Detect	16					Minimum Non-Detect	2.773
166				Maximum Non-Detect	33					Maximum Non-Detect	3.497
167											
168	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	15
169	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	4
170	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	78.95%
171											
172	**Warning: There are only 5 Detected Values in this data**										
173	**Note: It should be noted that even though bootstrap may be performed on this data set**										
174	**the resulting calculations may not be reliable enough to draw conclusions**										
175											
176	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**										
177											
178											
179	**UCL Statistics**										
180	**Normal Distribution Test with Detected Values Only**					**Lognormal Distribution Test with Detected Values Only**					
181				Shapiro Wilk Test Statistic	0.741					Shapiro Wilk Test Statistic	0.93
182				5% Shapiro Wilk Critical Value	0.762					5% Shapiro Wilk Critical Value	0.762
183	**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**					
184											
185	**Assuming Normal Distribution**					**Assuming Lognormal Distribution**					
186				DL/2 Substitution Method						DL/2 Substitution Method	
187				Mean	53.89					Mean	2.939
188				SD	128.7					SD	1.155
189				95% DL/2 (t) UCL	105.1					95% H-Stat (DL/2) UCL	79.72
190											
191				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
192	**MLE yields a negative mean**									Mean in Log Scale	1.142
193										SD in Log Scale	2.334
194										Mean in Original Scale	47
195										SD in Original Scale	131.1
196										95% t UCL	99.17
197										95% Percentile Bootstrap UCL	107.5
198										95% BCA Bootstrap UCL	144.2
199										95% H-UCL	688.1
200											
201	**Gamma Distribution Test with Detected Values Only**					**Data Distribution Test with Detected Values Only**					
202				k star (bias corrected)	0.518	**Data appear Gamma Distributed at 5% Significance Level**					
203				Theta Star	337						
204				nu star	5.183						
205											
206				A-D Test Statistic	0.439	**Nonparametric Statistics**					
207				5% A-D Critical Value	0.692					Kaplan-Meier (KM) Method	
208				K-S Test Statistic	0.692					Mean	65.35

209				5% K-S Critical Value	0.365					SD	121.4
210	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean	31.14
211										95% KM (t) UCL	119.3
212	**Assuming Gamma Distribution**									95% KM (z) UCL	116.6
213				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	108.1
214				Minimum	0.000001					95% KM (bootstrap t) UCL	442.5
215				Maximum	560					95% KM (BCA) UCL	176
216				Mean	45.97					95% KM (Percentile Bootstrap) UCL	147.6
217				Median	0.000001					95% KM (Chebyshev) UCL	201.1
218				SD	131.5					97.5% KM (Chebyshev) UCL	259.8
219				k star	0.0911					99% KM (Chebyshev) UCL	375.2
220				Theta star	504.8						
221				Nu star	3.46					**Potential UCLs to Use**	
222				AppChi2	0.521					95% KM (t) UCL	119.3
223				95% Gamma Approximate UCL (Use when n >= 40)	305.4						
224				95% Adjusted Gamma UCL (Use when n < 40)	364.7						
225	**Note: DL/2 is not a recommended method.**										
226											
227	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
228	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**										
229	**For additional insight, the user may want to consult a statistician.**										
230											
231											
232	**Nitrogen, as Ammonia**										
233											
234	**General Statistics**										
235				Number of Valid Observations	32					Number of Distinct Observations	30
236				Number of Missing Values	76						
237											
238	**Raw Statistics**									**Log-transformed Statistics**	
239				Minimum	27					Minimum of Log Data	3.296
240				Maximum	1800					Maximum of Log Data	7.496
241				Mean	261.6					Mean of log Data	5.066
242				Geometric Mean	158.6					SD of log Data	0.948
243				Median	135						
244				SD	348						
245				Std. Error of Mean	61.51						
246				Coefficient of Variation	1.33						
247				Skewness	3.231						
248											
249	**Relevant UCL Statistics**										
250	**Normal Distribution Test**									**Lognormal Distribution Test**	
251				Shapiro Wilk Test Statistic	0.617					Shapiro Wilk Test Statistic	0.966
252				Shapiro Wilk Critical Value	0.93					Shapiro Wilk Critical Value	0.93
253	**Data not Normal at 5% Significance Level**									**Data appear Lognormal at 5% Significance Level**	
254											
255	**Assuming Normal Distribution**									**Assuming Lognormal Distribution**	
256				95% Student's-t UCL	365.9					95% H-UCL	371.9
257	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	446.5
258				95% Adjusted-CLT UCL (Chen-1995)	400.4					97.5% Chebyshev (MVUE) UCL	534.2
259				95% Modified-t UCL (Johnson-1978)	371.8					99% Chebyshev (MVUE) UCL	706.6
260											

261	**Gamma Distribution Test**						**Data Distribution**					
262	k star (bias corrected)				1.051		**Data Follow Appr. Gamma Distribution at 5% Significance Level**					
263	Theta Star				249							
264	MLE of Mean				261.6							
265	MLE of Standard Deviation				255.3							
266	nu star				67.25							
267	Approximate Chi Square Value (.05)				49.37		**Nonparametric Statistics**					
268	Adjusted Level of Significance				0.0416		95% CLT UCL					362.8
269	Adjusted Chi Square Value				48.55		95% Jackknife UCL					365.9
270							95% Standard Bootstrap UCL					361.8
271	Anderson-Darling Test Statistic				1.221		95% Bootstrap-t UCL					465.9
272	Anderson-Darling 5% Critical Value				0.773		95% Hall's Bootstrap UCL					756.7
273	Kolmogorov-Smirnov Test Statistic				0.141		95% Percentile Bootstrap UCL					357.5
274	Kolmogorov-Smirnov 5% Critical Value				0.16		95% BCA Bootstrap UCL					397.6
275	**Data follow Appr. Gamma Distribution at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					529.8
276							97.5% Chebyshev(Mean, Sd) UCL					645.8
277	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					873.7
278	95% Approximate Gamma UCL (Use when n >= 40)				356.4							
279	95% Adjusted Gamma UCL (Use when n < 40)				362.4							
280												
281	**Potential UCL to Use**						Use 95% Approximate Gamma UCL					356.4
282												
283	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
284	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
285	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
286												
287												
288	**Sulfate**											
289												
290	**General Statistics**											
291	Number of Valid Data				27		Number of Detected Data					15
292	Number of Distinct Detected Data				13		Number of Non-Detect Data					12
293	Number of Missing Values				81		Percent Non-Detects					44.44%
294												
295	**Raw Statistics**						**Log-transformed Statistics**					
296	Minimum Detected				13.4		Minimum Detected					2.595
297	Maximum Detected				23900		Maximum Detected					10.08
298	Mean of Detected				1954		Mean of Detected					5.58
299	SD of Detected				6099		SD of Detected					1.733
300	Minimum Non-Detect				31		Minimum Non-Detect					3.434
301	Maximum Non-Detect				66		Maximum Non-Detect					4.19
302												
303	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					15
304	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					12
305	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					55.56%
306												
307	**UCL Statistics**											
308	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
309	Shapiro Wilk Test Statistic				0.341		Shapiro Wilk Test Statistic					0.913
310	5% Shapiro Wilk Critical Value				0.881		5% Shapiro Wilk Critical Value					0.881
311	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
312												

313	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
314				DL/2 Substitution Method						DL/2 Substitution Method		
315				Mean		1095				Mean		4.447
316				SD		4581				SD		1.816
317				95% DL/2 (t) UCL		2599				95% H-Stat (DL/2) UCL		1679
318												
319				Maximum Likelihood Estimate(MLE) Method		N/A				Log ROS Method		
320				**MLE yields a negative mean**						Mean in Log Scale		4.021
321										SD in Log Scale		2.234
322										Mean in Original Scale		1090
323										SD in Original Scale		4583
324										95% t UCL		2594
325										95% Percentile Bootstrap UCL		2834
326										95% BCA Bootstrap UCL		3806
327										95% H-UCL		4701
328												
329	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
330				k star (bias corrected)		0.315	**Data appear Lognormal at 5% Significance Level**					
331				Theta Star		6200						
332				nu star		9.455						
333												
334				A-D Test Statistic		2.161	**Nonparametric Statistics**					
335				5% A-D Critical Value		0.827				Kaplan-Meier (KM) Method		
336				K-S Test Statistic		0.827				Mean		1092
337				5% K-S Critical Value		0.239				SD		4496
338	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean		895.7
339										95% KM (t) UCL		2620
340	**Assuming Gamma Distribution**									95% KM (z) UCL		2565
341				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		2581
342				Minimum		0.000001				95% KM (bootstrap t) UCL		31205
343				Maximum		23900				95% KM (BCA) UCL		2869
344				Mean		1086				95% KM (Percentile Bootstrap) UCL		2823
345				Median		52				95% KM (Chebyshev) UCL		4996
346				SD		4584				97.5% KM (Chebyshev) UCL		6685
347				k star		0.0983				99% KM (Chebyshev) UCL		10004
348				Theta star		11042						
349				Nu star		5.309	**Potential UCLs to Use**					
350				AppChi2		1.298				99% KM (Chebyshev) UCL		10004
351				95% Gamma Approximate UCL (Use when n >= 40)		4442						
352				95% Adjusted Gamma UCL (Use when n < 40)		4898						
353	**Note: DL/2 is not a recommended method.**											
354												
355	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
356	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
357	**For additional insight, the user may want to consult a statistician.**											
358												
359												
360	**C11-C22 Aromatics**											
361												
362	**General Statistics**											
363				Number of Valid Data		12				Number of Detected Data		8
364				Number of Distinct Detected Data		8				Number of Non-Detect Data		4

365											Percent Non-Detects	33.33%
366												
367	**Raw Statistics**						**Log-transformed Statistics**					
368					Minimum Detected	6.8					Minimum Detected	1.917
369					Maximum Detected	130					Maximum Detected	4.868
370					Mean of Detected	47.03					Mean of Detected	3.288
371					SD of Detected	47.38					SD of Detected	1.197
372					Minimum Non-Detect	3.6					Minimum Non-Detect	1.281
373					Maximum Non-Detect	3.7					Maximum Non-Detect	1.308
374												
375	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	4
376	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	8
377	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	33.33%
378												
379	**Warning: There are only 8 Detected Values in this data**											
380	**Note: It should be noted that even though bootstrap may be performed on this data set**											
381	**the resulting calculations may not be reliable enough to draw conclusions**											
382												
383	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
384												
385												
386	**UCL Statistics**											
387	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
388					Shapiro Wilk Test Statistic	0.832					Shapiro Wilk Test Statistic	0.884
389					5% Shapiro Wilk Critical Value	0.818					5% Shapiro Wilk Critical Value	0.818
390	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
391												
392	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
393					DL/2 Substitution Method						DL/2 Substitution Method	
394					Mean	31.95					Mean	2.39
395					SD	43.87					SD	1.634
396					95% DL/2 (t) UCL	54.7					95% H-Stat (DL/2) UCL	324.7
397												
398					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
399					Mean	19.37					Mean in Log Scale	2.274
400					SD	56.23					SD in Log Scale	1.804
401					95% MLE (t) UCL	48.53					Mean in Original Scale	31.83
402					95% MLE (Tiku) UCL	50.62					SD in Original Scale	43.96
403											95% t UCL	54.62
404											95% Percentile Bootstrap UCL	52.85
405											95% BCA Bootstrap UCL	60.22
406											95% H UCL	582.7
407												
408	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
409					k star (bias corrected)	0.723	**Data appear Normal at 5% Significance Level**					
410					Theta Star	65.05						
411					nu star	11.57						
412												
413					A-D Test Statistic	0.493	**Nonparametric Statistics**					
414					5% A-D Critical Value	0.735					Kaplan-Meier (KM) Method	
415					K-S Test Statistic	0.735					Mean	33.62
416					5% K-S Critical Value	0.301					SD	40.86

417	Data appear Gamma Distributed at 5% Significance Level										SE of Mean	12.61
418											95% KM (t) UCL	56.26
419	Assuming Gamma Distribution										95% KM (z) UCL	54.36
420	Gamma ROS Statistics using Extrapolated Data										95% KM (jackknife) UCL	55.49
421					Minimum	0.000001					95% KM (bootstrap t) UCL	70.19
422					Maximum	130					95% KM (BCA) UCL	57.17
423					Mean	31.35					95% KM (Percentile Bootstrap) UCL	55.93
424					Median	8.2					95% KM (Chebyshev) UCL	88.57
425					SD	44.33					97.5% KM (Chebyshev) UCL	112.4
426					k star	0.156					99% KM (Chebyshev) UCL	159.1
427					Theta star	201.5						
428					Nu star	3.735					Potential UCLs to Use	
429					AppChi2	0.62					95% KM (t) UCL	56.26
430				95% Gamma Approximate UCL (Use when n >= 40)		188.9					95% KM (Percentile Bootstrap) UCL	55.93
431				95% Adjusted Gamma UCL (Use when n < 40)		255.3						
432	Note: DL/2 is not a recommended method.											
433												
434	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
435	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
436	For additional insight, the user may want to consult a statistician.											
437												
438												
439	Acetaldehyde											
440												
441	General Statistics											
442					Number of Valid Data	6					Number of Detected Data	1
443					Number of Distinct Detected Data	1					Number of Non-Detect Data	5
444					Number of Missing Values	78					Percent Non-Detects	83.33%
445												
446	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
447	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
448												
449	The data set for variable Acetaldehyde was not processed!											
450												
451												
452												
453	Bis(2-Ethylhexyl)phthalate											
454												
455	General Statistics											
456					Number of Valid Data	74					Number of Detected Data	55
457					Number of Distinct Detected Data	52					Number of Non-Detect Data	19
458					Number of Missing Values	34					Percent Non-Detects	25.68%
459												
460	Raw Statistics										Log-transformed Statistics	
461					Minimum Detected	0.014					Minimum Detected	-4.269
462					Maximum Detected	200					Maximum Detected	5.298
463					Mean of Detected	12.34					Mean of Detected	0.00369
464					SD of Detected	33.61					SD of Detected	2.402
465					Minimum Non-Detect	0.043					Minimum Non-Detect	-3.147
466					Maximum Non-Detect	0.98					Maximum Non-Detect	-0.0202
467												
468	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	50

	A	B	C	D	E	F	G	H	I	J	K	L
469	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	24
470	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	67.57%
471												
472	**UCL Statistics**											
473	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
474					Lilliefors Test Statistic	0.365					Lilliefors Test Statistic	0.0836
475					5% Lilliefors Critical Value	0.119					5% Lilliefors Critical Value	0.119
476	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
477												
478	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
479					DL/2 Substitution Method						DL/2 Substitution Method	
480					Mean	9.233					Mean	-0.404
481					SD	29.4					SD	2.201
482					95% DL/2 (t) UCL	14.93					95% H-Stat (DL/2) UCL	19.42
483												
484					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
485	**MLE yields a negative mean**										Mean in Log Scale	-0.55
486											SD in Log Scale	2.297
487											Mean in Original Scale	9.21
488											SD in Original Scale	29.4
489											95% t UCL	14.9
490											95% Percentile Bootstrap UCL	15.04
491											95% BCA Bootstrap UCL	17.14
492											95% H-UCL	22.44
493												
494	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
495					k star (bias corrected)	0.275	**Data appear Lognormal at 5% Significance Level**					
496					Theta Star	44.86						
497					nu star	30.26						
498												
499					A-D Test Statistic	3.341	**Nonparametric Statistics**					
500					5% A-D Critical Value	0.873					Kaplan-Meier (KM) Method	
501					K-S Test Statistic	0.873					Mean	9.218
502					5% K-S Critical Value	0.131					SD	29.2
503	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	3.426
504											95% KM (t) UCL	14.93
505	**Assuming Gamma Distribution**										95% KM (z) UCL	14.85
506					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	14.91
507					Minimum	0.000001					95% KM (bootstrap t) UCL	19.9
508					Maximum	200					95% KM (BCA) UCL	15.68
509					Mean	9.174					95% KM (Percentile Bootstrap) UCL	15.14
510					Median	0.305					95% KM (Chebyshev) UCL	24.15
511					SD	29.41					97.5% KM (Chebyshev) UCL	30.61
512					k star	0.139					99% KM (Chebyshev) UCL	43.31
513					Theta star	66.05						
514					Nu star	20.56	**Potential UCLs to Use**					
515					AppChi2	11.26					97.5% KM (Chebyshev) UCL	30.61
516					95% Gamma Approximate UCL (Use when n >= 40)	16.74						
517					95% Adjusted Gamma UCL (Use when n < 40)	16.95						
518	**Note: DL/2 is not a recommended method.**											
519												
520	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											

	A	B	C	D	E	F	G	H	I	J	K	L
521	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
522	For additional insight, the user may want to consult a statistician.											
523												
524												
525	Butylbenzylphthalate											
526												
527	General Statistics											
528						Number of Valid Data	74			Number of Detected Data	0	
529						Number of Distinct Detected Data	0			Number of Non-Detect Data	74	
530						Number of Missing Values	34			Percent Non-Detects	100.00%	
531												
532	Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!											
533	Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!											
534	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
535												
536	The data set for variable Butylbenzylphthalate was not processed!											
537												
538												
539												
540	C19-C36 Aliphatics											
541												
542	General Statistics											
543						Number of Valid Data	12			Number of Detected Data	7	
544						Number of Distinct Detected Data	6			Number of Non-Detect Data	5	
545										Percent Non-Detects	41.67%	
546												
547	Raw Statistics							Log-transformed Statistics				
548						Minimum Detected	5.9			Minimum Detected	1.775	
549						Maximum Detected	190			Maximum Detected	5.247	
550						Mean of Detected	71.11			Mean of Detected	3.657	
551						SD of Detected	68.07			SD of Detected	1.368	
552						Minimum Non-Detect	3.6			Minimum Non-Detect	1.281	
553						Maximum Non-Detect	3.8			Maximum Non-Detect	1.335	
554												
555	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	5	
556	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	7	
557	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	41.67%	
558												
559	Warning: There are only 7 Detected Values in this data											
560	Note: It should be noted that even though bootstrap may be performed on this data set											
561	the resulting calculations may not be reliable enough to draw conclusions											
562												
563	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
564												
565												
566	UCL Statistics											
567	Normal Distribution Test with Detected Values Only							Lognormal Distribution Test with Detected Values Only				
568						Shapiro Wilk Test Statistic	0.88			Shapiro Wilk Test Statistic	0.889	
569						5% Shapiro Wilk Critical Value	0.803			5% Shapiro Wilk Critical Value	0.803	
570	Data appear Normal at 5% Significance Level							Data appear Lognormal at 5% Significance Level				
571												
572	Assuming Normal Distribution							Assuming Lognormal Distribution				

573				DL/2 Substitution Method						DL/2 Substitution Method		
574				Mean	42.25					Mean	2.385	
575				SD	61.64					SD	1.869	
576				95% DL/2 (t) UCL	74.2					95% H-Stat (DL/2) UCL	869.1	
577												
578				Maximum Likelihood Estimate(MLE) Method						Log ROS Method		
579				Mean	15.59					Mean in Log Scale	2.172	
580				SD	87.8					SD in Log Scale	2.134	
581				95% MLE (t) UCL	61.11					Mean in Original Scale	42.02	
582				95% MLE (Tiku) UCL	67.45					SD in Original Scale	61.81	
583										95% t UCL	74.06	
584										95% Percentile Bootstrap UCL	71.33	
585										95% BCA Bootstrap UCL	80.32	
586										95% H UCL	2516	
587												
588				**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**		
589				k star (bias corrected)	0.642					**Data appear Normal at 5% Significance Level**		
590				Theta Star	110.8							
591				nu star	8.982							
592												
593				A-D Test Statistic	0.354					**Nonparametric Statistics**		
594				5% A-D Critical Value	0.729					Kaplan-Meier (KM) Method		
595				K-S Test Statistic	0.729					Mean	43.94	
596				5% K-S Critical Value	0.32					SD	57.88	
597				**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean	18.05	
598										95% KM (t) UCL	76.35	
599				**Assuming Gamma Distribution**						95% KM (z) UCL	73.63	
600				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	75.02	
601				Minimum	0.000001					95% KM (bootstrap t) UCL	90.95	
602				Maximum	190					95% KM (BCA) UCL	86.83	
603				Mean	41.48					95% KM (Percentile Bootstrap) UCL	80.92	
604				Median	6.4					95% KM (Chebyshev) UCL	122.6	
605				SD	62.19					97.5% KM (Chebyshev) UCL	156.6	
606				k star	0.138					99% KM (Chebyshev) UCL	223.5	
607				Theta star	301.7							
608				Nu star	3.3					**Potential UCLs to Use**		
609				AppChi2	0.467					95% KM (t) UCL	76.35	
610				95% Gamma Approximate UCL (Use when n >= 40)	293.4					95% KM (Percentile Bootstrap) UCL	80.92	
611				95% Adjusted Gamma UCL (Use when n < 40)	404.3							
612	**Note: DL/2 is not a recommended method.**											
613												
614	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
615	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
616	**For additional insight, the user may want to consult a statistician.**											
617												
618												
619	**C9-C18 Aliphatics**											
620												
621	**General Statistics**											
622				Number of Valid Data	12					Number of Detected Data	5	
623				Number of Distinct Detected Data	4					Number of Non-Detect Data	7	
624										Percent Non-Detects	58.33%	

625												
626	**Raw Statistics**						**Log-transformed Statistics**					
627					Minimum Detected	6.7					Minimum Detected	1.902
628					Maximum Detected	17					Maximum Detected	2.833
629					Mean of Detected	13.02					Mean of Detected	2.494
630					SD of Detected	5.046					SD of Detected	0.445
631					Minimum Non-Detect	3.4					Minimum Non-Detect	1.224
632					Maximum Non-Detect	3.8					Maximum Non-Detect	1.335
633												
634	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	7
635	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	5
636	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	58.33%
637												
638	**Warning: There are only 4 Distinct Detected Values in this data**											
639	**Note: It should be noted that even though bootstrap may be performed on this data set**											
640	**the resulting calculations may not be reliable enough to draw conclusions**											
641												
642	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
643												
644												
645	**UCL Statistics**											
646	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
647					Shapiro Wilk Test Statistic	0.781					Shapiro Wilk Test Statistic	0.786
648					5% Shapiro Wilk Critical Value	0.762					5% Shapiro Wilk Critical Value	0.762
649	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
650												
651	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
652					DL/2 Substitution Method						DL/2 Substitution Method	
653					Mean	6.475					Mean	1.382
654					SD	6.53					SD	1.018
655					95% DL/2 (t) UCL	9.86					95% H-Stat (DL/2) UCL	16.53
656												
657					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
658					Mean	2.176					Mean in Log Scale	1.747
659					SD	10.97					SD in Log Scale	0.732
660					95% MLE (t) UCL	7.863					Mean in Original Scale	7.432
661					95% MLE (Tiku) UCL	9.928					SD in Original Scale	5.824
662											95% t UCL	10.45
663											95% Percentile Bootstrap UCL	10.3
664											95% BCA Bootstrap UCL	10.54
665											95% H UCL	12.92
666												
667	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
668					k star (bias corrected)	2.953	**Data appear Normal at 5% Significance Level**					
669					Theta Star	4.41						
670					nu star	29.53						
671												
672					A-D Test Statistic	0.674	**Nonparametric Statistics**					
673					5% A-D Critical Value	0.68					Kaplan-Meier (KM) Method	
674					K-S Test Statistic	0.68					Mean	9.333
675					5% K-S Critical Value	0.358					SD	4.266
676	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	1.377

677											95% KM (t) UCL	11.81
678	**Assuming Gamma Distribution**										95% KM (z) UCL	11.6
679				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	11.51
680					Minimum	0.000001					95% KM (bootstrap t) UCL	11.71
681					Maximum	17					95% KM (BCA) UCL	17
682					Mean	5.425					95% KM (Percentile Bootstrap) UCL	16.33
683					Median	0.000001					95% KM (Chebyshev) UCL	15.33
684					SD	7.363					97.5% KM (Chebyshev) UCL	17.93
685					k star	0.126					99% KM (Chebyshev) UCL	23.03
686					Theta star	43.05						
687					Nu star	3.025		**Potential UCLs to Use**				
688					AppChi2	0.38					95% KM (t) UCL	11.81
689				95% Gamma Approximate UCL (Use when n >= 40)		43.21					95% KM (Percentile Bootstrap) UCL	16.33
690				95% Adjusted Gamma UCL (Use when n < 40)		60.13						
691	**Note: DL/2 is not a recommended method.**											
692												
693	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
694	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
695	**For additional insight, the user may want to consult a statistician.**											
696												
697												
698	**Fluoranthene**											
699												
700	**General Statistics**											
701					Number of Valid Data	77					Number of Detected Data	24
702					Number of Distinct Detected Data	23					Number of Non-Detect Data	53
703					Number of Missing Values	31					Percent Non-Detects	68.83%
704												
705	**Raw Statistics**						**Log-transformed Statistics**					
706					Minimum Detected	0.011					Minimum Detected	-4.51
707					Maximum Detected	1.9					Maximum Detected	0.642
708					Mean of Detected	0.415					Mean of Detected	-2.143
709					SD of Detected	0.614					SD of Detected	1.7
710					Minimum Non-Detect	0.061					Minimum Non-Detect	-2.797
711					Maximum Non-Detect	32					Maximum Non-Detect	3.466
712												
713	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	77
714	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
715	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
716												
717	**UCL Statistics**											
718	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
719					Shapiro Wilk Test Statistic	0.685					Shapiro Wilk Test Statistic	0.913
720					5% Shapiro Wilk Critical Value	0.916					5% Shapiro Wilk Critical Value	0.916
721	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
722												
723	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
724					DL/2 Substitution Method						DL/2 Substitution Method	
725					Mean	0.866					Mean	-1.348
726					SD	2.3					SD	1.437
727					95% DL/2 (t) UCL	1.303					95% H-Stat (DL/2) UCL	1.145
728												

729				Maximum Likelihood Estimate(MLE) Method		N/A				Log ROS Method		
730				**MLE method failed to converge properly**						Mean in Log Scale		-2.666
731										SD in Log Scale		1.092
732										Mean in Original Scale		0.172
733										SD in Original Scale		0.377
734										95% t UCL		0.244
735										95% Percentile Bootstrap UCL		0.244
736										95% BCA Bootstrap UCL		0.265
737										95% H-UCL		0.169
738												
739				**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**		
740				k star (bias corrected)		0.468				**Data do not follow a Discernable Distribution (0.05)**		
741				Theta Star		0.887						
742				nu star		22.44						
743												
744				A-D Test Statistic		1.388				**Nonparametric Statistics**		
745				5% A-D Critical Value		0.806				Kaplan-Meier (KM) Method		
746				K-S Test Statistic		0.806				Mean		0.194
747				5% K-S Critical Value		0.188				SD		0.399
748				**Data not Gamma Distributed at 5% Significance Level**						SE of Mean		0.0513
749										95% KM (t) UCL		0.279
750				**Assuming Gamma Distribution**						95% KM (z) UCL		0.278
751				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.278
752				Minimum		0.000001				95% KM (bootstrap t) UCL		0.305
753				Maximum		1.9				95% KM (BCA) UCL		0.281
754				Mean		0.203				95% KM (Percentile Bootstrap) UCL		0.283
755				Median		0.0635				95% KM (Chebyshev) UCL		0.417
756				SD		0.382				97.5% KM (Chebyshev) UCL		0.514
757				k star		0.269				99% KM (Chebyshev) UCL		0.704
758				Theta star		0.753						
759				Nu star		41.49				**Potential UCLs to Use**		
760				AppChi2		27.72				95% KM (Chebyshev) UCL		0.417
761				95% Gamma Approximate UCL (Use when n >= 40)		0.304						
762				95% Adjusted Gamma UCL (Use when n < 40)		0.306						
763	**Note: DL/2 is not a recommended method.**											
764												
765	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
766	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
767	**For additional insight, the user may want to consult a statistician.**											
768												
769												
770	**Naphthalene**											
771												
772				**General Statistics**								
773				Number of Valid Data		77				Number of Detected Data		4
774				Number of Distinct Detected Data		4				Number of Non-Detect Data		73
775				Number of Missing Values		31				Percent Non-Detects		94.81%
776												
777				**Raw Statistics**						**Log-transformed Statistics**		
778				Minimum Detected		0.008				Minimum Detected		-4.828
779				Maximum Detected		0.21				Maximum Detected		-1.561
780				Mean of Detected		0.0663				Mean of Detected		-3.478

781					SD of Detected	0.0962					SD of Detected	1.379
782					Minimum Non-Detect	0.088					Minimum Non-Detect	-2.43
783					Maximum Non-Detect	32					Maximum Non-Detect	3.466
784												
785	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	77
786	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
787	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
788												
789	**Warning: There are only 4 Distinct Detected Values in this data**											
790	**Note: It should be noted that even though bootstrap may be performed on this data set**											
791	**the resulting calculations may not be reliable enough to draw conclusions**											
792												
793	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
794												
795												
796	**UCL Statistics**											
797	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
798					Shapiro Wilk Test Statistic	0.707					Shapiro Wilk Test Statistic	0.924
799					5% Shapiro Wilk Critical Value	0.748					5% Shapiro Wilk Critical Value	0.748
800	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
801												
802	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
803					DL/2 Substitution Method						DL/2 Substitution Method	
804					Mean	0.831					Mean	-1.288
805					SD	2.299					SD	1.271
806					95% DL/2 (t) UCL	1.267					95% H-Stat (DL/2) UCL	0.897
807												
808					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
809	**MLE method failed to converge properly**										Mean in Log Scale	-3.915
810											SD in Log Scale	0.577
811											Mean in Original Scale	0.0245
812											SD in Original Scale	0.0249
813											95% t UCL	0.0292
814											95% Percentile Bootstrap UCL	0.0297
815											95% BCA Bootstrap UCL	0.0324
816											95% H-UCL	0.0267
817												
818	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
819					k star (bias corrected)	0.362	**Data appear Gamma Distributed at 5% Significance Level**					
820					Theta Star	0.183						
821					nu star	2.893						
822												
823					A-D Test Statistic	0.485	**Nonparametric Statistics**					
824					5% A-D Critical Value	0.67					Kaplan-Meier (KM) Method	
825					K-S Test Statistic	0.67					Mean	0.0343
826					5% K-S Critical Value	0.405					SD	0.0535
827	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0183
828											95% KM (t) UCL	0.0648
829	**Assuming Gamma Distribution**										95% KM (z) UCL	0.0644
830					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.0637
831					Minimum	0.000001					95% KM (bootstrap t) UCL	0.142
832					Maximum	0.21					95% KM (BCA) UCL	0.21

833					Mean	0.0292				95% KM (Percentile Bootstrap) UCL		0.21
834					Median	0.0198				95% KM (Chebyshev) UCL		0.114
835					SD	0.0354				97.5% KM (Chebyshev) UCL		0.149
836					k star	0.32				99% KM (Chebyshev) UCL		0.216
837					Theta star	0.0914						
838					Nu star	49.23				**Potential UCLs to Use**		
839					AppChi2	34.12				95% KM (t) UCL		0.0648
840				95% Gamma Approximate UCL (Use when n >= 40)		0.0421						
841				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
842	**Note: DL/2 is not a recommended method.**											
843												
844	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
845	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
846	**For additional insight, the user may want to consult a statistician.**											
847												
848												
849	**Phenanthrene**											
850												
851	**General Statistics**											
852					Number of Valid Data	77				Number of Detected Data		17
853					Number of Distinct Detected Data	15				Number of Non-Detect Data		60
854					Number of Missing Values	31				Percent Non-Detects		77.92%
855												
856	**Raw Statistics**						**Log-transformed Statistics**					
857					Minimum Detected	0.012				Minimum Detected		-4.423
858					Maximum Detected	0.69				Maximum Detected		-0.371
859					Mean of Detected	0.189				Mean of Detected		-2.433
860					SD of Detected	0.218				SD of Detected		1.383
861					Minimum Non-Detect	0.044				Minimum Non-Detect		-3.124
862					Maximum Non-Detect	32				Maximum Non-Detect		3.466
863												
864	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		77
865	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
866	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
867												
868	**UCL Statistics**											
869	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
870					Shapiro Wilk Test Statistic	0.785				Shapiro Wilk Test Statistic		0.915
871					5% Shapiro Wilk Critical Value	0.892				5% Shapiro Wilk Critical Value		0.892
872	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
873												
874	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
875					DL/2 Substitution Method					DL/2 Substitution Method		
876					Mean	0.792				Mean		-1.436
877					SD	2.295				SD		1.366
878					95% DL/2 (t) UCL	1.227				95% H-Stat (DL/2) UCL		0.916
879												
880					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
881	**MLE method failed to converge properly**									Mean in Log Scale		-2.958
882										SD in Log Scale		0.809
883										Mean in Original Scale		0.0806
884										SD in Original Scale		0.118

885											95% t UCL	0.103
886											95% Percentile Bootstrap UCL	0.105
887											95% BCA Bootstrap UCL	0.109
888											95% H-UCL	0.0874
889												
890	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
891					k star (bias corrected)	0.677	**Data appear Gamma Distributed at 5% Significance Level**					
892					Theta Star	0.28						
893					nu star	23.03						
894												
895					A-D Test Statistic	0.635	**Nonparametric Statistics**					
896					5% A-D Critical Value	0.775					Kaplan-Meier (KM) Method	
897					K-S Test Statistic	0.775					Mean	0.103
898					5% K-S Critical Value	0.217					SD	0.142
899	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0235
900											95% KM (t) UCL	0.142
901	**Assuming Gamma Distribution**										95% KM (z) UCL	0.142
902					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.142
903					Minimum	0.000001					95% KM (bootstrap t) UCL	0.152
904					Maximum	0.69					95% KM (BCA) UCL	0.144
905					Mean	0.109					95% KM (Percentile Bootstrap) UCL	0.142
906					Median	0.0896					95% KM (Chebyshev) UCL	0.206
907					SD	0.125					97.5% KM (Chebyshev) UCL	0.25
908					k star	0.354					99% KM (Chebyshev) UCL	0.337
909					Theta star	0.308						
910					Nu star	54.52	**Potential UCLs to Use**					
911					AppChi2	38.56					95% KM (t) UCL	0.142
912					95% Gamma Approximate UCL (Use when n >= 40)	0.154						
913					95% Adjusted Gamma UCL (Use when n < 40)	0.155						
914	**Note: DL/2 is not a recommended method.**											
915												
916	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
917	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
918	**For additional insight, the user may want to consult a statistician.**											
919												
920												
921	**Pyrene**											
922												
923	**General Statistics**											
924					Number of Valid Data	76	Number of Detected Data					24
925					Number of Distinct Detected Data	22	Number of Non-Detect Data					52
926					Number of Missing Values	30	Percent Non-Detects					68.42%
927												
928	**Raw Statistics**						**Log-transformed Statistics**					
929					Minimum Detected	0.013	Minimum Detected					-4.343
930					Maximum Detected	1.3	Maximum Detected					0.262
931					Mean of Detected	0.318	Mean of Detected					-2.249
932					SD of Detected	0.44	SD of Detected					1.587
933					Minimum Non-Detect	0.061	Minimum Non-Detect					-2.797
934					Maximum Non-Detect	32	Maximum Non-Detect					3.466
935												
936	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					76

937	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
938	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
939												
940	**UCL Statistics**											
941	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
942					Shapiro Wilk Test Statistic	0.698					Shapiro Wilk Test Statistic	0.907
943					5% Shapiro Wilk Critical Value	0.916					5% Shapiro Wilk Critical Value	0.916
944	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
945												
946	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
947					DL/2 Substitution Method						DL/2 Substitution Method	
948					Mean	0.833					Mean	-1.4
949					SD	2.31					SD	1.416
950					95% DL/2 (t) UCL	1.274					95% H-Stat (DL/2) UCL	1.046
951												
952					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
953	**MLE method failed to converge properly**										Mean in Log Scale	-2.696
954											SD in Log Scale	1.021
955											Mean in Original Scale	0.143
956											SD in Original Scale	0.273
957											95% t UCL	0.195
958											95% Percentile Bootstrap UCL	0.196
959											95% BCA Bootstrap UCL	0.204
960											95% H-UCL	0.149
961												
962	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
963					k star (bias corrected)	0.522	**Data Follow Appr. Gamma Distribution at 5% Significance Level**					
964					Theta Star	0.609						
965					nu star	25.07						
966												
967					A-D Test Statistic	1.355	**Nonparametric Statistics**					
968					5% A-D Critical Value	0.8					Kaplan-Meier (KM) Method	
969					K-S Test Statistic	0.8					Mean	0.163
970					5% K-S Critical Value	0.187					SD	0.291
971	**Data follow Appr. Gamma Distribution at 5% Significance Level**										SE of Mean	0.039
972											95% KM (t) UCL	0.228
973	**Assuming Gamma Distribution**										95% KM (z) UCL	0.227
974					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.227
975					Minimum	0.000001					95% KM (bootstrap t) UCL	0.244
976					Maximum	1.3					95% KM (BCA) UCL	0.23
977					Mean	0.177					95% KM (Percentile Bootstrap) UCL	0.228
978					Median	0.0728					95% KM (Chebyshev) UCL	0.333
979					SD	0.278					97.5% KM (Chebyshev) UCL	0.406
980					k star	0.298					99% KM (Chebyshev) UCL	0.551
981					Theta star	0.594						
982					Nu star	45.22	**Potential UCLs to Use**					
983					AppChi2	30.8					95% KM (t) UCL	0.228
984					95% Gamma Approximate UCL (Use when n >= 40)	0.26						
985					95% Adjusted Gamma UCL (Use when n < 40)	0.262						
986	**Note: DL/2 is not a recommended method.**											
987												
988	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											

	A	B	C	D	E	F	G	H	I	J	K	L
989	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
990	For additional insight, the user may want to consult a statistician.											
991												
992												
993	4,4'-DDD											
994												
995	General Statistics											
996						Number of Valid Data	34			Number of Detected Data		6
997						Number of Distinct Detected Data	6			Number of Non-Detect Data		28
998						Number of Missing Values	74			Percent Non-Detects		82.35%
999												
1000	Raw Statistics						Log-transformed Statistics					
1001						Minimum Detected	0.00012			Minimum Detected		-9.028
1002						Maximum Detected	0.16			Maximum Detected		-1.833
1003						Mean of Detected	0.0345			Mean of Detected		-5.776
1004						SD of Detected	0.0633			SD of Detected		2.872
1005						Minimum Non-Detect	0.0042			Minimum Non-Detect		-5.473
1006						Maximum Non-Detect	0.13			Maximum Non-Detect		-2.04
1007												
1008	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		33
1009	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		1
1010	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		97.06%
1011												
1012	Warning: There are only 6 Detected Values in this data											
1013	Note: It should be noted that even though bootstrap may be performed on this data set											
1014	the resulting calculations may not be reliable enough to draw conclusions											
1015												
1016	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
1017												
1018												
1019	UCL Statistics											
1020	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
1021						Shapiro Wilk Test Statistic	0.651			Shapiro Wilk Test Statistic		0.926
1022						5% Shapiro Wilk Critical Value	0.788			5% Shapiro Wilk Critical Value		0.788
1023	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
1024												
1025	Assuming Normal Distribution						Assuming Lognormal Distribution					
1026						DL/2 Substitution Method				DL/2 Substitution Method		
1027						Mean	0.0214			Mean		-4.762
1028						SD	0.0303			SD		1.606
1029						95% DL/2 (t) UCL	0.0302			95% H-Stat (DL/2) UCL		0.0775
1030												
1031						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
1032	MLE method failed to converge properly									Mean in Log Scale		-7.483
1033										SD in Log Scale		1.483
1034										Mean in Original Scale		0.00646
1035										SD in Original Scale		0.0279
1036										95% t UCL		0.0146
1037										95% Percentile Bootstrap UCL		0.0158
1038										95% BCA Bootstrap UCL		0.0239
1039										95% H-UCL		0.00376
1040												

	A	B	C	D	E	F	G	H	I	J	K	L
1041	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1042					k star (bias corrected)	0.255	**Data appear Gamma Distributed at 5% Significance Level**					
1043					Theta Star	0.135						
1044					nu star	3.063						
1045												
1046					A-D Test Statistic	0.402	**Nonparametric Statistics**					
1047					5% A-D Critical Value	0.771	Kaplan-Meier (KM) Method					
1048					K-S Test Statistic	0.771	Mean					0.00715
1049					5% K-S Critical Value	0.358	SD					0.0277
1050	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.00531
1051							95% KM (t) UCL					0.0161
1052	**Assuming Gamma Distribution**						95% KM (z) UCL					0.0159
1053	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.0155
1054					Minimum	0.000001	95% KM (bootstrap t) UCL					0.0595
1055					Maximum	0.16	95% KM (BCA) UCL					0.0191
1056					Mean	0.0064	95% KM (Percentile Bootstrap) UCL					0.0173
1057					Median	0.000001	95% KM (Chebyshev) UCL					0.0303
1058					SD	0.028	97.5% KM (Chebyshev) UCL					0.0403
1059					k star	0.129	99% KM (Chebyshev) UCL					0.06
1060					Theta star	0.0498						
1061					Nu star	8.753	**Potential UCLs to Use**					
1062					AppChi2	3.178	95% KM (t) UCL					0.0161
1063				95% Gamma Approximate UCL (Use when n >= 40)		0.0176						
1064				95% Adjusted Gamma UCL (Use when n < 40)		0.0186						
1065	**Note: DL/2 is not a recommended method.**											
1066												
1067	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1068	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1069	**For additional insight, the user may want to consult a statistician.**											
1070												
1071												
1072	**4,4'-DDE**											
1073												
1074	**General Statistics**											
1075	Number of Valid Data					34	Number of Detected Data					11
1076	Number of Distinct Detected Data					11	Number of Non-Detect Data					23
1077	Number of Missing Values					74	Percent Non-Detects					67.65%
1078												
1079	**Raw Statistics**						**Log-transformed Statistics**					
1080	Minimum Detected					0.00053	Minimum Detected					-7.543
1081	Maximum Detected					0.011	Maximum Detected					-4.51
1082	Mean of Detected					0.0024	Mean of Detected					-6.469
1083	SD of Detected					0.00301	SD of Detected					0.891
1084	Minimum Non-Detect					0.0042	Minimum Non-Detect					-5.473
1085	Maximum Non-Detect					0.13	Maximum Non-Detect					-2.04
1086												
1087	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					34
1088	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					0
1089	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					100.00%
1090												
1091	**UCL Statistics**											
1092	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					

	A	B	C	D	E	F	G	H	I	J	K	L
1093					Shapiro Wilk Test Statistic	0.622					Shapiro Wilk Test Statistic	0.935
1094					5% Shapiro Wilk Critical Value	0.85					5% Shapiro Wilk Critical Value	0.85
1095					**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**	
1096												
1097					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
1098					DL/2 Substitution Method						DL/2 Substitution Method	
1099					Mean	0.0169					Mean	-4.823
1100					SD	0.0174					SD	1.439
1101					95% DL/2 (t) UCL	0.0219					95% H-Stat (DL/2) UCL	0.0484
1102												
1103					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1104					**MLE method failed to converge properly**						Mean in Log Scale	-6.493
1105											SD in Log Scale	0.532
1106											Mean in Original Scale	0.00182
1107											SD in Original Scale	0.00174
1108											95% t UCL	0.00232
1109											95% Percentile Bootstrap UCL	0.00238
1110											95% BCA Bootstrap UCL	0.00264
1111											95% H-UCL	0.00209
1112												
1113					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
1114					k star (bias corrected)	0.999					**Data appear Gamma Distributed at 5% Significance Level**	
1115					Theta Star	0.0024						
1116					nu star	21.98						
1117												
1118					A-D Test Statistic	0.635					**Nonparametric Statistics**	
1119					5% A-D Critical Value	0.746					Kaplan-Meier (KM) Method	
1120					K-S Test Statistic	0.746					Mean	0.00232
1121					5% K-S Critical Value	0.261					SD	0.00277
1122					**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean	0.0008441
1123											95% KM (t) UCL	0.00375
1124					**Assuming Gamma Distribution**						95% KM (z) UCL	0.00371
1125					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.00379
1126					Minimum	0.00053					95% KM (bootstrap t) UCL	0.00655
1127					Maximum	0.011					95% KM (BCA) UCL	0.00403
1128					Mean	0.00236					95% KM (Percentile Bootstrap) UCL	0.00384
1129					Median	0.00236					95% KM (Chebyshev) UCL	0.006
1130					SD	0.00179					97.5% KM (Chebyshev) UCL	0.0076
1131					k star	2.592					99% KM (Chebyshev) UCL	0.0107
1132					Theta star	0.0009103						
1133					Nu star	176.2					**Potential UCLs to Use**	
1134					AppChi2	146.5					95% KM (t) UCL	0.00375
1135					95% Gamma Approximate UCL (Use when n >= 40)	0.00284						
1136					95% Adjusted Gamma UCL (Use when n < 40)	0.00286						
1137	**Note: DL/2 is not a recommended method.**											
1138												
1139	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1140	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1141	**For additional insight, the user may want to consult a statistician.**											
1142												
1143												
1144	**4,4'-DDT**											

	A	B	C	D	E	F	G	H	I	J	K	L
1145												
1146	**General Statistics**											
1147					Number of Valid Data	34				Number of Detected Data		18
1148					Number of Distinct Detected Data	15				Number of Non-Detect Data		16
1149					Number of Missing Values	74				Percent Non-Detects		47.06%
1150												
1151	**Raw Statistics**						**Log-transformed Statistics**					
1152					Minimum Detected	0.0014				Minimum Detected		-6.571
1153					Maximum Detected	0.15				Maximum Detected		-1.897
1154					Mean of Detected	0.0219				Mean of Detected		-4.954
1155					SD of Detected	0.0374				SD of Detected		1.53
1156					Minimum Non-Detect	0.012				Minimum Non-Detect		-4.423
1157					Maximum Non-Detect	0.13				Maximum Non-Detect		-2.04
1158												
1159	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		33
1160	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		1
1161	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		97.06%
1162												
1163	**UCL Statistics**											
1164	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1165					Shapiro Wilk Test Statistic	0.611				Shapiro Wilk Test Statistic		0.885
1166					5% Shapiro Wilk Critical Value	0.897				5% Shapiro Wilk Critical Value		0.897
1167	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
1168												
1169	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1170					DL/2 Substitution Method					DL/2 Substitution Method		
1171					Mean	0.0253				Mean		-4.386
1172					SD	0.0296				SD		1.348
1173					95% DL/2 (t) UCL	0.0339				95% H-Stat (DL/2) UCL		0.0611
1174												
1175					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
1176	**MLE method failed to converge properly**									Mean in Log Scale		-5.186
1177										SD in Log Scale		1.141
1178										Mean in Original Scale		0.0137
1179										SD in Original Scale		0.0283
1180										95% t UCL		0.0219
1181										95% Percentile Bootstrap UCL		0.0221
1182										95% BCA Bootstrap UCL		0.0257
1183										95% H-UCL		0.0181
1184												
1185	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1186					k star (bias corrected)	0.498	**Data do not follow a Discernable Distribution (0.05)**					
1187					Theta Star	0.0439						
1188					nu star	17.93						
1189												
1190					A-D Test Statistic	1.164	**Nonparametric Statistics**					
1191					5% A-D Critical Value	0.795				Kaplan-Meier (KM) Method		
1192					K-S Test Statistic	0.795				Mean		0.0153
1193					5% K-S Critical Value	0.214				SD		0.0286
1194	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean		0.00533
1195										95% KM (t) UCL		0.0243
1196	**Assuming Gamma Distribution**									95% KM (z) UCL		0.024

1197	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.0242
1198	Minimum					0.000001	95% KM (bootstrap t) UCL					0.0321
1199	Maximum					0.15	95% KM (BCA) UCL					0.0254
1200	Mean					0.0143	95% KM (Percentile Bootstrap) UCL					0.0241
1201	Median					0.006	95% KM (Chebyshev) UCL					0.0385
1202	SD					0.0283	97.5% KM (Chebyshev) UCL					0.0486
1203	k star					0.362	99% KM (Chebyshev) UCL					0.0683
1204	Theta star					0.0395						
1205	Nu star					24.63	**Potential UCLs to Use**					
1206	AppChi2					14.33	99% KM (Chebyshev) UCL					0.0683
1207	95% Gamma Approximate UCL (Use when n >= 40)					0.0246						
1208	95% Adjusted Gamma UCL (Use when n < 40)					0.0253						
1209	**Note: DL/2 is not a recommended method.**											
1210												
1211	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1212	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1213	**For additional insight, the user may want to consult a statistician.**											
1214												
1215												
1216	**Alpha-BHC**											
1217												
1218	**General Statistics**											
1219	Number of Valid Data					34	Number of Detected Data					3
1220	Number of Distinct Detected Data					3	Number of Non-Detect Data					31
1221	Number of Missing Values					74	Percent Non-Detects					91.18%
1222												
1223	**Raw Statistics**						**Log-transformed Statistics**					
1224	Minimum Detected					0.0002	Minimum Detected					-8.517
1225	Maximum Detected					0.0058	Maximum Detected					-5.15
1226	Mean of Detected					0.00237	Mean of Detected					-6.827
1227	SD of Detected					0.00301	SD of Detected					1.684
1228	Minimum Non-Detect					0.0022	Minimum Non-Detect					-6.119
1229	Maximum Non-Detect					0.13	Maximum Non-Detect					-2.04
1230												
1231	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					34
1232	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					0
1233	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					100.00%
1234												
1235	**Warning: There are only 3 Distinct Detected Values in this data set**											
1236	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
1237	**Those methods will return a 'N/A' value on your output display!**											
1238												
1239	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
1240	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
1241	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
1242												
1243												
1244	**UCL Statistics**											
1245	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1246	Shapiro Wilk Test Statistic					0.867	Shapiro Wilk Test Statistic					1
1247	5% Shapiro Wilk Critical Value					0.767	5% Shapiro Wilk Critical Value					0.767
1248	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					

1249												
1250	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1251				DL/2 Substitution Method						DL/2 Substitution Method		
1252				Mean	0.0145					Mean		-5.076
1253				SD	0.0167					SD		1.505
1254				95% DL/2 (t) UCL	0.0194					95% H-Stat (DL/2) UCL		0.0439
1255												
1256				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
1257	**MLE method failed to converge properly**									Mean in Log Scale		-7.551
1258										SD in Log Scale		0.605
1259										Mean in Original Scale		0.0006896
1260										SD in Original Scale		0.000932
1261										95% t UCL		0.0009601
1262										95% Percentile Bootstrap UCL		0.0009967
1263										95% BCA Bootstrap UCL		0.00119
1264										95% H-UCL		0.0007813
1265												
1266	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1267				k star (bias corrected)	N/A		**Data appear Normal at 5% Significance Level**					
1268				Theta Star	N/A							
1269				nu star	N/A							
1270												
1271				A-D Test Statistic	N/A		**Nonparametric Statistics**					
1272				5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method		
1273				K-S Test Statistic	N/A					Mean		0.00105
1274				5% K-S Critical Value	N/A					SD		0.00144
1275	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean		0.0005888
1276										95% KM (t) UCL		0.00204
1277	**Assuming Gamma Distribution**									95% KM (z) UCL		0.00201
1278				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.00224
1279				Minimum	N/A					95% KM (bootstrap t) UCL		0.00234
1280				Maximum	N/A					95% KM (BCA) UCL		0.0058
1281				Mean	N/A					95% KM (Percentile Bootstrap) UCL		N/A
1282				Median	N/A					95% KM (Chebyshev) UCL		0.00361
1283				SD	N/A					97.5% KM (Chebyshev) UCL		0.00472
1284				k star	N/A					99% KM (Chebyshev) UCL		0.0069
1285				Theta star	N/A							
1286				Nu star	N/A		**Potential UCLs to Use**					
1287				AppChi2	N/A					95% KM (t) UCL		0.00204
1288				95% Gamma Approximate UCL (Use when n >= 40)	N/A					95% KM (Percentile Bootstrap) UCL		N/A
1289				95% Adjusted Gamma UCL (Use when n < 40)	N/A							
1290	**Note: DL/2 is not a recommended method.**											
1291												
1292	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1293	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1294	**For additional insight, the user may want to consult a statistician.**											
1295												
1296												
1297	**Gamma-BHC/Lindane**											
1298												
1299	**General Statistics**											
1300				Number of Valid Data	34					Number of Detected Data		5

1301					Number of Distinct Detected Data	5					Number of Non-Detect Data	29
1302					Number of Missing Values	74					Percent Non-Detects	85.29%
1303												
1304					**Raw Statistics**						**Log-transformed Statistics**	
1305					Minimum Detected	0.00011					Minimum Detected	-9.115
1306					Maximum Detected	0.13					Maximum Detected	-2.04
1307					Mean of Detected	0.0285					Mean of Detected	-5.701
1308					SD of Detected	0.0568					SD of Detected	2.611
1309					Minimum Non-Detect	0.0022					Minimum Non-Detect	-6.119
1310					Maximum Non-Detect	0.13					Maximum Non-Detect	-2.04
1311												
1312	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	33
1313	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1
1314	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	97.06%
1315												
1316	**Warning: There are only 5 Detected Values in this data**											
1317	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1318	**the resulting calculations may not be reliable enough to draw conclusions**											
1319												
1320	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1321												
1322												
1323	**UCL Statistics**											
1324	**Normal Distribution Test with Detected Values Only**										**Lognormal Distribution Test with Detected Values Only**	
1325					Shapiro Wilk Test Statistic	0.594					Shapiro Wilk Test Statistic	0.975
1326					5% Shapiro Wilk Critical Value	0.762					5% Shapiro Wilk Critical Value	0.762
1327	**Data not Normal at 5% Significance Level**										**Data appear Lognormal at 5% Significance Level**	
1328												
1329	**Assuming Normal Distribution**										**Assuming Lognormal Distribution**	
1330					DL/2 Substitution Method						DL/2 Substitution Method	
1331					Mean	0.0195					Mean	-4.866
1332					SD	0.0261					SD	1.612
1333					95% DL/2 (t) UCL	0.0271					95% H-Stat (DL/2) UCL	0.0709
1334												
1335					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1336	**MLE method failed to converge properly**										Mean in Log Scale	-7.545
1337											SD in Log Scale	1.316
1338											Mean in Original Scale	0.00457
1339											SD in Original Scale	0.0222
1340											95% t UCL	0.011
1341											95% Percentile Bootstrap UCL	0.0122
1342											95% BCA Bootstrap UCL	0.016
1343											95% H-UCL	0.00242
1344												
1345	**Gamma Distribution Test with Detected Values Only**										**Data Distribution Test with Detected Values Only**	
1346					k star (bias corrected)	0.261					**Data appear Gamma Distributed at 5% Significance Level**	
1347					Theta Star	0.109						
1348					nu star	2.608						
1349												
1350					A-D Test Statistic	0.426					**Nonparametric Statistics**	
1351					5% A-D Critical Value	0.737					Kaplan-Meier (KM) Method	
1352					K-S Test Statistic	0.737					Mean	0.00515

1353				5% K-S Critical Value	0.379					SD	0.0218
1354	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean	0.00422
1355										95% KM (t) UCL	0.0123
1356	**Assuming Gamma Distribution**									95% KM (z) UCL	0.0121
1357	Gamma ROS Statistics using Extrapolated Data									95% KM (jackknife) UCL	0.0117
1358				Minimum	0.000001					95% KM (bootstrap t) UCL	0.0384
1359				Maximum	0.13					95% KM (BCA) UCL	0.0207
1360				Mean	0.0043					95% KM (Percentile Bootstrap) UCL	0.0132
1361				Median	0.000001					95% KM (Chebyshev) UCL	0.0235
1362				SD	0.0223					97.5% KM (Chebyshev) UCL	0.0315
1363				k star	0.13					99% KM (Chebyshev) UCL	0.0471
1364				Theta star	0.0331						
1365				Nu star	8.84	**Potential UCLs to Use**					
1366				AppChi2	3.23					95% KM (t) UCL	0.0123
1367			95% Gamma Approximate UCL (Use when n >= 40)		0.0118						
1368			95% Adjusted Gamma UCL (Use when n < 40)		0.0124						
1369	**Note: DL/2 is not a recommended method.**										
1370											
1371	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
1372	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**										
1373	**For additional insight, the user may want to consult a statistician.**										
1374											
1375											
1376	**Aluminum**										
1377											
1378	**General Statistics**										
1379				Number of Valid Observations	41					Number of Distinct Observations	35
1380				Number of Missing Values	67						
1381											
1382	**Raw Statistics**					**Log-transformed Statistics**					
1383				Minimum	640					Minimum of Log Data	6.461
1384				Maximum	59000					Maximum of Log Data	10.99
1385				Mean	6934					Mean of log Data	8.457
1386				Geometric Mean	4710					SD of log Data	0.859
1387				Median	4930						
1388				SD	9133						
1389				Std. Error of Mean	1426						
1390				Coefficient of Variation	1.317						
1391				Skewness	4.89						
1392											
1393	**Relevant UCL Statistics**										
1394	**Normal Distribution Test**					**Lognormal Distribution Test**					
1395				Shapiro Wilk Test Statistic	0.503					Shapiro Wilk Test Statistic	0.968
1396				Shapiro Wilk Critical Value	0.941					Shapiro Wilk Critical Value	0.941
1397	**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**					
1398											
1399	**Assuming Normal Distribution**					**Assuming Lognormal Distribution**					
1400				95% Student's-t UCL	9335					95% H-UCL	9185
1401	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	11170
1402			95% Adjusted-CLT UCL (Chen-1995)		10444					97.5% Chebyshev (MVUE) UCL	13092
1403			95% Modified-t UCL (Johnson-1978)		9517					99% Chebyshev (MVUE) UCL	16866
1404											

1405	**Gamma Distribution Test**						**Data Distribution**					
1406					k star (bias corrected)	1.348	**Data Follow Appr. Gamma Distribution at 5% Significance Level**					
1407					Theta Star	5144						
1408					MLE of Mean	6934						
1409					MLE of Standard Deviation	5972						
1410					nu star	110.5						
1411					Approximate Chi Square Value (.05)	87.27	**Nonparametric Statistics**					
1412					Adjusted Level of Significance	0.0441					95% CLT UCL	9280
1413					Adjusted Chi Square Value	86.51					95% Jackknife UCL	9335
1414											95% Standard Bootstrap UCL	9249
1415					Anderson-Darling Test Statistic	0.935					95% Bootstrap-t UCL	12594
1416					Anderson-Darling 5% Critical Value	0.768					95% Hall's Bootstrap UCL	19024
1417					Kolmogorov-Smirnov Test Statistic	0.14					95% Percentile Bootstrap UCL	9563
1418					Kolmogorov-Smirnov 5% Critical Value	0.141					95% BCA Bootstrap UCL	10635
1419	**Data follow Appr. Gamma Distribution at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	13151
1420											97.5% Chebyshev(Mean, Sd) UCL	15842
1421	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	21126
1422					95% Approximate Gamma UCL (Use when n >= 40)	8782						
1423					95% Adjusted Gamma UCL (Use when n < 40)	8859						
1424												
1425	**Potential UCL to Use**										Use 95% Approximate Gamma UCL	8782
1426												
1427	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1428	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1429	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1430												
1431												
1432	**Cadmium**											
1433												
1434	**General Statistics**											
1435					Number of Valid Data	58					Number of Detected Data	18
1436					Number of Distinct Detected Data	15					Number of Non-Detect Data	40
1437					Number of Missing Values	50					Percent Non-Detects	68.97%
1438												
1439	**Raw Statistics**						**Log-transformed Statistics**					
1440					Minimum Detected	0.026					Minimum Detected	-3.65
1441					Maximum Detected	5.8					Maximum Detected	1.758
1442					Mean of Detected	0.591					Mean of Detected	-1.407
1443					SD of Detected	1.324					SD of Detected	1.16
1444					Minimum Non-Detect	0.18					Minimum Non-Detect	-1.715
1445					Maximum Non-Detect	4					Maximum Non-Detect	1.386
1446												
1447	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	57
1448	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1
1449	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	98.28%
1450												
1451	**UCL Statistics**											
1452	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1453					Shapiro Wilk Test Statistic	0.398					Shapiro Wilk Test Statistic	0.934
1454					5% Shapiro Wilk Critical Value	0.897					5% Shapiro Wilk Critical Value	0.897
1455	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1456												

1457	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1458				DL/2 Substitution Method						DL/2 Substitution Method		
1459				Mean		0.431				Mean		-1.49
1460				SD		0.844				SD		0.953
1461				95% DL/2 (t) UCL		0.616				95% H-Stat (DL/2) UCL		0.474
1462												
1463				Maximum Likelihood Estimate(MLE) Method		N/A				Log ROS Method		
1464	**MLE method failed to converge properly**									Mean in Log Scale		-1.911
1465										SD in Log Scale		0.84
1466										Mean in Original Scale		0.276
1467										SD in Original Scale		0.756
1468										95% t UCL		0.441
1469										95% Percentile Bootstrap UCL		0.467
1470										95% BCA Bootstrap UCL		0.597
1471										95% H-UCL		0.268
1472												
1473	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1474				k star (bias corrected)		0.61	**Data appear Lognormal at 5% Significance Level**					
1475				Theta Star		0.97						
1476				nu star		21.95						
1477												
1478				A-D Test Statistic		1.681	**Nonparametric Statistics**					
1479				5% A-D Critical Value		0.784				Kaplan-Meier (KM) Method		
1480				K-S Test Statistic		0.784				Mean		0.285
1481				5% K-S Critical Value		0.212				SD		0.75
1482	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean		0.102
1483										95% KM (t) UCL		0.456
1484	**Assuming Gamma Distribution**									95% KM (z) UCL		0.453
1485				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.453
1486				Minimum		0.000001				95% KM (bootstrap t) UCL		0.889
1487				Maximum		5.8				95% KM (BCA) UCL		0.503
1488				Mean		0.317				95% KM (Percentile Bootstrap) UCL		0.469
1489				Median		0.16				95% KM (Chebyshev) UCL		0.731
1490				SD		0.771				97.5% KM (Chebyshev) UCL		0.924
1491				k star		0.229				99% KM (Chebyshev) UCL		1.304
1492				Theta star		1.382						
1493				Nu star		26.56	**Potential UCLs to Use**					
1494				AppChi2		15.81				95% KM (BCA) UCL		0.503
1495				95% Gamma Approximate UCL (Use when n >= 40)		0.532						
1496				95% Adjusted Gamma UCL (Use when n < 40)		0.539						
1497	**Note: DL/2 is not a recommended method.**											
1498												
1499	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1500	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1501	**For additional insight, the user may want to consult a statistician.**											
1502												
1503												
1504	**Chromium**											
1505												
1506	**General Statistics**											
1507				Number of Valid Observations		84				Number of Distinct Observations		67
1508				Number of Missing Values		24						

Raw Statistics		
Minimum	1.1	
Maximum	5000	
Mean	272	
Geometric Mean	53.5	
Median	52	
SD	670.5	
Std. Error of Mean	73.16	
Coefficient of Variation	2.465	
Skewness	5.057	

Log-transformed Statistics		
Minimum of Log Data	0.0953	
Maximum of Log Data	8.517	
Mean of log Data	3.98	
SD of log Data	1.906	

Relevant UCL Statistics

Normal Distribution Test		
Lilliefors Test Statistic	0.343	
Lilliefors Critical Value	0.0967	
Data not Normal at 5% Significance Level		
Assuming Normal Distribution		
95% Student's-t UCL	393.7	
95% UCLs (Adjusted for Skewness)		
95% Adjusted-CLT UCL (Chen-1995)	435.4	
95% Modified-t UCL (Johnson-1978)	400.4	
Gamma Distribution Test		
k star (bias corrected)	0.398	
Theta Star	684.1	
MLE of Mean	272	
MLE of Standard Deviation	431.3	
nu star	66.79	
Approximate Chi Square Value (.05)	48.98	
Adjusted Level of Significance	0.0471	
Adjusted Chi Square Value	48.72	
Anderson-Darling Test Statistic	2.881	
Anderson-Darling 5% Critical Value	0.841	
Kolmogorov-Smirnov Test Statistic	0.122	
Kolmogorov-Smirnov 5% Critical Value	0.104	
Data not Gamma Distributed at 5% Significance Level		
Assuming Gamma Distribution		
95% Approximate Gamma UCL (Use when n >= 40)	370.8	
95% Adjusted Gamma UCL (Use when n < 40)	372.9	
Potential UCL to Use		

Lognormal Distribution Test		
Lilliefors Test Statistic	0.104	
Lilliefors Critical Value	0.0967	
Data not Lognormal at 5% Significance Level		
Assuming Lognormal Distribution		
95% H-UCL	649.6	
95% Chebyshev (MVUE) UCL	738.6	
97.5% Chebyshev (MVUE) UCL	923.8	
99% Chebyshev (MVUE) UCL	1288	
Data Distribution		
Data do not follow a Discernable Distribution (0.05)		
Nonparametric Statistics		
95% CLT UCL	392.3	
95% Jackknife UCL	393.7	
95% Standard Bootstrap UCL	395.5	
95% Bootstrap-t UCL	493.3	
95% Hall's Bootstrap UCL	841.5	
95% Percentile Bootstrap UCL	411.2	
95% BCA Bootstrap UCL	457.3	
95% Chebyshev(Mean, Sd) UCL	590.9	
97.5% Chebyshev(Mean, Sd) UCL	728.8	
99% Chebyshev(Mean, Sd) UCL	999.9	
Use 95% Chebyshev (Mean, Sd) UCL	590.9	

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Copper

1561												
1562	**General Statistics**											
1563					Number of Valid Observations	32				Number of Distinct Observations		29
1564					Number of Missing Values	76						
1565												
1566	**Raw Statistics**						**Log-transformed Statistics**					
1567					Minimum	0.94				Minimum of Log Data		-0.0619
1568					Maximum	79.5				Maximum of Log Data		4.376
1569					Mean	14.52				Mean of log Data		2.015
1570					Geometric Mean	7.504				SD of log Data		1.203
1571					Median	6.25						
1572					SD	17.91						
1573					Std. Error of Mean	3.165						
1574					Coefficient of Variation	1.233						
1575					Skewness	2.144						
1576												
1577	**Relevant UCL Statistics**											
1578	**Normal Distribution Test**						**Lognormal Distribution Test**					
1579					Shapiro Wilk Test Statistic	0.737				Shapiro Wilk Test Statistic		0.968
1580					Shapiro Wilk Critical Value	0.93				Shapiro Wilk Critical Value		0.93
1581	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1582												
1583	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1584					95% Student's-t UCL	19.89				95% H-UCL		27.64
1585	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL		31.54
1586					95% Adjusted-CLT UCL (Chen-1995)	21.01				97.5% Chebyshev (MVUE) UCL		38.74
1587					95% Modified-t UCL (Johnson-1978)	20.09				99% Chebyshev (MVUE) UCL		52.87
1588												
1589	**Gamma Distribution Test**						**Data Distribution**					
1590					k star (bias corrected)	0.825	**Data appear Gamma Distributed at 5% Significance Level**					
1591					Theta Star	17.61						
1592					MLE of Mean	14.52						
1593					MLE of Standard Deviation	15.99						
1594					nu star	52.78						
1595					Approximate Chi Square Value (.05)	37.09	**Nonparametric Statistics**					
1596					Adjusted Level of Significance	0.0416				95% CLT UCL		19.73
1597					Adjusted Chi Square Value	36.38				95% Jackknife UCL		19.89
1598										95% Standard Bootstrap UCL		19.6
1599					Anderson-Darling Test Statistic	0.629				95% Bootstrap-t UCL		22.62
1600					Anderson-Darling 5% Critical Value	0.781				95% Hall's Bootstrap UCL		23.49
1601					Kolmogorov-Smirnov Test Statistic	0.155				95% Percentile Bootstrap UCL		20.26
1602					Kolmogorov-Smirnov 5% Critical Value	0.161				95% BCA Bootstrap UCL		21.22
1603	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL		28.32
1604										97.5% Chebyshev(Mean, Sd) UCL		34.29
1605	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL		46.02
1606					95% Approximate Gamma UCL (Use when n >= 40)	20.67						
1607					95% Adjusted Gamma UCL (Use when n < 40)	21.07						
1608												
1609	**Potential UCL to Use**									Use 95% Approximate Gamma UCL		20.67
1610												
1611	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1612	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											

	A	B	C	D	E	F	G	H	I	J	K	L
1613	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
1614												
1615												
1616	Iron											
1617												
1618	General Statistics											
1619	Number of Valid Observations					41	Number of Distinct Observations					37
1620	Number of Missing Values					67						
1621												
1622	Raw Statistics						Log-transformed Statistics					
1623	Minimum					81	Minimum of Log Data					4.394
1624	Maximum					100000	Maximum of Log Data					11.51
1625	Mean					8518	Mean of log Data					8.434
1626	Geometric Mean					4602	SD of log Data					1.158
1627	Median					5200						
1628	SD					15470						
1629	Std. Error of Mean					2416						
1630	Coefficient of Variation					1.816						
1631	Skewness					5.44						
1632												
1633	Relevant UCL Statistics											
1634	Normal Distribution Test						Lognormal Distribution Test					
1635	Shapiro Wilk Test Statistic					0.412	Shapiro Wilk Test Statistic					0.929
1636	Shapiro Wilk Critical Value					0.941	Shapiro Wilk Critical Value					0.941
1637	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
1638												
1639	Assuming Normal Distribution						Assuming Lognormal Distribution					
1640	95% Student's-t UCL					12586	95% H-UCL					14297
1641	95% UCLs (Adjusted for Skewness)						95% Chebyshev (MVUE) UCL					17126
1642	95% Adjusted-CLT UCL (Chen-1995)					14685	97.5% Chebyshev (MVUE) UCL					20744
1643	95% Modified-t UCL (Johnson-1978)					12928	99% Chebyshev (MVUE) UCL					27851
1644												
1645	Gamma Distribution Test						Data Distribution					
1646	k star (bias corrected)					0.891	Data do not follow a Discernable Distribution (0.05)					
1647	Theta Star					9558						
1648	MLE of Mean					8518						
1649	MLE of Standard Deviation					9023						
1650	nu star					73.08						
1651	Approximate Chi Square Value (.05)					54.39	Nonparametric Statistics					
1652	Adjusted Level of Significance					0.0441	95% CLT UCL					12492
1653	Adjusted Chi Square Value					53.81	95% Jackknife UCL					12586
1654							95% Standard Bootstrap UCL					12447
1655	Anderson-Darling Test Statistic					1.3	95% Bootstrap-t UCL					20704
1656	Anderson-Darling 5% Critical Value					0.781	95% Hall's Bootstrap UCL					28387
1657	Kolmogorov-Smirnov Test Statistic					0.155	95% Percentile Bootstrap UCL					13024
1658	Kolmogorov-Smirnov 5% Critical Value					0.142	95% BCA Bootstrap UCL					15273
1659	Data not Gamma Distributed at 5% Significance Level						95% Chebyshev(Mean, Sd) UCL					19049
1660							97.5% Chebyshev(Mean, Sd) UCL					23606
1661	Assuming Gamma Distribution						99% Chebyshev(Mean, Sd) UCL					32557
1662	95% Approximate Gamma UCL (Use when n >= 40)					11444						
1663	95% Adjusted Gamma UCL (Use when n < 40)					11569						
1664												

	A	B	C	D	E	F	G	H	I	J	K	L
1665	**Potential UCL to Use**						Use 95% Chebyshev (Mean, Sd) UCL					19049
1666												
1667	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1668	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1669	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1670												
1671												
1672	**Lead**											
1673												
1674	**General Statistics**											
1675	Number of Valid Data					58	Number of Detected Data					57
1676	Number of Distinct Detected Data					49	Number of Non-Detect Data					1
1677	Number of Missing Values					50	Percent Non-Detects					1.72%
1678												
1679	**Raw Statistics**						**Log-transformed Statistics**					
1680	Minimum Detected					1.5	Minimum Detected					0.405
1681	Maximum Detected					210	Maximum Detected					5.347
1682	Mean of Detected					25.03	Mean of Detected					2.637
1683	SD of Detected					33.55	SD of Detected					1.072
1684	Minimum Non-Detect					7.6	Minimum Non-Detect					2.028
1685	Maximum Non-Detect					7.6	Maximum Non-Detect					2.028
1686												
1687												
1688	**UCL Statistics**											
1689	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1690	Lilliefors Test Statistic					0.242	Lilliefors Test Statistic					0.0879
1691	5% Lilliefors Critical Value					0.117	5% Lilliefors Critical Value					0.117
1692	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1693												
1694	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1695	DL/2 Substitution Method						DL/2 Substitution Method					
1696	Mean					24.66	Mean					2.615
1697	SD					33.38	SD					1.076
1698	95% DL/2 (t) UCL					31.99	95% H-Stat (DL/2) UCL					34.61
1699												
1700	Maximum Likelihood Estimate(MLE) Method						Log ROS Method					
1701	Mean					15.29	Mean in Log Scale					2.618
1702	SD					43	SD in Log Scale					1.073
1703	95% MLE (t) UCL					24.73	Mean in Original Scale					24.68
1704	95% MLE (Tiku) UCL					25.31	SD in Original Scale					33.37
1705							95% t UCL					32
1706							95% Percentile Bootstrap UCL					32.42
1707							95% BCA Bootstrap UCL					34.16
1708							95% H UCL					34.52
1709												
1710	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1711	k star (bias corrected)					0.951	**Data appear Lognormal at 5% Significance Level**					
1712	Theta Star					26.33						
1713	nu star					108.4						
1714												
1715	A-D Test Statistic					1.359	**Nonparametric Statistics**					
1716	5% A-D Critical Value					0.78	Kaplan-Meier (KM) Method					

1717				K-S Test Statistic	0.78					Mean	24.68
1718				5% K-S Critical Value	0.121					SD	33.08
1719	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean	4.382
1720										95% KM (t) UCL	32
1721	**Assuming Gamma Distribution**									95% KM (z) UCL	31.89
1722	Gamma ROS Statistics using Extrapolated Data									95% KM (jackknife) UCL	32
1723				Minimum	0.000001					95% KM (bootstrap t) UCL	36.17
1724				Maximum	210					95% KM (BCA) UCL	32.4
1725				Mean	24.6					95% KM (Percentile Bootstrap) UCL	32.36
1726				Median	12.85					95% KM (Chebyshev) UCL	43.78
1727				SD	33.42					97.5% KM (Chebyshev) UCL	52.04
1728				k star	0.685					99% KM (Chebyshev) UCL	68.28
1729				Theta star	35.91						
1730				Nu star	79.45	**Potential UCLs to Use**					
1731				AppChi2	59.91					95% KM (Chebyshev) UCL	43.78
1732			95% Gamma Approximate UCL (Use when n >= 40)		32.62						
1733			95% Adjusted Gamma UCL (Use when n < 40)		32.86						
1734	**Note: DL/2 is not a recommended method.**										
1735											
1736	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
1737	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**										
1738	**For additional insight, the user may want to consult a statistician.**										
1739											
1740											
1741	**Manganese**										
1742											
1743	**General Statistics**										
1744				Number of Valid Observations	32					Number of Distinct Observations	30
1745				Number of Missing Values	76						
1746											
1747	**Raw Statistics**					**Log-transformed Statistics**					
1748				Minimum	2.8					Minimum of Log Data	1.03
1749				Maximum	1035					Maximum of Log Data	6.942
1750				Mean	88.22					Mean of log Data	3.413
1751				Geometric Mean	30.35					SD of log Data	1.462
1752				Median	20.5						
1753				SD	184.8						
1754				Std. Error of Mean	32.67						
1755				Coefficient of Variation	2.095						
1756				Skewness	4.619						
1757											
1758	**Relevant UCL Statistics**										
1759	**Normal Distribution Test**					**Lognormal Distribution Test**					
1760				Shapiro Wilk Test Statistic	0.453					Shapiro Wilk Test Statistic	0.959
1761				Shapiro Wilk Critical Value	0.93					Shapiro Wilk Critical Value	0.93
1762	**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**					
1763											
1764	**Assuming Normal Distribution**					**Assuming Lognormal Distribution**					
1765				95% Student's-t UCL	143.6					95% H-UCL	196.2
1766	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	200.9
1767			95% Adjusted-CLT UCL (Chen-1995)		170.5					97.5% Chebyshev (MVUE) UCL	252
1768			95% Modified-t UCL (Johnson-1978)		148.1					99% Chebyshev (MVUE) UCL	352.3

1769												
1770	**Gamma Distribution Test**						**Data Distribution**					
1771					k star (bias corrected)	0.548	**Data appear Lognormal at 5% Significance Level**					
1772					Theta Star	161						
1773					MLE of Mean	88.22						
1774					MLE of Standard Deviation	119.2						
1775					nu star	35.07						
1776					Approximate Chi Square Value (.05)	22.52	**Nonparametric Statistics**					
1777					Adjusted Level of Significance	0.0416					95% CLT UCL	142
1778					Adjusted Chi Square Value	21.98					95% Jackknife UCL	143.6
1779											95% Standard Bootstrap UCL	141.2
1780					Anderson-Darling Test Statistic	1.185					95% Bootstrap-t UCL	228.9
1781					Anderson-Darling 5% Critical Value	0.803					95% Hall's Bootstrap UCL	343.6
1782					Kolmogorov-Smirnov Test Statistic	0.193					95% Percentile Bootstrap UCL	150.1
1783					Kolmogorov-Smirnov 5% Critical Value	0.163					95% BCA Bootstrap UCL	176.9
1784	**Data not Gamma Distributed at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	230.6
1785											97.5% Chebyshev(Mean, Sd) UCL	292.2
1786	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	413.3
1787					95% Approximate Gamma UCL (Use when n >= 40)	137.4						
1788					95% Adjusted Gamma UCL (Use when n < 40)	140.7						
1789												
1790	**Potential UCL to Use**										Use 95% H-UCL	196.2
1791												
1792	**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**											
1793	**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**											
1794	**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**											
1795	**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**											
1796												
1797	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1798	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1799	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1800												
1801												
1802	**Mercury**											
1803												
1804	**General Statistics**											
1805					Number of Valid Data	53	Number of Detected Data	23				
1806					Number of Distinct Detected Data	22	Number of Non-Detect Data	30				
1807					Number of Missing Values	55	Percent Non-Detects	56.60%				
1808												
1809	**Raw Statistics**						**Log-transformed Statistics**					
1810					Minimum Detected	0.034	Minimum Detected	-3.381				
1811					Maximum Detected	0.49	Maximum Detected	-0.713				
1812					Mean of Detected	0.211	Mean of Detected	-1.845				
1813					SD of Detected	0.147	SD of Detected	0.837				
1814					Minimum Non-Detect	0.04	Minimum Non-Detect	-3.219				
1815					Maximum Non-Detect	0.32	Maximum Non-Detect	-1.139				
1816												
1817	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect	46				
1818	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected	7				
1819	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage	86.79%				
1820												

	A	B	C	D	E	F	G	H	I	J	K	L
1821	**UCL Statistics**											
1822	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1823					Shapiro Wilk Test Statistic	0.909					Shapiro Wilk Test Statistic	0.934
1824					5% Shapiro Wilk Critical Value	0.914					5% Shapiro Wilk Critical Value	0.914
1825	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1826												
1827	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1828					DL/2 Substitution Method						DL/2 Substitution Method	
1829					Mean	0.121					Mean	-2.576
1830					SD	0.127					SD	0.954
1831					95% DL/2 (t) UCL	0.15					95% H-Stat (DL/2) UCL	0.162
1832												
1833					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
1834					Mean	0.153					Mean in Log Scale	-2.612
1835					SD	0.151					SD in Log Scale	0.93
1836					95% MLE (t) UCL	0.188					Mean in Original Scale	0.117
1837					95% MLE (Tiku) UCL	0.269					SD in Original Scale	0.127
1838											95% t UCL	0.146
1839											95% Percentile Bootstrap UCL	0.145
1840											95% BCA Bootstrap UCL	0.153
1841											95% H UCL	0.151
1842												
1843	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1844					k star (bias corrected)	1.66	**Data appear Gamma Distributed at 5% Significance Level**					
1845					Theta Star	0.127						
1846					nu star	76.38						
1847												
1848					A-D Test Statistic	0.465	**Nonparametric Statistics**					
1849					5% A-D Critical Value	0.756					Kaplan-Meier (KM) Method	
1850					K-S Test Statistic	0.756					Mean	0.117
1851					5% K-S Critical Value	0.184					SD	0.127
1852	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.018
1853											95% KM (t) UCL	0.147
1854	**Assuming Gamma Distribution**										95% KM (z) UCL	0.147
1855					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.147
1856					Minimum	0.000001					95% KM (bootstrap t) UCL	0.151
1857					Maximum	0.49					95% KM (BCA) UCL	0.15
1858					Mean	0.107					95% KM (Percentile Bootstrap) UCL	0.148
1859					Median	0.0497					95% KM (Chebyshev) UCL	0.195
1860					SD	0.136					97.5% KM (Chebyshev) UCL	0.229
1861					k star	0.205					99% KM (Chebyshev) UCL	0.296
1862					Theta star	0.52						
1863					Nu star	21.77	**Potential UCLs to Use**					
1864					AppChi2	12.17					95% KM (t) UCL	0.147
1865					95% Gamma Approximate UCL (Use when n >= 40)	0.191						
1866					95% Adjusted Gamma UCL (Use when n < 40)	0.194						
1867	**Note: DL/2 is not a recommended method.**											
1868												
1869	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1870	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1871	**For additional insight, the user may want to consult a statistician.**											
1872												

	A	B	C	D	E	F	G	H	I	J	K	L
1873												
1874	**Nickel**											
1875												
1876						**General Statistics**						
1877					Number of Valid Data	32			Number of Detected Data		31	
1878					Number of Distinct Detected Data	27			Number of Non-Detect Data		1	
1879					Number of Missing Values	76			Percent Non-Detects		3.13%	
1880												
1881				**Raw Statistics**				**Log-transformed Statistics**				
1882					Minimum Detected	0.66			Minimum Detected		-0.416	
1883					Maximum Detected	67			Maximum Detected		4.205	
1884					Mean of Detected	10.51			Mean of Detected		1.739	
1885					SD of Detected	14.67			SD of Detected		1.082	
1886					Minimum Non-Detect	5			Minimum Non-Detect		1.609	
1887					Maximum Non-Detect	5			Maximum Non-Detect		1.609	
1888												
1889												
1890						**UCL Statistics**						
1891				**Normal Distribution Test with Detected Values Only**				**Lognormal Distribution Test with Detected Values Only**				
1892					Shapiro Wilk Test Statistic	0.626			Shapiro Wilk Test Statistic		0.975	
1893					5% Shapiro Wilk Critical Value	0.929			5% Shapiro Wilk Critical Value		0.929	
1894				**Data not Normal at 5% Significance Level**				**Data appear Lognormal at 5% Significance Level**				
1895												
1896				**Assuming Normal Distribution**				**Assuming Lognormal Distribution**				
1897					DL/2 Substitution Method				DL/2 Substitution Method			
1898					Mean	10.26			Mean		1.713	
1899					SD	14.5			SD		1.075	
1900					95% DL/2 (t) UCL	14.61			95% H-Stat (DL/2) UCL		16.07	
1901												
1902					Maximum Likelihood Estimate(MLE) Method				Log ROS Method			
1903					Mean	3.137			Mean in Log Scale		1.712	
1904					SD	21.26			SD in Log Scale		1.076	
1905					95% MLE (t) UCL	9.508			Mean in Original Scale		10.26	
1906					95% MLE (Tiku) UCL	10.79			SD in Original Scale		14.5	
1907									95% t UCL		14.61	
1908									95% Percentile Bootstrap UCL		14.61	
1909									95% BCA Bootstrap UCL		16.18	
1910									95% H UCL		16.08	
1911												
1912				**Gamma Distribution Test with Detected Values Only**				**Data Distribution Test with Detected Values Only**				
1913					k star (bias corrected)	0.877			**Data appear Lognormal at 5% Significance Level**			
1914					Theta Star	11.99						
1915					nu star	54.35						
1916												
1917					A-D Test Statistic	1.131			**Nonparametric Statistics**			
1918					5% A-D Critical Value	0.778			Kaplan-Meier (KM) Method			
1919					K-S Test Statistic	0.778			Mean		10.26	
1920					5% K-S Critical Value	0.163			SD		14.27	
1921				**Data not Gamma Distributed at 5% Significance Level**					SE of Mean		2.565	
1922									95% KM (t) UCL		14.61	
1923				**Assuming Gamma Distribution**					95% KM (z) UCL		14.48	
1924					Gamma ROS Statistics using Extrapolated Data				95% KM (jackknife) UCL		14.61	

1925					Minimum	0.129					95% KM (bootstrap t) UCL	18.48
1926					Maximum	67					95% KM (BCA) UCL	15.36
1927					Mean	10.19					95% KM (Percentile Bootstrap) UCL	14.63
1928					Median	5.2					95% KM (Chebyshev) UCL	21.45
1929					SD	14.55					97.5% KM (Chebyshev) UCL	26.28
1930					k star	0.783					99% KM (Chebyshev) UCL	35.79
1931					Theta star	13						
1932					Nu star	50.14					**Potential UCLs to Use**	
1933					AppChi2	34.88					97.5% KM (Chebyshev) UCL	26.28
1934				95% Gamma Approximate UCL (Use when n >= 40)		14.64						
1935				95% Adjusted Gamma UCL (Use when n < 40)		14.94						
1936	**Note: DL/2 is not a recommended method.**											
1937												
1938	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1939	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1940	**For additional insight, the user may want to consult a statistician.**											
1941												
1942												
1943	**Vanadium**											
1944												
1945	**General Statistics**											
1946					Number of Valid Observations	32					Number of Distinct Observations	25
1947					Number of Missing Values	76						
1948												
1949	**Raw Statistics**						**Log-transformed Statistics**					
1950					Minimum	4.1					Minimum of Log Data	1.411
1951					Maximum	54					Maximum of Log Data	3.989
1952					Mean	17.33					Mean of log Data	2.655
1953					Geometric Mean	14.22					SD of log Data	0.632
1954					Median	13.5						
1955					SD	11.77						
1956					Std. Error of Mean	2.08						
1957					Coefficient of Variation	0.679						
1958					Skewness	1.409						
1959												
1960	**Relevant UCL Statistics**											
1961	**Normal Distribution Test**						**Lognormal Distribution Test**					
1962					Shapiro Wilk Test Statistic	0.852					Shapiro Wilk Test Statistic	0.975
1963					Shapiro Wilk Critical Value	0.93					Shapiro Wilk Critical Value	0.93
1964	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1965												
1966	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1967					95% Student's-t UCL	20.86					95% H-UCL	21.9
1968	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	26.22
1969					95% Adjusted-CLT UCL (Chen-1995)	21.31					97.5% Chebyshev (MVUE) UCL	30.11
1970					95% Modified-t UCL (Johnson-1978)	20.94					99% Chebyshev (MVUE) UCL	37.74
1971												
1972	**Gamma Distribution Test**						**Data Distribution**					
1973					k star (bias corrected)	2.455	**Data Follow Appr. Gamma Distribution at 5% Significance Level**					
1974					Theta Star	7.06						
1975					MLE of Mean	17.33						
1976					MLE of Standard Deviation	11.06						

1977					nu star	157.1						
1978					Approximate Chi Square Value (.05)	129.1		**Nonparametric Statistics**				
1979					Adjusted Level of Significance	0.0416					95% CLT UCL	20.75
1980					Adjusted Chi Square Value	127.8					95% Jackknife UCL	20.86
1981											95% Standard Bootstrap UCL	20.7
1982					Anderson-Darling Test Statistic	0.634					95% Bootstrap-t UCL	21.44
1983					Anderson-Darling 5% Critical Value	0.755					95% Hall's Bootstrap UCL	21.58
1984					Kolmogorov-Smirnov Test Statistic	0.166					95% Percentile Bootstrap UCL	20.82
1985					Kolmogorov-Smirnov 5% Critical Value	0.157					95% BCA Bootstrap UCL	21.27
1986	**Data follow Appr. Gamma Distribution at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	26.4
1987											97.5% Chebyshev(Mean, Sd) UCL	30.32
1988	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	38.03
1989					95% Approximate Gamma UCL (Use when n >= 40)	21.09						
1990					95% Adjusted Gamma UCL (Use when n < 40)	21.31						
1991												
1992	**Potential UCL to Use**										Use 95% Approximate Gamma UCL	21.09
1993												
1994	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1995	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1996	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1997												
1998												
1999	**Zinc**											
2000												
2001	**General Statistics**											
2002					Number of Valid Data	32					Number of Detected Data	27
2003					Number of Distinct Detected Data	24					Number of Non-Detect Data	5
2004					Number of Missing Values	76					Percent Non-Detects	15.63%
2005												
2006	**Raw Statistics**							**Log-transformed Statistics**				
2007					Minimum Detected	1.2					Minimum Detected	0.182
2008					Maximum Detected	180					Maximum Detected	5.193
2009					Mean of Detected	25.67					Mean of Detected	2.552
2010					SD of Detected	38.13					SD of Detected	1.17
2011					Minimum Non-Detect	11					Minimum Non-Detect	2.398
2012					Maximum Non-Detect	27					Maximum Non-Detect	3.296
2013												
2014	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	25
2015	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	7
2016	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	78.13%
2017												
2018	**UCL Statistics**											
2019	**Normal Distribution Test with Detected Values Only**							**Lognormal Distribution Test with Detected Values Only**				
2020					Shapiro Wilk Test Statistic	0.614					Shapiro Wilk Test Statistic	0.976
2021					5% Shapiro Wilk Critical Value	0.923					5% Shapiro Wilk Critical Value	0.923
2022	**Data not Normal at 5% Significance Level**							**Data appear Lognormal at 5% Significance Level**				
2023												
2024	**Assuming Normal Distribution**							**Assuming Lognormal Distribution**				
2025					DL/2 Substitution Method						DL/2 Substitution Method	
2026					Mean	23.16					Mean	2.496
2027					SD	35.45					SD	1.09
2028					95% DL/2 (t) UCL	33.78					95% H-Stat (DL/2) UCL	36.13

2029												
2030					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
2031					**MLE yields a negative mean**						Mean in Log Scale	2.451
2032											SD in Log Scale	1.1
2033											Mean in Original Scale	22.72
2034											SD in Original Scale	35.61
2035											95% t UCL	33.4
2036											95% Percentile Bootstrap UCL	33.57
2037											95% BCA Bootstrap UCL	37.38
2038											95% H-UCL	35.14
2039												
2040					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
2041					k star (bias corrected)	0.779					**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
2042					Theta Star	32.93						
2043					nu star	42.09						
2044												
2045					A-D Test Statistic	0.975					**Nonparametric Statistics**	
2046					5% A-D Critical Value	0.78					Kaplan-Meier (KM) Method	
2047					K-S Test Statistic	0.78					Mean	22.82
2048					5% K-S Critical Value	0.174					SD	35.06
2049					**Data follow Appr. Gamma Distribution at 5% Significance Level**						SE of Mean	6.327
2050											95% KM (t) UCL	33.55
2051					**Assuming Gamma Distribution**						95% KM (z) UCL	33.23
2052					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	33.52
2053					Minimum	0.195					95% KM (bootstrap t) UCL	44.78
2054					Maximum	180					95% KM (BCA) UCL	34.5
2055					Mean	22.56					95% KM (Percentile Bootstrap) UCL	33.55
2056					Median	9.888					95% KM (Chebyshev) UCL	50.4
2057					SD	35.72					97.5% KM (Chebyshev) UCL	62.33
2058					k star	0.703					99% KM (Chebyshev) UCL	85.77
2059					Theta star	32.08						
2060					Nu star	45.01					**Potential UCLs to Use**	
2061					AppChi2	30.62					95% KM (Chebyshev) UCL	50.4
2062					95% Gamma Approximate UCL (Use when n >= 40)	33.16						
2063					95% Adjusted Gamma UCL (Use when n < 40)	33.87						
2064	**Note: DL/2 is not a recommended method.**											
2065												
2066	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2067	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2068	**For additional insight, the user may want to consult a statistician.**											
2069												
2070												
2071	**Cyanide, Total**											
2072												
2073					**General Statistics**							
2074					Number of Valid Data	7					Number of Detected Data	6
2075					Number of Distinct Detected Data	6					Number of Non-Detect Data	1
2076					Number of Missing Values	101					Percent Non-Detects	14.29%
2077												
2078					**Raw Statistics**						**Log-transformed Statistics**	
2079					Minimum Detected	3.7					Minimum Detected	1.308
2080					Maximum Detected	9.05					Maximum Detected	2.203

2081					Mean of Detected	6.592					Mean of Detected	1.836
2082					SD of Detected	2.178					SD of Detected	0.353
2083					Minimum Non-Detect	2					Minimum Non-Detect	0.693
2084					Maximum Non-Detect	2					Maximum Non-Detect	0.693
2085												
2086												
2087					**Warning: There are only 6 Detected Values in this data**							
2088					**Note: It should be noted that even though bootstrap may be performed on this data set**							
2089					**the resulting calculations may not be reliable enough to draw conclusions**							
2090												
2091					**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**							
2092												
2093												
2094					**UCL Statistics**							
2095					**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**	
2096					Shapiro Wilk Test Statistic	0.909					Shapiro Wilk Test Statistic	0.91
2097					5% Shapiro Wilk Critical Value	0.788					5% Shapiro Wilk Critical Value	0.788
2098					**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**	
2099												
2100					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
2101					DL/2 Substitution Method						DL/2 Substitution Method	
2102					Mean	5.793					Mean	1.574
2103					SD	2.901					SD	0.765
2104					95% DL/2 (t) UCL	7.924					95% H-Stat (DL/2) UCL	16.85
2105												
2106					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
2107					Mean	5.751					Mean in Log Scale	1.712
2108					SD	2.795					SD in Log Scale	0.46
2109					95% MLE (t) UCL	7.804					Mean in Original Scale	6.026
2110					95% MLE (Tiku) UCL	7.884					SD in Original Scale	2.488
2111											95% t UCL	7.854
2112											95% Percentile Bootstrap UCL	7.464
2113											95% BCA Bootstrap UCL	7.471
2114											95% H UCL	9.623
2115												
2116					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
2117					k star (bias corrected)	5.231					**Data appear Normal at 5% Significance Level**	
2118					Theta Star	1.26						
2119					nu star	62.78						
2120												
2121					A-D Test Statistic	0.362					**Nonparametric Statistics**	
2122					5% A-D Critical Value	0.698					Kaplan-Meier (KM) Method	
2123					K-S Test Statistic	0.698					Mean	6.179
2124					5% K-S Critical Value	0.332					SD	2.1
2125					**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean	0.87
2126											95% KM (t) UCL	7.868
2127					**Assuming Gamma Distribution**						95% KM (z) UCL	7.609
2128					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	7.866
2129					Minimum	0.000001					95% KM (bootstrap t) UCL	7.814
2130					Maximum	9.05					95% KM (BCA) UCL	7.879
2131					Mean	5.65					95% KM (Percentile Bootstrap) UCL	7.707
2132					Median	5.3					95% KM (Chebyshev) UCL	9.969

2133					SD	3.187				97.5% KM (Chebyshev) UCL		11.61
2134					k star	0.278				99% KM (Chebyshev) UCL		14.83
2135					Theta star	20.31						
2136					Nu star	3.894				**Potential UCLs to Use**		
2137					AppChi2	0.68				95% KM (t) UCL		7.868
2138				95% Gamma Approximate UCL (Use when n >= 40)		32.34				95% KM (Percentile Bootstrap) UCL		7.707
2139				95% Adjusted Gamma UCL (Use when n < 40)		59						
2140	**Note: DL/2 is not a recommended method.**											
2141												
2142	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2143	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2144	**For additional insight, the user may want to consult a statistician.**											
2145												
2146												
2147	**Cobalt**											
2148												
2149	**General Statistics**											
2150					Number of Valid Data	32				Number of Detected Data		29
2151					Number of Distinct Detected Data	27				Number of Non-Detect Data		3
2152					Number of Missing Values	76				Percent Non-Detects		9.38%
2153												
2154	**Raw Statistics**						**Log-transformed Statistics**					
2155					Minimum Detected	0.16				Minimum Detected		-1.833
2156					Maximum Detected	45				Maximum Detected		3.807
2157					Mean of Detected	5.447				Mean of Detected		0.719
2158					SD of Detected	11.03				SD of Detected		1.318
2159					Minimum Non-Detect	0.24				Minimum Non-Detect		-1.427
2160					Maximum Non-Detect	5.4				Maximum Non-Detect		1.686
2161												
2162	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		25
2163	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		7
2164	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		78.13%
2165												
2166	**UCL Statistics**											
2167	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
2168					Shapiro Wilk Test Statistic	0.45				Shapiro Wilk Test Statistic		0.959
2169					5% Shapiro Wilk Critical Value	0.926				5% Shapiro Wilk Critical Value		0.926
2170	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
2171												
2172	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
2173					DL/2 Substitution Method					DL/2 Substitution Method		
2174					Mean	5.055				Mean		0.617
2175					SD	10.56				SD		1.355
2176					95% DL/2 (t) UCL	8.221				95% H-Stat (DL/2) UCL		9.378
2177												
2178					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
2179	**MLE yields a negative mean**									Mean in Log Scale		0.59
2180										SD in Log Scale		1.35
2181										Mean in Original Scale		5.004
2182										SD in Original Scale		10.58
2183										95% t UCL		8.175
2184										95% Percentile Bootstrap UCL		8.002

2185											95% BCA Bootstrap UCL	9.863
2186											95% H-UCL	9.025
2187												
2188	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
2189					k star (bias corrected)	0.587	**Data appear Lognormal at 5% Significance Level**					
2190					Theta Star	9.282						
2191					nu star	34.03						
2192												
2193					A-D Test Statistic	1.738	**Nonparametric Statistics**					
2194					5% A-D Critical Value	0.797					Kaplan-Meier (KM) Method	
2195					K-S Test Statistic	0.797					Mean	5.02
2196					5% K-S Critical Value	0.171					SD	10.41
2197	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	1.873
2198											95% KM (t) UCL	8.196
2199	**Assuming Gamma Distribution**										95% KM (z) UCL	8.101
2200				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	8.184
2201					Minimum	0.000001					95% KM (bootstrap t) UCL	18.43
2202					Maximum	45					95% KM (BCA) UCL	8.972
2203					Mean	4.965					95% KM (Percentile Bootstrap) UCL	8.15
2204					Median	1.45					95% KM (Chebyshev) UCL	13.19
2205					SD	10.6					97.5% KM (Chebyshev) UCL	16.72
2206					k star	0.354					99% KM (Chebyshev) UCL	23.66
2207					Theta star	14.04						
2208					Nu star	22.63	**Potential UCLs to Use**					
2209					AppChi2	12.81					97.5% KM (Chebyshev) UCL	16.72
2210				95% Gamma Approximate UCL (Use when n >= 40)		8.769						
2211				95% Adjusted Gamma UCL (Use when n < 40)		9.049						
2212	**Note: DL/2 is not a recommended method.**											
2213												
2214	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2215	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2216	**For additional insight, the user may want to consult a statistician.**											
2217												
2218												
2219	**Benzaldehyde**											
2220												
2221	**General Statistics**											
2222					Number of Valid Data	14					Number of Detected Data	12
2223					Number of Distinct Detected Data	12					Number of Non-Detect Data	2
2224					Number of Missing Values	71					Percent Non-Detects	14.29%
2225												
2226	**Raw Statistics**						**Log-transformed Statistics**					
2227					Minimum Detected	0.012					Minimum Detected	-4.423
2228					Maximum Detected	1.2					Maximum Detected	0.182
2229					Mean of Detected	0.246					Mean of Detected	-2.165
2230					SD of Detected	0.351					SD of Detected	1.307
2231					Minimum Non-Detect	0.35					Minimum Non-Detect	-1.05
2232					Maximum Non-Detect	0.41					Maximum Non-Detect	-0.892
2233												
2234	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	12
2235	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	2
2236	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	85.71%

	A	B	C	D	E	F	G	H	I	J	K	L
2237												
2238	**UCL Statistics**											
2239	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
2240					Shapiro Wilk Test Statistic	0.66					Shapiro Wilk Test Statistic	0.978
2241					5% Shapiro Wilk Critical Value	0.859					5% Shapiro Wilk Critical Value	0.859
2242	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
2243												
2244	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
2245					DL/2 Substitution Method						DL/2 Substitution Method	
2246					Mean	0.238					Mean	-2.093
2247					SD	0.324					SD	1.216
2248					95% DL/2 (t) UCL	0.391					95% H-Stat (DL/2) UCL	0.751
2249												
2250					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
2251	**MLE method failed to converge properly**										Mean in Log Scale	-2.213
2252											SD in Log Scale	1.208
2253											Mean in Original Scale	0.222
2254											SD in Original Scale	0.328
2255											95% t UCL	0.378
2256											95% Percentile Bootstrap UCL	0.37
2257											95% BCA Bootstrap UCL	0.439
2258											95% H-UCL	0.652
2259												
2260	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
2261					k star (bias corrected)	0.643	**Data appear Gamma Distributed at 5% Significance Level**					
2262					Theta Star	0.382						
2263					nu star	15.42						
2264												
2265					A-D Test Statistic	0.49	**Nonparametric Statistics**					
2266					5% A-D Critical Value	0.764					Kaplan-Meier (KM) Method	
2267					K-S Test Statistic	0.764					Mean	0.226
2268					5% K-S Critical Value	0.254					SD	0.316
2269	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0887
2270											95% KM (t) UCL	0.383
2271	**Assuming Gamma Distribution**										95% KM (z) UCL	0.371
2272					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.382
2273					Minimum	0.012					95% KM (bootstrap t) UCL	0.744
2274					Maximum	1.2					95% KM (BCA) UCL	0.374
2275					Mean	0.228					95% KM (Percentile Bootstrap) UCL	0.381
2276					Median	0.12					95% KM (Chebyshev) UCL	0.612
2277					SD	0.326					97.5% KM (Chebyshev) UCL	0.78
2278					k star	0.728					99% KM (Chebyshev) UCL	1.108
2279					Theta star	0.313						
2280					Nu star	20.38	**Potential UCLs to Use**					
2281					AppChi2	11.13					95% KM (Chebyshev) UCL	0.612
2282					95% Gamma Approximate UCL (Use when n >= 40)	0.417						
2283					95% Adjusted Gamma UCL (Use when n < 40)	0.453						
2284	**Note: DL/2 is not a recommended method.**											
2285												
2286	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
2287	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
2288	**For additional insight, the user may want to consult a statistician.**											

	A	B	C	D	E	F	G	H	I	J	K	L
2289												

Surface Soil – Exposure Area 5

	General UCL Statistics for Data Sets with Non-Detects	
User Selected Options		
From File	WorkSheet.wst	
Full Precision	OFF	
Confidence Coefficient	95%	
Number of Bootstrap Operations	2000	

Benzo(a)pyrene

General Statistics

Number of Valid Data	10	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	6
Number of Missing Values	5	Percent Non-Detects	60.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.014	Minimum Detected	-4.269
Maximum Detected	0.44	Maximum Detected	-0.821
Mean of Detected	0.136	Mean of Detected	-2.871
SD of Detected	0.204	SD of Detected	1.496
Minimum Non-Detect	0.056	Minimum Non-Detect	-2.882
Maximum Non-Detect	0.07	Maximum Non-Detect	-2.659
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	9
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	90.00%

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.715	Shapiro Wilk Test Statistic	0.937
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0724	Mean	-3.252
SD	0.13	SD	0.926
95% DL/2 (t) UCL	0.148	95% H-Stat (DL/2) UCL	0.148
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-3.499
		SD in Log Scale	1.049
		Mean in Original Scale	0.0667
		SD in Original Scale	0.132
		95% t UCL	0.143

53											95% Percentile Bootstrap UCL	0.149
54											95% BCA Bootstrap UCL	0.192
55											95% H-UCL	0.161
56												
57	**Gamma Distribution Test with Detected Values Only**										**Data Distribution Test with Detected Values Only**	
58					k star (bias corrected)	0.34					**Data appear Gamma Distributed at 5% Significance Level**	
59					Theta Star	0.399						
60					nu star	2.719						
61												
62					A-D Test Statistic	0.435					**Nonparametric Statistics**	
63					5% A-D Critical Value	0.673					Kaplan-Meier (KM) Method	
64					K-S Test Statistic	0.673					Mean	0.0678
65					5% K-S Critical Value	0.406					SD	0.125
66	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0458
67											95% KM (t) UCL	0.152
68	**Assuming Gamma Distribution**										95% KM (z) UCL	0.143
69					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.145
70					Minimum	0.000001					95% KM (bootstrap t) UCL	0.454
71					Maximum	0.44					95% KM (BCA) UCL	0.44
72					Mean	0.0569					95% KM (Percentile Bootstrap) UCL	0.175
73					Median	0.00798					95% KM (Chebyshev) UCL	0.268
74					SD	0.136					97.5% KM (Chebyshev) UCL	0.354
75					k star	0.195					99% KM (Chebyshev) UCL	0.524
76					Theta star	0.291						
77					Nu star	3.907					**Potential UCLs to Use**	
78					AppChi2	0.685					95% KM (t) UCL	0.152
79					95% Gamma Approximate UCL (Use when n >= 40)	0.324						
80					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
81	**Note: DL/2 is not a recommended method.**											
82												
83	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
84	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
85	**For additional insight, the user may want to consult a statistician.**											
86												
87												
88	**Chromium, Hexavalent**											
89												
90	**General Statistics**											
91					Number of Valid Data	16					Number of Detected Data	4
92					Number of Distinct Detected Data	4					Number of Non-Detect Data	12
93					Number of Missing Values	7					Percent Non-Detects	75.00%
94												
95	**Raw Statistics**										**Log-transformed Statistics**	
96					Minimum Detected	19					Minimum Detected	2.944
97					Maximum Detected	1100					Maximum Detected	7.003
98					Mean of Detected	293.3					Mean of Detected	4.134
99					SD of Detected	537.8					SD of Detected	1.92
100					Minimum Non-Detect	2.8					Minimum Non-Detect	1.03
101					Maximum Non-Detect	110					Maximum Non-Detect	4.7
102												
103	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	15
104	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1

105	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	93.75%
106												
107	**Warning: There are only 4 Distinct Detected Values in this data**											
108	**Note: It should be noted that even though bootstrap may be performed on this data set**											
109	**the resulting calculations may not be reliable enough to draw conclusions**											
110												
111	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
112												
113												
114	**UCL Statistics**											
115	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
116	Shapiro Wilk Test Statistic				0.636		Shapiro Wilk Test Statistic				0.71	
117	5% Shapiro Wilk Critical Value				0.748		5% Shapiro Wilk Critical Value				0.748	
118	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
119												
120	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
121	DL/2 Substitution Method						DL/2 Substitution Method					
122	Mean				78.86		Mean				1.824	
123	SD				272.7		SD				1.893	
124	95% DL/2 (t) UCL				198.4		95% H-Stat (DL/2) UCL				299	
125												
126	Maximum Likelihood Estimate(MLE) Method				N/A		Log ROS Method					
127	**MLE method failed to converge properly**						Mean in Log Scale				-0.171	
128							SD in Log Scale				2.822	
129							Mean in Original Scale				73.53	
130							SD in Original Scale				273.9	
131							95% t UCL				193.6	
132							95% Percentile Bootstrap UCL				209.7	
133							95% BCA Bootstrap UCL				281.2	
134							95% H-UCL				3760	
135												
136	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
137	k star (bias corrected)				0.272		**Data do not follow a Discernable Distribution (0.05)**					
138	Theta Star				1078							
139	nu star				2.177							
140												
141	A-D Test Statistic				0.835		**Nonparametric Statistics**					
142	5% A-D Critical Value				0.69		Kaplan-Meier (KM) Method					
143	K-S Test Statistic				0.69		Mean				87.72	
144	5% K-S Critical Value				0.413		SD				261.4	
145	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean				75.46	
146							95% KM (t) UCL				220	
147	**Assuming Gamma Distribution**						95% KM (z) UCL				211.8	
148	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL				201.9	
149	Minimum				0.000001		95% KM (bootstrap t) UCL				6990	
150	Maximum				1100		95% KM (BCA) UCL				1100	
151	Mean				73.31		95% KM (Percentile Bootstrap) UCL				229	
152	Median				0.000001		95% KM (Chebyshev) UCL				416.6	
153	SD				274		97.5% KM (Chebyshev) UCL				558.9	
154	k star				0.0927		99% KM (Chebyshev) UCL				838.5	
155	Theta star				790.6							
156	Nu star				2.967		**Potential UCLs to Use**					

157					AppChi2	0.363					97.5% KM (Chebyshev) UCL	558.9
158					95% Gamma Approximate UCL (Use when n >= 40)	599.6						
159					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
160	**Note: DL/2 is not a recommended method.**											
161												
162	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
163	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
164	**For additional insight, the user may want to consult a statistician.**											
165												
166												
167	**Antimony**											
168												
169	**General Statistics**											
170					Number of Valid Data	7					Number of Detected Data	2
171					Number of Distinct Detected Data	2					Number of Non-Detect Data	5
172					Number of Missing Values	7					Percent Non-Detects	71.43%
173												
174	**Raw Statistics**						**Log-transformed Statistics**					
175					Minimum Detected	0.29					Minimum Detected	-1.238
176					Maximum Detected	0.34					Maximum Detected	-1.079
177					Mean of Detected	0.315					Mean of Detected	-1.158
178					SD of Detected	0.0354					SD of Detected	0.112
179					Minimum Non-Detect	0.92					Minimum Non-Detect	-0.0834
180					Maximum Non-Detect	6.9					Maximum Non-Detect	1.932
181												
182	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	7
183	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
184	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
185												
186	**Warning: Data set has only 2 Distinct Detected Values.**											
187	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
188	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
189												
190	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
191												
192	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
193	**Those methods will return a 'N/A' value on your output display!**											
194												
195	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
196	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
197	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
198												
199												
200	**UCL Statistics**											
201	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
202					Shapiro Wilk Test Statistic	N/A					Shapiro Wilk Test Statistic	N/A
203					5% Shapiro Wilk Critical Value	N/A					5% Shapiro Wilk Critical Value	N/A
204	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
205												
206	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
207					DL/2 Substitution Method						DL/2 Substitution Method	
208					Mean	0.88					Mean	-0.533

209					SD	1.139					SD	0.824
210					95% DL/2 (t) UCL	1.717					95% H-Stat (DL/2) UCL	2.434
211												
212					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
213					**MLE method failed to converge properly**						Mean in Log Scale	N/A
214											SD in Log Scale	N/A
215											Mean in Original Scale	N/A
216											SD in Original Scale	N/A
217											95% t UCL	N/A
218											95% Percentile Bootstrap UCL	N/A
219											95% BCA Bootstrap UCL	N/A
220											95% H-UCL	N/A
221												
222					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
223					k star (bias corrected)	N/A					**Data do not follow a Discernable Distribution (0.05)**	
224					Theta Star	N/A						
225					nu star	N/A						
226												
227					A-D Test Statistic	N/A					**Nonparametric Statistics**	
228					5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method	
229					K-S Test Statistic	N/A					Mean	0.315
230					5% K-S Critical Value	N/A					SD	0.025
231					**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.025
232											95% KM (t) UCL	0.364
233					**Assuming Gamma Distribution**						95% KM (z) UCL	0.356
234					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.379
235					Minimum	N/A					95% KM (bootstrap t) UCL	0.353
236					Maximum	N/A					95% KM (BCA) UCL	0.34
237					Mean	N/A					95% KM (Percentile Bootstrap) UCL	0.34
238					Median	N/A					95% KM (Chebyshev) UCL	0.424
239					SD	N/A					97.5% KM (Chebyshev) UCL	0.471
240					k star	N/A					99% KM (Chebyshev) UCL	0.564
241					Theta star	N/A						
242					Nu star	N/A					**Potential UCLs to Use**	
243					AppChi2	N/A					95% KM (t) UCL	0.364
244					95% Gamma Approximate UCL (Use when n >= 40)	N/A					95% KM (% Bootstrap) UCL	0.34
245					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
246					**Warning: Recommended UCL exceeds the maximum observation**							
247	**Note: DL/2 is not a recommended method.**											
248												
249					**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**							
250					**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**							
251					**For additional insight, the user may want to consult a statistician.**							
252												
253												
254	**Arsenic**											
255												
256					**General Statistics**							
257					Number of Valid Data	11					Number of Detected Data	10
258					Number of Distinct Detected Data	10					Number of Non-Detect Data	1
259					Number of Missing Values	4					Percent Non-Detects	9.09%
260												

	A	B	C	D	E	F	G	H	I	J	K	L
261	**Raw Statistics**						**Log-transformed Statistics**					
262					Minimum Detected	4.5					Minimum Detected	1.504
263					Maximum Detected	42					Maximum Detected	3.738
264					Mean of Detected	19.53					Mean of Detected	2.698
265					SD of Detected	13.92					SD of Detected	0.825
266					Minimum Non-Detect	37					Minimum Non-Detect	3.611
267					Maximum Non-Detect	37					Maximum Non-Detect	3.611
268												
269												
270	**UCL Statistics**											
271	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
272					Shapiro Wilk Test Statistic	0.9					Shapiro Wilk Test Statistic	0.929
273					5% Shapiro Wilk Critical Value	0.842					5% Shapiro Wilk Critical Value	0.842
274	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
275												
276	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
277					DL/2 Substitution Method						DL/2 Substitution Method	
278					Mean	19.44					Mean	2.718
279					SD	13.21					SD	0.786
280					95% DL/2 (t) UCL	26.66					95% H-Stat (DL/2) UCL	39.43
281												
282					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
283	**MLE method failed to converge properly**										Mean in Log Scale	2.675
284											SD in Log Scale	0.786
285											Mean in Original Scale	18.81
286											SD in Original Scale	13.42
287											95% t UCL	26.14
288											95% Percentile Bootstrap UCL	25.08
289											95% BCA Bootstrap UCL	25.65
290											95% H-UCL	37.85
291												
292	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
293					k star (bias corrected)	1.449	**Data appear Normal at 5% Significance Level**					
294					Theta Star	13.48						
295					nu star	28.98						
296												
297					A-D Test Statistic	0.27	**Nonparametric Statistics**					
298					5% A-D Critical Value	0.736					Kaplan-Meier (KM) Method	
299					K-S Test Statistic	0.736					Mean	19.04
300					5% K-S Critical Value	0.27					SD	12.95
301	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	4.207
302											95% KM (t) UCL	26.67
303	**Assuming Gamma Distribution**										95% KM (z) UCL	25.96
304					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	26.68
305					Minimum	4.5					95% KM (bootstrap t) UCL	27.87
306					Maximum	42					95% KM (BCA) UCL	25.79
307					Mean	19.19					95% KM (Percentile Bootstrap) UCL	25.65
308					Median	15.78					95% KM (Chebyshev) UCL	37.38
309					SD	13.26					97.5% KM (Chebyshev) UCL	45.31
310					k star	1.62					99% KM (Chebyshev) UCL	60.9
311					Theta star	11.84						
312					Nu star	35.65	**Potential UCLs to Use**					

313					AppChi2	22.98					95% KM (t) UCL	26.67
314				95% Gamma Approximate UCL (Use when n >= 40)		29.76					95% KM (Percentile Bootstrap) UCL	25.65
315				95% Adjusted Gamma UCL (Use when n < 40)		32.05						
316	**Note: DL/2 is not a recommended method.**											
317												
318	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
319	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
320	**For additional insight, the user may want to consult a statistician.**											
321												
322												
323	**Silver**											
324												
325	**General Statistics**											
326					Number of Valid Data	11					Number of Detected Data	2
327					Number of Distinct Detected Data	2					Number of Non-Detect Data	9
328					Number of Missing Values	4					Percent Non-Detects	81.82%
329												
330	**Raw Statistics**						**Log-transformed Statistics**					
331					Minimum Detected	10					Minimum Detected	2.303
332					Maximum Detected	1100					Maximum Detected	7.003
333					Mean of Detected	555					Mean of Detected	4.653
334					SD of Detected	770.7					SD of Detected	3.324
335					Minimum Non-Detect	0.75					Minimum Non-Detect	-0.288
336					Maximum Non-Detect	19					Maximum Non-Detect	2.944
337												
338	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	10
339	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1
340	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	90.91%
341												
342	**Warning: Data set has only 2 Distinct Detected Values.**											
343	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
344	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
345												
346	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
347												
348	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
349	**Those methods will return a 'N/A' value on your output display!**											
350												
351	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
352	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
353	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
354												
355												
356	**UCL Statistics**											
357	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
358					Shapiro Wilk Test Statistic	N/A					Shapiro Wilk Test Statistic	N/A
359					5% Shapiro Wilk Critical Value	N/A					5% Shapiro Wilk Critical Value	N/A
360	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
361												
362	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
363					DL/2 Substitution Method						DL/2 Substitution Method	
364					Mean	103					Mean	0.898

365					SD	330.7					SD	2.431
366					95% DL/2 (t) UCL	283.7					95% H-Stat (DL/2) UCL	5345
367												
368					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
369					**MLE method failed to converge properly**						Mean in Log Scale	N/A
370											SD in Log Scale	N/A
371											Mean in Original Scale	N/A
372											SD in Original Scale	N/A
373											95% t UCL	N/A
374											95% Percentile Bootstrap UCL	N/A
375											95% BCA Bootstrap UCL	N/A
376											95% H-UCL	N/A
377												
378					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
379					k star (bias corrected)	N/A					**Data do not follow a Discernable Distribution (0.05)**	
380					Theta Star	N/A						
381					nu star	N/A						
382												
383					A-D Test Statistic	N/A					**Nonparametric Statistics**	
384					5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method	
385					K-S Test Statistic	N/A					Mean	109.1
386					5% K-S Critical Value	N/A					SD	313.4
387					**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	133.6
388											95% KM (t) UCL	351.3
389					**Assuming Gamma Distribution**						95% KM (z) UCL	328.9
390					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	861.4
391					Minimum	N/A					95% KM (bootstrap t) UCL	N/A
392					Maximum	N/A					95% KM (BCA) UCL	1100
393					Mean	N/A					95% KM (Percentile Bootstrap) UCL	N/A
394					Median	N/A					95% KM (Chebyshev) UCL	691.5
395					SD	N/A					97.5% KM (Chebyshev) UCL	943.5
396					k star	N/A					99% KM (Chebyshev) UCL	1439
397					Theta star	N/A						
398					Nu star	N/A					**Potential UCLs to Use**	
399					AppChi2	N/A					99% KM (Chebyshev) UCL	1439
400					95% Gamma Approximate UCL (Use when n >= 40)	N/A						
401					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
402					**Warning: Recommended UCL exceeds the maximum observation**							
403	**Note: DL/2 is not a recommended method.**											
404												
405					**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**							
406					**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**							
407					**For additional insight, the user may want to consult a statistician.**							
408												
409												
410	**Thallium**											
411												
412					**General Statistics**							
413					Number of Valid Data	8					Number of Detected Data	1
414					Number of Distinct Detected Data	1					Number of Non-Detect Data	7
415					Number of Missing Values	6					Percent Non-Detects	87.50%
416												

	A	B	C	D	E	F	G	H	I	J	K	L
417	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
418	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
419												
420	**The data set for variable Thallium was not processed!**											
421												
422												
423												
424	**Nitrogen, as Ammonia**											
425												
426	**General Statistics**											
427						Number of Valid Observations	9			Number of Distinct Observations	8	
428						Number of Missing Values	6					
429												
430	**Raw Statistics**							**Log-transformed Statistics**				
431						Minimum	150			Minimum of Log Data	5.011	
432						Maximum	1100			Maximum of Log Data	7.003	
433						Mean	405.6			Mean of log Data	5.768	
434						Geometric Mean	320			SD of log Data	0.679	
435						Median	240					
436						SD	338.2					
437						Std. Error of Mean	112.7					
438						Coefficient of Variation	0.834					
439						Skewness	1.625					
440												
441												
442	**Warning: There are only 9 Values in this data**											
443	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
444	**the resulting calculations may not be reliable enough to draw conclusions**											
445												
446	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											
447												
448	**Relevant UCL Statistics**											
449	**Normal Distribution Test**							**Lognormal Distribution Test**				
450						Shapiro Wilk Test Statistic	0.715			Shapiro Wilk Test Statistic	0.848	
451						Shapiro Wilk Critical Value	0.829			Shapiro Wilk Critical Value	0.829	
452	**Data not Normal at 5% Significance Level**							**Data appear Lognormal at 5% Significance Level**				
453												
454	**Assuming Normal Distribution**							**Assuming Lognormal Distribution**				
455						95% Student's-t UCL	615.2			95% H-UCL	749.1	
456	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	786	
457						95% Adjusted-CLT UCL (Chen-1995)	656.3			97.5% Chebyshev (MVUE) UCL	956.8	
458						95% Modified-t UCL (Johnson-1978)	625.4			99% Chebyshev (MVUE) UCL	1292	
459												
460	**Gamma Distribution Test**							**Data Distribution**				
461						k star (bias corrected)	1.582	**Data appear Lognormal at 5% Significance Level**				
462						Theta Star	256.4					
463						MLE of Mean	405.6					
464						MLE of Standard Deviation	322.4					
465						nu star	28.48					
466						Approximate Chi Square Value (.05)	17.3	**Nonparametric Statistics**				
467						Adjusted Level of Significance	0.0231			95% CLT UCL	591	
468						Adjusted Chi Square Value	15.49			95% Jackknife UCL	615.2	

469											95% Standard Bootstrap UCL	585.2
470					Anderson-Darling Test Statistic	0.925					95% Bootstrap-t UCL	1307
471					Anderson-Darling 5% Critical Value	0.729					95% Hall's Bootstrap UCL	1847
472					Kolmogorov-Smirnov Test Statistic	0.29					95% Percentile Bootstrap UCL	605.6
473					Kolmogorov-Smirnov 5% Critical Value	0.282					95% BCA Bootstrap UCL	654.4
474					**Data not Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	897
475											97.5% Chebyshev(Mean, Sd) UCL	1110
476					**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	1527
477					95% Approximate Gamma UCL (Use when n >= 40)	667.6						
478					95% Adjusted Gamma UCL (Use when n < 40)	745.6						
479												
480					**Potential UCL to Use**						Use 95% H-UCL	749.1
481												
482												
483												
484												
485												
486												
487												
488												
489												
490												
491												
492	**Sulfate**											
493												
494							**General Statistics**					
495					Number of Valid Data	8					Number of Detected Data	2
496					Number of Distinct Detected Data	2					Number of Non-Detect Data	6
497					Number of Missing Values	7					Percent Non-Detects	75.00%
498												
499					**Raw Statistics**						**Log-transformed Statistics**	
500					Minimum Detected	120					Minimum Detected	4.787
501					Maximum Detected	230					Maximum Detected	5.438
502					Mean of Detected	175					Mean of Detected	5.113
503					SD of Detected	77.78					SD of Detected	0.46
504					Minimum Non-Detect	56					Minimum Non-Detect	4.025
505					Maximum Non-Detect	150					Maximum Non-Detect	5.011
506												
507	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	7
508	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1
509	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	87.50%
510												
511												
512												
513												
514												
515												
516												
517												
518												
519												
520												

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.

H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.

It is therefore recommended to avoid the use of H-statistic based 95% UCLs.

Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

521	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
522	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
523												
524												
525	**UCL Statistics**											
526	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
527	Shapiro Wilk Test Statistic				N/A		Shapiro Wilk Test Statistic					N/A
528	5% Shapiro Wilk Critical Value				N/A		5% Shapiro Wilk Critical Value					N/A
529	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
530												
531	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
532	DL/2 Substitution Method						DL/2 Substitution Method					
533	Mean				74.31		Mean					4.017
534	SD				70.25		SD					0.756
535	95% DL/2 (t) UCL				121.4		95% H-Stat (DL/2) UCL					167
536												
537	Maximum Likelihood Estimate(MLE) Method				N/A		Log ROS Method					
538	**MLE method failed to converge properly**						Mean in Log Scale					N/A
539							SD in Log Scale					N/A
540							Mean in Original Scale					N/A
541							SD in Original Scale					N/A
542							95% t UCL					N/A
543							95% Percentile Bootstrap UCL					N/A
544							95% BCA Bootstrap UCL					N/A
545							95% H-UCL					N/A
546												
547	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
548	k star (bias corrected)				N/A		**Data do not follow a Discernable Distribution (0.05)**					
549	Theta Star				N/A							
550	nu star				N/A							
551												
552	A-D Test Statistic				N/A		**Nonparametric Statistics**					
553	5% A-D Critical Value				N/A		Kaplan-Meier (KM) Method					
554	K-S Test Statistic				N/A		Mean					133.8
555	5% K-S Critical Value				N/A		SD					36.38
556	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					18.19
557							95% KM (t) UCL					168.2
558	**Assuming Gamma Distribution**						95% KM (z) UCL					163.7
559	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					213.3
560	Minimum				N/A		95% KM (bootstrap t) UCL					N/A
561	Maximum				N/A		95% KM (BCA) UCL					N/A
562	Mean				N/A		95% KM (Percentile Bootstrap) UCL					230
563	Median				N/A		95% KM (Chebyshev) UCL					213
564	SD				N/A		97.5% KM (Chebyshev) UCL					247.3
565	k star				N/A		99% KM (Chebyshev) UCL					314.7
566	Theta star				N/A							
567	Nu star				N/A		**Potential UCLs to Use**					
568	AppChi2				N/A		95% KM (t) UCL					168.2
569	95% Gamma Approximate UCL (Use when n >= 40)				N/A		95% KM (% Bootstrap) UCL					230
570	95% Adjusted Gamma UCL (Use when n < 40)				N/A							
571	**Note: DL/2 is not a recommended method.**											
572												

	A	B	C	D	E	F	G	H	I	J	K	L
573	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
574	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
575	For additional insight, the user may want to consult a statistician.											
576												
577												
578	C11-C22 Aromatics											
579												
580	General Statistics											
581	Number of Valid Observations	2				Number of Distinct Observations	2					
582												
583												
584	Warning: This data set only has 2 observations!											
585	Data set is too small to compute reliable and meaningful statistics and estimates!											
586	The data set for variable C11-C22 Aromatics was not processed!											
587												
588	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
589	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
590												
591												
592												
593	Acetaldehyde											
594												
595	General Statistics											
596	Number of Valid Observations	3				Number of Distinct Observations	3					
597	Number of Missing Values	12										
598												
599												
600	Warning: This data set only has 3 observations!											
601	Data set is too small to compute reliable and meaningful statistics and estimates!											
602	The data set for variable Acetaldehyde was not processed!											
603												
604	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
605	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
606												
607												
608												
609	Aniline											
610												
611	General Statistics											
612	Number of Valid Data	12				Number of Detected Data	1					
613	Number of Distinct Detected Data	1				Number of Non-Detect Data	11					
614	Number of Missing Values	2				Percent Non-Detects	91.67%					
615												
616	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
617	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
618												
619	The data set for variable Aniline was not processed!											
620												
621												
622												
623	Benzaldehyde											
624												

625	**General Statistics**											
626	Number of Valid Observations				10		Number of Distinct Observations					10
627	Number of Missing Values				5							
628												
629	**Raw Statistics**						**Log-transformed Statistics**					
630	Minimum				0.029		Minimum of Log Data					-3.54
631	Maximum				0.33		Maximum of Log Data					-1.109
632	Mean				0.119		Mean of log Data					-2.501
633	Geometric Mean				0.082		SD of log Data					0.879
634	Median				0.0605							
635	SD				0.115							
636	Std. Error of Mean				0.0364							
637	Coefficient of Variation				0.968							
638	Skewness				1.38							
639												
640	**Relevant UCL Statistics**											
641	**Normal Distribution Test**						**Lognormal Distribution Test**					
642	Shapiro Wilk Test Statistic				0.743		Shapiro Wilk Test Statistic					0.899
643	Shapiro Wilk Critical Value				0.842		Shapiro Wilk Critical Value					0.842
644	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
645												
646	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
647	95% Student's-t UCL				0.186		95% H-UCL					0.279
648	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL					0.26
649	95% Adjusted-CLT UCL (Chen-1995)				0.196		97.5% Chebyshev (MVUE) UCL					0.323
650	95% Modified-t UCL (Johnson-1978)				0.188		99% Chebyshev (MVUE) UCL					0.446
651												
652	**Gamma Distribution Test**						**Data Distribution**					
653	k star (bias corrected)				1.109		**Data appear Gamma Distributed at 5% Significance Level**					
654	Theta Star				0.107							
655	MLE of Mean				0.119							
656	MLE of Standard Deviation				0.113							
657	nu star				22.18							
658	Approximate Chi Square Value (.05)				12.48		**Nonparametric Statistics**					
659	Adjusted Level of Significance				0.0267		95% CLT UCL					0.179
660	Adjusted Chi Square Value				11.23		95% Jackknife UCL					0.186
661							95% Standard Bootstrap UCL					0.175
662	Anderson-Darling Test Statistic				0.679		95% Bootstrap-t UCL					0.277
663	Anderson-Darling 5% Critical Value				0.739		95% Hall's Bootstrap UCL					0.235
664	Kolmogorov-Smirnov Test Statistic				0.249		95% Percentile Bootstrap UCL					0.179
665	Kolmogorov-Smirnov 5% Critical Value				0.271		95% BCA Bootstrap UCL					0.196
666	**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					0.278
667							97.5% Chebyshev(Mean, Sd) UCL					0.346
668	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					0.481
669	95% Approximate Gamma UCL (Use when n >= 40)				0.211							
670	95% Adjusted Gamma UCL (Use when n < 40)				0.235							
671												
672	**Potential UCL to Use**						Use 95% Approximate Gamma UCL					0.211
673												
674	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
675	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
676	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											

	A	B	C	D	E	F	G	H	I	J	K	L
677												
678												
679	**Bis(2-Ethylhexyl)phthalate**											
680												
681						**General Statistics**						
682					Number of Valid Data	14			Number of Detected Data	11		
683					Number of Distinct Detected Data	11			Number of Non-Detect Data	3		
684					Number of Missing Values	1			Percent Non-Detects	21.43%		
685												
686					**Raw Statistics**				**Log-transformed Statistics**			
687					Minimum Detected	0.026			Minimum Detected	-3.65		
688					Maximum Detected	216			Maximum Detected	5.375		
689					Mean of Detected	39.78			Mean of Detected	0.344		
690					SD of Detected	67.13			SD of Detected	3.786		
691					Minimum Non-Detect	0.057			Minimum Non-Detect	-2.865		
692					Maximum Non-Detect	0.28			Maximum Non-Detect	-1.273		
693												
694	Note: Data have multiple DLs - Use of KM Method is recommended								Number treated as Non-Detect	8		
695	For all methods (except KM, DL/2, and ROS Methods),								Number treated as Detected	6		
696	Observations < Largest ND are treated as NDs								Single DL Non-Detect Percentage	57.14%		
697												
698						**UCL Statistics**						
699					**Normal Distribution Test with Detected Values Only**				**Lognormal Distribution Test with Detected Values Only**			
700					Shapiro Wilk Test Statistic	0.674			Shapiro Wilk Test Statistic	0.817		
701					5% Shapiro Wilk Critical Value	0.85			5% Shapiro Wilk Critical Value	0.85		
702					**Data not Normal at 5% Significance Level**				**Data not Lognormal at 5% Significance Level**			
703												
704					**Assuming Normal Distribution**				**Assuming Lognormal Distribution**			
705					DL/2 Substitution Method				DL/2 Substitution Method			
706					Mean	31.28			Mean	-0.265		
707					SD	61.25			SD	3.552		
708					95% DL/2 (t) UCL	60.27			95% H-Stat (DL/2) UCL	1020179		
709												
710					Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method			
711					**MLE yields a negative mean**				Mean in Log Scale	-0.355		
712									SD in Log Scale	3.628		
713									Mean in Original Scale	31.28		
714									SD in Original Scale	61.26		
715									95% t UCL	60.27		
716									95% Percentile Bootstrap UCL	59.75		
717									95% BCA Bootstrap UCL	70.38		
718									95% H-UCL	1698753		
719												
720					**Gamma Distribution Test with Detected Values Only**				**Data Distribution Test with Detected Values Only**			
721					k star (bias corrected)	0.219			**Data appear Gamma Distributed at 5% Significance Level**			
722					Theta Star	181.8						
723					nu star	4.813						
724												
725					A-D Test Statistic	0.837			**Nonparametric Statistics**			
726					5% A-D Critical Value	0.853			Kaplan-Meier (KM) Method			
727					K-S Test Statistic	0.853			Mean	31.27		
728					5% K-S Critical Value	0.281			SD	59.03		

729	Data appear Gamma Distributed at 5% Significance Level										SE of Mean	16.55
730											95% KM (t) UCL	60.57
731	Assuming Gamma Distribution										95% KM (z) UCL	58.48
732	Gamma ROS Statistics using Extrapolated Data										95% KM (jackknife) UCL	60.26
733	Minimum	0.000001									95% KM (bootstrap t) UCL	115.2
734	Maximum	216									95% KM (BCA) UCL	61.79
735	Mean	31.26									95% KM (Percentile Bootstrap) UCL	60.5
736	Median	0.075									95% KM (Chebyshev) UCL	103.4
737	SD	61.27									97.5% KM (Chebyshev) UCL	134.6
738	k star	0.148									99% KM (Chebyshev) UCL	195.9
739	Theta star	210.7										
740	Nu star	4.153									Potential UCLs to Use	
741	AppChi2	0.783									95% KM (Chebyshev) UCL	103.4
742	95% Gamma Approximate UCL (Use when n >= 40)	165.8										
743	95% Adjusted Gamma UCL (Use when n < 40)	211.6										
744	Note: DL/2 is not a recommended method.											
745												
746	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
747	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
748	For additional insight, the user may want to consult a statistician.											
749												
750												
751	C19-C36 Aliphatics											
752												
753	General Statistics											
754	Number of Valid Observations	2									Number of Distinct Observations	2
755												
756												
757	Warning: This data set only has 2 observations!											
758	Data set is too small to compute reliable and meaningful statistics and estimates!											
759	The data set for variable C19-C36 Aliphatics was not processed!											
760												
761	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
762	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
763												
764												
765												
766	C9-C18 Aliphatics											
767												
768	General Statistics											
769	Number of Valid Observations	2									Number of Distinct Observations	2
770												
771												
772	Warning: This data set only has 2 observations!											
773	Data set is too small to compute reliable and meaningful statistics and estimates!											
774	The data set for variable C9-C18 Aliphatics was not processed!											
775												
776	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
777	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
778												
779												
780												

	A	B	C	D	E	F	G	H	I	J	K	L
781	**Fluoranthene**											
782												
783					**General Statistics**							
784					Number of Valid Data	13			Number of Detected Data			10
785					Number of Distinct Detected Data	10			Number of Non-Detect Data			3
786					Number of Missing Values	2			Percent Non-Detects			23.08%
787												
788					**Raw Statistics**				**Log-transformed Statistics**			
789					Minimum Detected	0.018			Minimum Detected			-4.017
790					Maximum Detected	2.6			Maximum Detected			0.956
791					Mean of Detected	0.459			Mean of Detected			-2.185
792					SD of Detected	0.849			SD of Detected			1.686
793					Minimum Non-Detect	0.056			Minimum Non-Detect			-2.882
794					Maximum Non-Detect	2.2			Maximum Non-Detect			0.788
795												
796	Note: Data have multiple DLs - Use of KM Method is recommended								Number treated as Non-Detect			12
797	For all methods (except KM, DL/2, and ROS Methods),								Number treated as Detected			1
798	Observations < Largest ND are treated as NDs								Single DL Non-Detect Percentage			92.31%
799												
800					**UCL Statistics**							
801					**Normal Distribution Test with Detected Values Only**				**Lognormal Distribution Test with Detected Values Only**			
802					Shapiro Wilk Test Statistic	0.602			Shapiro Wilk Test Statistic			0.875
803					5% Shapiro Wilk Critical Value	0.842			5% Shapiro Wilk Critical Value			0.842
804					**Data not Normal at 5% Significance Level**				**Data appear Lognormal at 5% Significance Level**			
805												
806					**Assuming Normal Distribution**				**Assuming Lognormal Distribution**			
807					DL/2 Substitution Method				DL/2 Substitution Method			
808					Mean	0.442			Mean			-2.219
809					SD	0.778			SD			1.695
810					95% DL/2 (t) UCL	0.827			95% H-Stat (DL/2) UCL			3.46
811												
812					Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method			
813					**MLE method failed to converge properly**				Mean in Log Scale			-2.401
814									SD in Log Scale			1.527
815									Mean in Original Scale			0.364
816									SD in Original Scale			0.757
817									95% t UCL			0.738
818									95% Percentile Bootstrap UCL			0.729
819									95% BCA Bootstrap UCL			0.919
820									95% H-UCL			1.576
821												
822					**Gamma Distribution Test with Detected Values Only**				**Data Distribution Test with Detected Values Only**			
823					k star (bias corrected)	0.387			**Data appear Lognormal at 5% Significance Level**			
824					Theta Star	1.186						
825					nu star	7.743						
826												
827					A-D Test Statistic	1.036			**Nonparametric Statistics**			
828					5% A-D Critical Value	0.785			Kaplan-Meier (KM) Method			
829					K-S Test Statistic	0.785			Mean			0.373
830					5% K-S Critical Value	0.282			SD			0.731
831					**Data not Gamma Distributed at 5% Significance Level**				SE of Mean			0.216
832									95% KM (t) UCL			0.758

833	**Assuming Gamma Distribution**										95% KM (z) UCL	0.728
834	Gamma ROS Statistics using Extrapolated Data										95% KM (jackknife) UCL	0.754
835					Minimum	0.000001					95% KM (bootstrap t) UCL	3.062
836					Maximum	2.6					95% KM (BCA) UCL	0.775
837					Mean	0.356					95% KM (Percentile Bootstrap) UCL	0.724
838					Median	0.039					95% KM (Chebyshev) UCL	1.314
839					SD	0.761					97.5% KM (Chebyshev) UCL	1.722
840					k star	0.233					99% KM (Chebyshev) UCL	2.522
841					Theta star	1.526						
842					Nu star	6.065					**Potential UCLs to Use**	
843					AppChi2	1.673					99% KM (Chebyshev) UCL	2.522
844				95% Gamma Approximate UCL (Use when n >= 40)		1.29						
845				95% Adjusted Gamma UCL (Use when n < 40)		1.579						
846	**Note: DL/2 is not a recommended method.**											
847												
848	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
849	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
850	**For additional insight, the user may want to consult a statistician.**											
851												
852												
853	**Hexachlorobenzene**											
854												
855	**General Statistics**											
856					Number of Valid Data	10					Number of Detected Data	0
857					Number of Distinct Detected Data	0					Number of Non-Detect Data	10
858					Number of Missing Values	4					Percent Non-Detects	100.00%
859												
860	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
861	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
862	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
863												
864	**The data set for variable Hexachlorobenzene was not processed!**											
865												
866												
867												
868	**N-Nitrosodi-n-propylamine**											
869												
870	**General Statistics**											
871					Number of Valid Data	12					Number of Detected Data	1
872					Number of Distinct Detected Data	1					Number of Non-Detect Data	11
873					Number of Missing Values	2					Percent Non-Detects	91.67%
874												
875	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
876	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
877												
878	**The data set for variable N-Nitrosodi-n-propylamine was not processed!**											
879												
880												
881												
882	**Phenanthrene**											
883												
884	**General Statistics**											

885					Number of Valid Data	13					Number of Detected Data	9
886					Number of Distinct Detected Data	9					Number of Non-Detect Data	4
887					Number of Missing Values	2					Percent Non-Detects	30.77%
888												
889					**Raw Statistics**						**Log-transformed Statistics**	
890					Minimum Detected	0.023					Minimum Detected	-3.772
891					Maximum Detected	0.41					Maximum Detected	-0.892
892					Mean of Detected	0.0971					Mean of Detected	-2.891
893					SD of Detected	0.129					SD of Detected	1.024
894					Minimum Non-Detect	0.056					Minimum Non-Detect	-2.882
895					Maximum Non-Detect	2.6					Maximum Non-Detect	0.956
896												
897	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	13
898	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
899	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
900												
901	**Warning: There are only 9 Detected Values in this data**											
902	**Note: It should be noted that even though bootstrap may be performed on this data set**											
903	**the resulting calculations may not be reliable enough to draw conclusions**											
904												
905	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
906												
907												
908	**UCL Statistics**											
909	**Normal Distribution Test with Detected Values Only**										**Lognormal Distribution Test with Detected Values Only**	
910					Shapiro Wilk Test Statistic	0.655					Shapiro Wilk Test Statistic	0.837
911					5% Shapiro Wilk Critical Value	0.829					5% Shapiro Wilk Critical Value	0.829
912	**Data not Normal at 5% Significance Level**										**Data appear Lognormal at 5% Significance Level**	
913												
914	**Assuming Normal Distribution**										**Assuming Lognormal Distribution**	
915					DL/2 Substitution Method						DL/2 Substitution Method	
916					Mean	0.257					Mean	-2.506
917					SD	0.434					SD	1.471
918					95% DL/2 (t) UCL	0.471					95% H-Stat (DL/2) UCL	1.174
919												
920					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
921	**MLE method failed to converge properly**										Mean in Log Scale	-2.982
922											SD in Log Scale	0.854
923											Mean in Original Scale	0.0801
924											SD in Original Scale	0.109
925											95% t UCL	0.134
926											95% Percentile Bootstrap UCL	0.132
927											95% BCA Bootstrap UCL	0.16
928											95% H-UCL	0.139
929												
930	**Gamma Distribution Test with Detected Values Only**										**Data Distribution Test with Detected Values Only**	
931					k star (bias corrected)	0.76					**Data Follow Appr. Gamma Distribution at 5% Significance Level**	
932					Theta Star	0.128						
933					nu star	13.69						
934												
935					A-D Test Statistic	0.907					**Nonparametric Statistics**	
936					5% A-D Critical Value	0.743					Kaplan-Meier (KM) Method	

937				K-S Test Statistic	0.743					Mean	0.0852	
938				5% K-S Critical Value	0.287					SD	0.113	
939	**Data follow Appr. Gamma Distribution at 5% Significance Level**									SE of Mean	0.0362	
940										95% KM (t) UCL	0.15	
941	**Assuming Gamma Distribution**									95% KM (z) UCL	0.145	
942				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.149	
943				Minimum	0.023					95% KM (bootstrap t) UCL	0.37	
944				Maximum	0.41					95% KM (BCA) UCL	0.149	
945				Mean	0.0843					95% KM (Percentile Bootstrap) UCL	0.152	
946				Median	0.034					95% KM (Chebyshev) UCL	0.243	
947				SD	0.108					97.5% KM (Chebyshev) UCL	0.311	
948				k star	1.026					99% KM (Chebyshev) UCL	0.445	
949				Theta star	0.0822							
950				Nu star	26.67					**Potential UCLs to Use**		
951				AppChi2	15.9					95% KM (BCA) UCL	0.149	
952				95% Gamma Approximate UCL (Use when n >= 40)	0.141							
953				95% Adjusted Gamma UCL (Use when n < 40)	0.153							
954	**Note: DL/2 is not a recommended method.**											
955												
956	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
957	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
958	**For additional insight, the user may want to consult a statistician.**											
959												
960												
961	**Pyrene**											
962												
963	**General Statistics**											
964				Number of Valid Data	13					Number of Detected Data	7	
965				Number of Distinct Detected Data	7					Number of Non-Detect Data	6	
966				Number of Missing Values	2					Percent Non-Detects	46.15%	
967												
968	**Raw Statistics**						**Log-transformed Statistics**					
969				Minimum Detected	0.024					Minimum Detected	-3.73	
970				Maximum Detected	0.79					Maximum Detected	-0.236	
971				Mean of Detected	0.17					Mean of Detected	-2.609	
972				SD of Detected	0.28					SD of Detected	1.251	
973				Minimum Non-Detect	0.056					Minimum Non-Detect	-2.882	
974				Maximum Non-Detect	2.6					Maximum Non-Detect	0.956	
975												
976	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	13	
977	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	0	
978	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	100.00%	
979												
980	**Warning: There are only 7 Detected Values in this data**											
981	**Note: It should be noted that even though bootstrap may be performed on this data set**											
982	**the resulting calculations may not be reliable enough to draw conclusions**											
983												
984	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
985												
986												
987	**UCL Statistics**											
988	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					

	A	B	C	D	E	F	G	H	I	J	K	L
989					Shapiro Wilk Test Statistic	0.6					Shapiro Wilk Test Statistic	0.837
990					5% Shapiro Wilk Critical Value	0.803					5% Shapiro Wilk Critical Value	0.803
991					**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**	
992												
993					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
994					DL/2 Substitution Method						DL/2 Substitution Method	
995					Mean	0.285					Mean	-2.464
996					SD	0.458					SD	1.53
997					95% DL/2 (t) UCL	0.511					95% H-Stat (DL/2) UCL	1.496
998												
999					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1000					**MLE method failed to converge properly**						Mean in Log Scale	-2.878
1001											SD in Log Scale	0.959
1002											Mean in Original Scale	0.111
1003											SD in Original Scale	0.209
1004											95% t UCL	0.214
1005											95% Percentile Bootstrap UCL	0.224
1006											95% BCA Bootstrap UCL	0.282
1007											95% H-UCL	0.192
1008												
1009					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
1010					k star (bias corrected)	0.508					**Data appear Lognormal at 5% Significance Level**	
1011					Theta Star	0.334						
1012					nu star	7.105						
1013												
1014					A-D Test Statistic	0.878					**Nonparametric Statistics**	
1015					5% A-D Critical Value	0.738					Kaplan-Meier (KM) Method	
1016					K-S Test Statistic	0.738					Mean	0.121
1017					5% K-S Critical Value	0.323					SD	0.217
1018					**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.0707
1019											95% KM (t) UCL	0.247
1020					**Assuming Gamma Distribution**						95% KM (z) UCL	0.237
1021					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.244
1022					Minimum	0.000001					95% KM (bootstrap t) UCL	1.588
1023					Maximum	0.79					95% KM (BCA) UCL	0.27
1024					Mean	0.109					95% KM (Percentile Bootstrap) UCL	0.244
1025					Median	0.046					95% KM (Chebyshev) UCL	0.429
1026					SD	0.211					97.5% KM (Chebyshev) UCL	0.562
1027					k star	0.332					99% KM (Chebyshev) UCL	0.824
1028					Theta star	0.329						
1029					Nu star	8.641					**Potential UCLs to Use**	
1030					AppChi2	3.111					97.5% KM (Chebyshev) UCL	0.562
1031					95% Gamma Approximate UCL (Use when n >= 40)	0.304						
1032					95% Adjusted Gamma UCL (Use when n < 40)	0.356						
1033	**Note: DL/2 is not a recommended method.**											
1034												
1035	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1036	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1037	**For additional insight, the user may want to consult a statistician.**											
1038												
1039												
1040	**4,4'-DDT**											

	A	B	C	D	E	F	G	H	I	J	K	L
1041												
1042						General Statistics						
1043					Number of Valid Observations	1			Number of Distinct Observations	1		
1044					Number of Missing Values	2						
1045												
1046												
1047						Warning: This data set only has 1 observations!						
1048						Data set is too small to compute reliable and meaningful statistics and estimates!						
1049						The data set for variable 4,4'-DDT was not processed!						
1050												
1051						It is suggested to collect at least 8 to 10 observations before using these statistical methods!						
1052						If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.						
1053												
1054												
1055												
1056	Aluminum											
1057												
1058						General Statistics						
1059					Number of Valid Observations	9			Number of Distinct Observations	9		
1060					Number of Missing Values	6						
1061												
1062				Raw Statistics					Log-transformed Statistics			
1063					Minimum	2500			Minimum of Log Data	7.824		
1064					Maximum	43000			Maximum of Log Data	10.67		
1065					Mean	10789			Mean of log Data	8.925		
1066					Geometric Mean	7515			SD of log Data	0.816		
1067					Median	6700						
1068					SD	12478						
1069					Std. Error of Mean	4159						
1070					Coefficient of Variation	1.157						
1071					Skewness	2.656						
1072												
1073												
1074						Warning: There are only 9 Values in this data						
1075						Note: It should be noted that even though bootstrap methods may be performed on this data set,						
1076						the resulting calculations may not be reliable enough to draw conclusions						
1077												
1078						The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.						
1079												
1080						Relevant UCL Statistics						
1081				Normal Distribution Test					Lognormal Distribution Test			
1082					Shapiro Wilk Test Statistic	0.621			Shapiro Wilk Test Statistic	0.922		
1083					Shapiro Wilk Critical Value	0.829			Shapiro Wilk Critical Value	0.829		
1084				Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level			
1085												
1086				Assuming Normal Distribution					Assuming Lognormal Distribution			
1087					95% Student's-t UCL	18524			95% H-UCL	23830		
1088				95% UCLs (Adjusted for Skewness)					95% Chebyshev (MVUE) UCL	22254		
1089					95% Adjusted-CLT UCL (Chen-1995)	21565			97.5% Chebyshev (MVUE) UCL	27547		
1090					95% Modified-t UCL (Johnson-1978)	19137			99% Chebyshev (MVUE) UCL	37944		
1091												
1092				Gamma Distribution Test					Data Distribution			

1093				k star (bias corrected)	1.093	**Data appear Gamma Distributed at 5% Significance Level**						
1094				Theta Star	9873							
1095				MLE of Mean	10789							
1096				MLE of Standard Deviation	10321							
1097				nu star	19.67							
1098				Approximate Chi Square Value (.05)	10.61	**Nonparametric Statistics**						
1099				Adjusted Level of Significance	0.0231					95% CLT UCL	17631	
1100				Adjusted Chi Square Value	9.237					95% Jackknife UCL	18524	
1101										95% Standard Bootstrap UCL	17204	
1102				Anderson-Darling Test Statistic	0.711					95% Bootstrap-t UCL	40490	
1103				Anderson-Darling 5% Critical Value	0.734					95% Hall's Bootstrap UCL	46833	
1104				Kolmogorov-Smirnov Test Statistic	0.253					95% Percentile Bootstrap UCL	18178	
1105				Kolmogorov-Smirnov 5% Critical Value	0.284					95% BCA Bootstrap UCL	20478	
1106	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL	28919	
1107										97.5% Chebyshev(Mean, Sd) UCL	36765	
1108	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL	52175	
1109				95% Approximate Gamma UCL (Use when n >= 40)	20005							
1110				95% Adjusted Gamma UCL (Use when n < 40)	22975							
1111												
1112	**Potential UCL to Use**									Use 95% Approximate Gamma UCL	20005	
1113												
1114	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1115	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1116	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1117												
1118												
1119	**Cadmium**											
1120												
1121	**General Statistics**											
1122				Number of Valid Data	10					Number of Detected Data	6	
1123				Number of Distinct Detected Data	6					Number of Non-Detect Data	4	
1124				Number of Missing Values	5					Percent Non-Detects	40.00%	
1125												
1126	**Raw Statistics**					**Log-transformed Statistics**						
1127				Minimum Detected	0.093					Minimum Detected	-2.375	
1128				Maximum Detected	0.52					Maximum Detected	-0.654	
1129				Mean of Detected	0.332					Mean of Detected	-1.244	
1130				SD of Detected	0.159					SD of Detected	0.65	
1131				Minimum Non-Detect	0.36					Minimum Non-Detect	-1.022	
1132				Maximum Non-Detect	4					Maximum Non-Detect	1.386	
1133												
1134	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	10	
1135	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	0	
1136	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	100.00%	
1137												
1138	**Warning: There are only 6 Detected Values in this data**											
1139	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1140	**the resulting calculations may not be reliable enough to draw conclusions**											
1141												
1142	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1143												
1144												

	A	B	C	D	E	F	G	H	I	J	K	L
1145	**UCL Statistics**											
1146	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1147					Shapiro Wilk Test Statistic	0.917					Shapiro Wilk Test Statistic	0.84
1148					5% Shapiro Wilk Critical Value	0.788					5% Shapiro Wilk Critical Value	0.788
1149	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1150												
1151	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1152					DL/2 Substitution Method						DL/2 Substitution Method	
1153					Mean	0.652					Mean	-0.886
1154					SD	0.722					SD	0.977
1155					95% DL/2 (t) UCL	1.07					95% H-Stat (DL/2) UCL	1.797
1156												
1157					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1158	**MLE method failed to converge properly**										Mean in Log Scale	-1.343
1159											SD in Log Scale	0.549
1160											Mean in Original Scale	0.295
1161											SD in Original Scale	0.139
1162											95% t UCL	0.375
1163											95% Percentile Bootstrap UCL	0.361
1164											95% BCA Bootstrap UCL	0.361
1165											95% H-UCL	0.461
1166												
1167	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1168					k star (bias corrected)	1.947	**Data appear Normal at 5% Significance Level**					
1169					Theta Star	0.171						
1170					nu star	23.37						
1171												
1172					A-D Test Statistic	0.517	**Nonparametric Statistics**					
1173					5% A-D Critical Value	0.7					Kaplan-Meier (KM) Method	
1174					K-S Test Statistic	0.7					Mean	0.305
1175					5% K-S Critical Value	0.334					SD	0.151
1176	**Data follow Appr. Gamma Distribution at 5% Significance Level**										SE of Mean	0.0632
1177											95% KM (t) UCL	0.421
1178	**Assuming Gamma Distribution**										95% KM (z) UCL	0.409
1179					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.425
1180					Minimum	0.093					95% KM (bootstrap t) UCL	0.414
1181					Maximum	0.52					95% KM (BCA) UCL	0.423
1182					Mean	0.31					95% KM (Percentile Bootstrap) UCL	0.419
1183					Median	0.351					95% KM (Chebyshev) UCL	0.58
1184					SD	0.138					97.5% KM (Chebyshev) UCL	0.7
1185					k star	3.196					99% KM (Chebyshev) UCL	0.934
1186					Theta star	0.0969						
1187					Nu star	63.92	**Potential UCLs to Use**					
1188					AppChi2	46.53					95% KM (t) UCL	0.421
1189				95% Gamma Approximate UCL (Use when n >= 40)		0.426					95% KM (Percentile Bootstrap) UCL	0.419
1190				95% Adjusted Gamma UCL (Use when n < 40)		0.45						
1191	**Note: DL/2 is not a recommended method.**											
1192												
1193	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1194	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1195	**For additional insight, the user may want to consult a statistician.**											
1196												

	A	B	C	D	E	F	G	H	I	J	K	L
1197												
1198	**Chromium**											
1199												
1200						**General Statistics**							
1201					Number of Valid Data	43				Number of Detected Data	42	
1202					Number of Distinct Detected Data	37				Number of Non-Detect Data	1	
1203					Number of Missing Values	4				Percent Non-Detects	2.33%	
1204												
1205				**Raw Statistics**			**Log-transformed Statistics**					
1206					Minimum Detected	7.2				Minimum Detected	1.974	
1207					Maximum Detected	62000				Maximum Detected	11.03	
1208					Mean of Detected	6806				Mean of Detected	6.105	
1209					SD of Detected	13092				SD of Detected	2.969	
1210					Minimum Non-Detect	10				Minimum Non-Detect	2.303	
1211					Maximum Non-Detect	10				Maximum Non-Detect	2.303	
1212												
1213												
1214						**UCL Statistics**							
1215				**Normal Distribution Test with Detected Values Only**			**Lognormal Distribution Test with Detected Values Only**					
1216					Shapiro Wilk Test Statistic	0.565				Shapiro Wilk Test Statistic	0.823	
1217					5% Shapiro Wilk Critical Value	0.942				5% Shapiro Wilk Critical Value	0.942	
1218				**Data not Normal at 5% Significance Level**			**Data not Lognormal at 5% Significance Level**					
1219												
1220				**Assuming Normal Distribution**			**Assuming Lognormal Distribution**					
1221					DL/2 Substitution Method					DL/2 Substitution Method		
1222					Mean	6648				Mean	6	
1223					SD	12977				SD	3.012	
1224					95% DL/2 (t) UCL	9977				95% H-Stat (DL/2) UCL	416986	
1225												
1226					Maximum Likelihood Estimate(MLE) Method					Log ROS Method		
1227					Mean	6033				Mean in Log Scale	5.971	
1228					SD	13461				SD in Log Scale	3.061	
1229					95% MLE (t) UCL	9486				Mean in Original Scale	6648	
1230					95% MLE (Tiku) UCL	9206				SD in Original Scale	12977	
1231										95% t UCL	9977	
1232										95% Percentile Bootstrap UCL	10152	
1233										95% BCA Bootstrap UCL	11285	
1234										95% H UCL	506418	
1235												
1236				**Gamma Distribution Test with Detected Values Only**			**Data Distribution Test with Detected Values Only**					
1237					k star (bias corrected)	0.257	**Data do not follow a Discernable Distribution (0.05)**					
1238					Theta Star	26500						
1239					nu star	21.57						
1240												
1241					A-D Test Statistic	1.961	**Nonparametric Statistics**					
1242					5% A-D Critical Value	0.877	Kaplan-Meier (KM) Method					
1243					K-S Test Statistic	0.877	Mean	6648				
1244					5% K-S Critical Value	0.149	SD	12825				
1245				**Data not Gamma Distributed at 5% Significance Level**			SE of Mean	1980				
1246							95% KM (t) UCL	9978				
1247				**Assuming Gamma Distribution**			95% KM (z) UCL	9904				
1248					Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	9977				

1249					Minimum	0.000001					95% KM (bootstrap t) UCL	12357
1250					Maximum	62000					95% KM (BCA) UCL	10409
1251					Mean	6648					95% KM (Percentile Bootstrap) UCL	10105
1252					Median	180					95% KM (Chebyshev) UCL	15277
1253					SD	12977					97.5% KM (Chebyshev) UCL	19010
1254					k star	0.228					99% KM (Chebyshev) UCL	26344
1255					Theta star	29200						
1256					Nu star	19.58					**Potential UCLs to Use**	
1257					AppChi2	10.54					99% KM (Chebyshev) UCL	26344
1258				95% Gamma Approximate UCL (Use when n >= 40)		12347						
1259				95% Adjusted Gamma UCL (Use when n < 40)		12624						
1260	**Note: DL/2 is not a recommended method.**											
1261												
1262	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1263	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1264	**For additional insight, the user may want to consult a statistician.**											
1265												
1266												
1267	**Copper**											
1268												
1269	**General Statistics**											
1270					Number of Valid Observations	9					Number of Distinct Observations	9
1271					Number of Missing Values	6						
1272												
1273	**Raw Statistics**						**Log-transformed Statistics**					
1274					Minimum	3.8					Minimum of Log Data	1.335
1275					Maximum	190					Maximum of Log Data	5.247
1276					Mean	38.3					Mean of log Data	2.807
1277					Geometric Mean	16.56					SD of log Data	1.31
1278					Median	12						
1279					SD	60.43						
1280					Std. Error of Mean	20.14						
1281					Coefficient of Variation	1.578						
1282					Skewness	2.447						
1283												
1284												
1285	**Warning: There are only 9 Values in this data**											
1286	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
1287	**the resulting calculations may not be reliable enough to draw conclusions**											
1288												
1289	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											
1290												
1291	**Relevant UCL Statistics**											
1292	**Normal Distribution Test**						**Lognormal Distribution Test**					
1293					Shapiro Wilk Test Statistic	0.633					Shapiro Wilk Test Statistic	0.933
1294					Shapiro Wilk Critical Value	0.829					Shapiro Wilk Critical Value	0.829
1295	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1296												
1297	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1298					95% Student's-t UCL	75.76					95% H-UCL	245.3
1299	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	100.5
1300					95% Adjusted-CLT UCL (Chen-1995)	88.99					97.5% Chebyshev (MVUE) UCL	129.4

1301	95% Modified-t UCL (Johnson-1978)					78.5	99% Chebyshev (MVUE) UCL					186.1
1302												
1303	**Gamma Distribution Test**						**Data Distribution**					
1304	k star (bias corrected)					0.553	**Data appear Gamma Distributed at 5% Significance Level**					
1305	Theta Star					69.28						
1306	MLE of Mean					38.3						
1307	MLE of Standard Deviation					51.51						
1308	nu star					9.951						
1309	Approximate Chi Square Value (.05)					3.911	**Nonparametric Statistics**					
1310	Adjusted Level of Significance					0.0231	95% CLT UCL					71.43
1311	Adjusted Chi Square Value					3.154	95% Jackknife UCL					75.76
1312							95% Standard Bootstrap UCL					69.97
1313	Anderson-Darling Test Statistic					0.589	95% Bootstrap-t UCL					219.3
1314	Anderson-Darling 5% Critical Value					0.754	95% Hall's Bootstrap UCL					218.6
1315	Kolmogorov-Smirnov Test Statistic					0.217	95% Percentile Bootstrap UCL					71.5
1316	Kolmogorov-Smirnov 5% Critical Value					0.29	95% BCA Bootstrap UCL					94.1
1317	**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					126.1
1318							97.5% Chebyshev(Mean, Sd) UCL					164.1
1319	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					238.7
1320	95% Approximate Gamma UCL (Use when n >= 40)					97.45						
1321	95% Adjusted Gamma UCL (Use when n < 40)					120.9						
1322												
1323	**Potential UCL to Use**						Use 95% Approximate Gamma UCL					97.45
1324												
1325	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1326	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1327	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1328												
1329												
1330	**Iron**											
1331												
1332	**General Statistics**											
1333	Number of Valid Observations					9	Number of Distinct Observations					9
1334	Number of Missing Values					6						
1335												
1336	**Raw Statistics**						**Log-transformed Statistics**					
1337	Minimum					3700	Minimum of Log Data					8.216
1338	Maximum					31000	Maximum of Log Data					10.34
1339	Mean					14067	Mean of log Data					9.326
1340	Geometric Mean					11228	SD of log Data					0.725
1341	Median					10000						
1342	SD					9797						
1343	Std. Error of Mean					3266						
1344	Coefficient of Variation					0.696						
1345	Skewness					0.838						
1346												
1347												
1348	**Warning: There are only 9 Values in this data**											
1349	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
1350	**the resulting calculations may not be reliable enough to draw conclusions**											
1351												
1352	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											

1353												
1354	**Relevant UCL Statistics**											
1355	**Normal Distribution Test**						**Lognormal Distribution Test**					
1356				Shapiro Wilk Test Statistic	0.887					Shapiro Wilk Test Statistic	0.962	
1357				Shapiro Wilk Critical Value	0.829					Shapiro Wilk Critical Value	0.829	
1358	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1359												
1360	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1361				95% Student's-t UCL	20139					95% H-UCL	28941	
1362	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	29365	
1363				95% Adjusted-CLT UCL (Chen-1995)	20413					97.5% Chebyshev (MVUE) UCL	35964	
1364				95% Modified-t UCL (Johnson-1978)	20291					99% Chebyshev (MVUE) UCL	48928	
1365												
1366	**Gamma Distribution Test**						**Data Distribution**					
1367				k star (bias corrected)	1.655		**Data appear Normal at 5% Significance Level**					
1368				Theta Star	8498							
1369				MLE of Mean	14067							
1370				MLE of Standard Deviation	10934							
1371				nu star	29.79							
1372				Approximate Chi Square Value (.05)	18.33		**Nonparametric Statistics**					
1373				Adjusted Level of Significance	0.0231					95% CLT UCL	19438	
1374				Adjusted Chi Square Value	16.46					95% Jackknife UCL	20139	
1375										95% Standard Bootstrap UCL	19211	
1376				Anderson-Darling Test Statistic	0.273					95% Bootstrap-t UCL	23023	
1377				Anderson-Darling 5% Critical Value	0.729					95% Hall's Bootstrap UCL	20896	
1378				Kolmogorov-Smirnov Test Statistic	0.163					95% Percentile Bootstrap UCL	19089	
1379				Kolmogorov-Smirnov 5% Critical Value	0.282					95% BCA Bootstrap UCL	19522	
1380	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL	28301	
1381										97.5% Chebyshev(Mean, Sd) UCL	34460	
1382	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL	46558	
1383				95% Approximate Gamma UCL (Use when n >= 40)	22863							
1384				95% Adjusted Gamma UCL (Use when n < 40)	25459							
1385												
1386	**Potential UCL to Use**									Use 95% Student's-t UCL	20139	
1387												
1388	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1389	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1390	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1391												
1392												
1393	**Lead**											
1394												
1395	**General Statistics**											
1396				Number of Valid Observations	11					Number of Distinct Observations	11	
1397				Number of Missing Values	4							
1398												
1399	**Raw Statistics**						**Log-transformed Statistics**					
1400				Minimum	27					Minimum of Log Data	3.296	
1401				Maximum	150					Maximum of Log Data	5.011	
1402				Mean	70.73					Mean of log Data	4.098	
1403				Geometric Mean	60.23					SD of log Data	0.605	
1404				Median	59							

SD	41.04	
Std. Error of Mean	12.38	
Coefficient of Variation	0.58	
Skewness	0.692	

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.913	Shapiro Wilk Test Statistic	0.935
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	93.16	95% H-UCL	112.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	129
95% Adjusted-CLT UCL (Chen-1995)	93.84	97.5% Chebyshev (MVUE) UCL	154.1
95% Modified-t UCL (Johnson-1978)	93.59	99% Chebyshev (MVUE) UCL	203.5
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.438	**Data appear Normal at 5% Significance Level**	
Theta Star	29.01		
MLE of Mean	70.73		
MLE of Standard Deviation	45.3		
nu star	53.63		
Approximate Chi Square Value (.05)	37.8	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0278	95% CLT UCL	91.08
Adjusted Chi Square Value	35.65	95% Jackknife UCL	93.16
		95% Standard Bootstrap UCL	89.85
Anderson-Darling Test Statistic	0.321	95% Bootstrap-t UCL	97.16
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	93.64
Kolmogorov-Smirnov Test Statistic	0.155	95% Percentile Bootstrap UCL	91.09
Kolmogorov-Smirnov 5% Critical Value	0.257	95% BCA Bootstrap UCL	92.55
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	124.7
		97.5% Chebyshev(Mean, Sd) UCL	148
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	193.9
95% Approximate Gamma UCL (Use when n >= 40)	100.3		
95% Adjusted Gamma UCL (Use when n < 40)	106.4		
Potential UCL to Use		Use 95% Student's-t UCL	93.16

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Mercury

General Statistics

Number of Valid Data	11	Number of Detected Data	10
Number of Distinct Detected Data	9	Number of Non-Detect Data	1
Number of Missing Values	4	Percent Non-Detects	9.09%

Raw Statistics	**Log-transformed Statistics**

	A	B	C	D	E	F	G	H	I	J	K	L
1457					Minimum Detected	0.047					Minimum Detected	-3.058
1458					Maximum Detected	3.1					Maximum Detected	1.131
1459					Mean of Detected	0.7					Mean of Detected	-1.345
1460					SD of Detected	1.008					SD of Detected	1.501
1461					Minimum Non-Detect	0.16					Minimum Non-Detect	-1.833
1462					Maximum Non-Detect	0.16					Maximum Non-Detect	-1.833
1463												
1464												
1465					**UCL Statistics**							
1466				**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**		
1467					Shapiro Wilk Test Statistic	0.707					Shapiro Wilk Test Statistic	0.894
1468					5% Shapiro Wilk Critical Value	0.842					5% Shapiro Wilk Critical Value	0.842
1469				**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**		
1470												
1471				**Assuming Normal Distribution**						**Assuming Lognormal Distribution**		
1472					DL/2 Substitution Method						DL/2 Substitution Method	
1473					Mean	0.644					Mean	-1.452
1474					SD	0.974					SD	1.467
1475					95% DL/2 (t) UCL	1.176					95% H-Stat (DL/2) UCL	4.319
1476												
1477					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1478				**MLE yields a negative mean**							Mean in Log Scale	-1.445
1479											SD in Log Scale	1.462
1480											Mean in Original Scale	0.644
1481											SD in Original Scale	0.974
1482											95% t UCL	1.176
1483											95% Percentile Bootstrap UCL	1.158
1484											95% BCA Bootstrap UCL	1.214
1485											95% H-UCL	4.258
1486												
1487				**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**		
1488					k star (bias corrected)	0.502				**Data appear Gamma Distributed at 5% Significance Level**		
1489					Theta Star	1.394						
1490					nu star	10.04						
1491												
1492					A-D Test Statistic	0.725				**Nonparametric Statistics**		
1493					5% A-D Critical Value	0.767					Kaplan-Meier (KM) Method	
1494					K-S Test Statistic	0.767					Mean	0.644
1495					5% K-S Critical Value	0.278					SD	0.929
1496				**Data appear Gamma Distributed at 5% Significance Level**							SE of Mean	0.295
1497											95% KM (t) UCL	1.179
1498				**Assuming Gamma Distribution**							95% KM (z) UCL	1.129
1499					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	1.176
1500					Minimum	0.000001					95% KM (bootstrap t) UCL	1.627
1501					Maximum	3.1					95% KM (BCA) UCL	1.172
1502					Mean	0.636					95% KM (Percentile Bootstrap) UCL	1.166
1503					Median	0.11					95% KM (Chebyshev) UCL	1.93
1504					SD	0.979					97.5% KM (Chebyshev) UCL	2.487
1505					k star	0.304					99% KM (Chebyshev) UCL	3.58
1506					Theta star	2.095						
1507					Nu star	6.683				**Potential UCLs to Use**		
1508					AppChi2	1.998					95% KM (Chebyshev) UCL	1.93

1509	95% Gamma Approximate UCL (Use when n >= 40)					2.128						
1510	95% Adjusted Gamma UCL (Use when n < 40)					2.644						
1511	**Note: DL/2 is not a recommended method.**											
1512												
1513	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1514	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1515	**For additional insight, the user may want to consult a statistician.**											
1516												
1517												
1518	**Sodium**											
1519												
1520	**General Statistics**											
1521	Number of Valid Data					7	Number of Detected Data					0
1522	Number of Distinct Detected Data					0	Number of Non-Detect Data					7
1523	Number of Missing Values					7	Percent Non-Detects					100.00%
1524												
1525	**Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!**											
1526	**Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!**											
1527	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
1528												
1529	**The data set for variable Sodium was not processed!**											
1530												
1531												
1532												
1533	**Tin**											
1534												
1535	**General Statistics**											
1536	Number of Valid Data					9	Number of Detected Data					8
1537	Number of Distinct Detected Data					8	Number of Non-Detect Data					1
1538	Number of Missing Values					6	Percent Non-Detects					11.11%
1539												
1540	**Raw Statistics**						**Log-transformed Statistics**					
1541	Minimum Detected					4.5	Minimum Detected					1.504
1542	Maximum Detected					26000	Maximum Detected					10.17
1543	Mean of Detected					3289	Mean of Detected					3.515
1544	SD of Detected					9177	SD of Detected					2.989
1545	Minimum Non-Detect					7.5	Minimum Non-Detect					2.015
1546	Maximum Non-Detect					7.5	Maximum Non-Detect					2.015
1547												
1548												
1549	**Warning: There are only 8 Detected Values in this data**											
1550	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1551	**the resulting calculations may not be reliable enough to draw conclusions**											
1552												
1553	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1554												
1555												
1556	**UCL Statistics**											
1557	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1558	Shapiro Wilk Test Statistic					0.424	Shapiro Wilk Test Statistic					0.71
1559	5% Shapiro Wilk Critical Value					0.818	5% Shapiro Wilk Critical Value					0.818
1560	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					

1561												
1562	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1563				DL/2 Substitution Method						DL/2 Substitution Method		
1564				Mean		2924				Mean		3.271
1565				SD		8654				SD		2.89
1566				95% DL/2 (t) UCL		8288				95% H-Stat (DL/2) UCL		6453580
1567												
1568				Maximum Likelihood Estimate(MLE) Method		N/A				Log ROS Method		
1569	**MLE yields a negative mean**									Mean in Log Scale		3.25
1570										SD in Log Scale		2.907
1571										Mean in Original Scale		2924
1572										SD in Original Scale		8654
1573										95% t UCL		8288
1574										95% Percentile Bootstrap UCL		8672
1575										95% BCA Bootstrap UCL		11587
1576										95% H-UCL		7276712
1577												
1578	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1579				k star (bias corrected)		0.187	**Data do not follow a Discernable Distribution (0.05)**					
1580				Theta Star		17624						
1581				nu star		2.986						
1582												
1583				A-D Test Statistic		1.688	**Nonparametric Statistics**					
1584				5% A-D Critical Value		0.848	Kaplan-Meier (KM) Method					
1585				K-S Test Statistic		0.848	Mean					2925
1586				5% K-S Critical Value		0.325	SD					8159
1587	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					2907
1588							95% KM (t) UCL					8331
1589	**Assuming Gamma Distribution**						95% KM (z) UCL					7707
1590				Gamma ROS Statistics using Extrapolated Data			95% KM (jackknife) UCL					8289
1591				Minimum		0.000001	95% KM (bootstrap t) UCL					4643053
1592				Maximum		26000	95% KM (BCA) UCL					8673
1593				Mean		2924	95% KM (Percentile Bootstrap) UCL					8672
1594				Median		7.5	95% KM (Chebyshev) UCL					15597
1595				SD		8654	97.5% KM (Chebyshev) UCL					21081
1596				k star		0.156	99% KM (Chebyshev) UCL					31853
1597				Theta star		18688						
1598				Nu star		2.816	**Potential UCLs to Use**					
1599				AppChi2		0.32	99% KM (Chebyshev) UCL					31853
1600				95% Gamma Approximate UCL (Use when n >= 40)		25722						
1601				95% Adjusted Gamma UCL (Use when n < 40)		40823						
1602	**Warning: Recommended UCL exceeds the maximum observation**											
1603	**Note: DL/2 is not a recommended method.**											
1604												
1605	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1606	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1607	**For additional insight, the user may want to consult a statistician.**											
1608												
1609												
1610	**Vanadium**											
1611												
1612	**General Statistics**											

1613	Number of Valid Observations				9		Number of Distinct Observations				9	
1614	Number of Missing Values				6							
1615												
1616	**Raw Statistics**						**Log-transformed Statistics**					
1617	Minimum				12		Minimum of Log Data				2.485	
1618	Maximum				150		Maximum of Log Data				5.011	
1619	Mean				39		Mean of log Data				3.354	
1620	Geometric Mean				28.6		SD of log Data				0.74	
1621	Median				28							
1622	SD				42.71							
1623	Std. Error of Mean				14.24							
1624	Coefficient of Variation				1.095							
1625	Skewness				2.719							
1626												
1627												
1628	**Warning: There are only 9 Values in this data**											
1629	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
1630	**the resulting calculations may not be reliable enough to draw conclusions**											
1631												
1632	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											
1633												
1634	**Relevant UCL Statistics**											
1635	**Normal Distribution Test**						**Lognormal Distribution Test**					
1636	Shapiro Wilk Test Statistic				0.601		Shapiro Wilk Test Statistic				0.883	
1637	Shapiro Wilk Critical Value				0.829		Shapiro Wilk Critical Value				0.829	
1638	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1639												
1640	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1641	95% Student's-t UCL				65.47		95% H-UCL				76.18	
1642	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL				76.35	
1643	95% Adjusted-CLT UCL (Chen-1995)				76.21		97.5% Chebyshev (MVUE) UCL				93.68	
1644	95% Modified-t UCL (Johnson-1978)				67.62		99% Chebyshev (MVUE) UCL				127.7	
1645												
1646	**Gamma Distribution Test**						**Data Distribution**					
1647	k star (bias corrected)				1.248		**Data Follow Appr. Gamma Distribution at 5% Significance Level**					
1648	Theta Star				31.24							
1649	MLE of Mean				39							
1650	MLE of Standard Deviation				34.91							
1651	nu star				22.47							
1652	Approximate Chi Square Value (.05)				12.69		**Nonparametric Statistics**					
1653	Adjusted Level of Significance				0.0231		95% CLT UCL				62.42	
1654	Adjusted Chi Square Value				11.17		95% Jackknife UCL				65.47	
1655							95% Standard Bootstrap UCL				60.87	
1656	Anderson-Darling Test Statistic				0.825		95% Bootstrap-t UCL				136.9	
1657	Anderson-Darling 5% Critical Value				0.732		95% Hall's Bootstrap UCL				172.2	
1658	Kolmogorov-Smirnov Test Statistic				0.277		95% Percentile Bootstrap UCL				65.33	
1659	Kolmogorov-Smirnov 5% Critical Value				0.283		95% BCA Bootstrap UCL				79.44	
1660	**Data follow Appr. Gamma Distribution at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL				101.1	
1661							97.5% Chebyshev(Mean, Sd) UCL				127.9	
1662	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL				180.6	
1663	95% Approximate Gamma UCL (Use when n >= 40)				69.05							
1664	95% Adjusted Gamma UCL (Use when n < 40)				78.44							

	Potential UCL to Use	Use 95% Approximate Gamma UCL 69.05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Zinc

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	9
Number of Missing Values	6		

Raw Statistics		**Log-transformed Statistics**	
Minimum	3.4	Minimum of Log Data	1.224
Maximum	47	Maximum of Log Data	3.85
Mean	16.98	Mean of log Data	2.487
Geometric Mean	12.03	SD of log Data	0.875
Median	11		
SD	15.51		
Std. Error of Mean	5.17		
Coefficient of Variation	0.914		
Skewness	1.367		

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.799	Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	26.59	95% H-UCL	44.18
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	38.66
95% Adjusted-CLT UCL (Chen-1995)	28	97.5% Chebyshev (MVUE) UCL	48.16
95% Modified-t UCL (Johnson-1978)	26.98	99% Chebyshev (MVUE) UCL	66.8

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.139	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	14.91	
MLE of Mean	16.98	
MLE of Standard Deviation	15.91	
nu star	20.5	
Approximate Chi Square Value (.05)	11.22	**Nonparametric Statistics**
Adjusted Level of Significance	0.0231	95% CLT UCL 25.48

1717				Adjusted Chi Square Value	9.803					95% Jackknife UCL	26.59
1718										95% Standard Bootstrap UCL	24.71
1719				Anderson-Darling Test Statistic	0.384					95% Bootstrap-t UCL	43.61
1720				Anderson-Darling 5% Critical Value	0.733					95% Hall's Bootstrap UCL	80.47
1721				Kolmogorov-Smirnov Test Statistic	0.172					95% Percentile Bootstrap UCL	25.32
1722				Kolmogorov-Smirnov 5% Critical Value	0.284					95% BCA Bootstrap UCL	27.48
1723				**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	39.51
1724										97.5% Chebyshev(Mean, Sd) UCL	49.27
1725				**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	68.42
1726				95% Approximate Gamma UCL (Use when n >= 40)	31.02						
1727				95% Adjusted Gamma UCL (Use when n < 40)	35.5						
1728											
1729				**Potential UCL to Use**						Use 95% Approximate Gamma UCL	31.02
1730											
1731	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
1732	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**										
1733	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**										
1734											
1735											
1736	**Cyanide, Total**										
1737											
1738	**General Statistics**										
1739	Number of Valid Observations	1		Number of Distinct Observations	1						
1740	Number of Missing Values	2									
1741											
1742											
1743	**Warning: This data set only has 1 observations!**										
1744	**Data set is too small to compute reliable and meaningful statistics and estimates!**										
1745	**The data set for variable Cyanide, Total was not processed!**										
1746											
1747	**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**										
1748	**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**										
1749											
1750											
1751											
1752	**Diphenyl ether**										
1753											
1754	**General Statistics**										
1755	Number of Valid Data	10		Number of Detected Data	2						
1756	Number of Distinct Detected Data	2		Number of Non-Detect Data	8						
1757	Number of Missing Values	4		Percent Non-Detects	80.00%						
1758											
1759	**Raw Statistics**			**Log-transformed Statistics**							
1760	Minimum Detected	1.6		Minimum Detected	0.47						
1761	Maximum Detected	1.9		Maximum Detected	0.642						
1762	Mean of Detected	1.75		Mean of Detected	0.556						
1763	SD of Detected	0.212		SD of Detected	0.122						
1764	Minimum Non-Detect	0.046		Minimum Non-Detect	-3.079						
1765	Maximum Non-Detect	0.07		Maximum Non-Detect	-2.659						
1766											
1767	Note: Data have multiple DLs - Use of KM Method is recommended			Number treated as Non-Detect	8						
1768	For all methods (except KM, DL/2, and ROS Methods),			Number treated as Detected	2						

	A	B	C	D	E	F	G	H	I	J	K	L
1769	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		80.00%
1770												
1771	**Warning: Data set has only 2 Distinct Detected Values.**											
1772	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
1773	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
1774												
1775	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
1776												
1777	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
1778	**Those methods will return a 'N/A' value on your output display!**											
1779												
1780	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
1781	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
1782	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
1783												
1784												
1785	**UCL Statistics**											
1786	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1787	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk Test Statistic					N/A
1788	5% Shapiro Wilk Critical Value					N/A	5% Shapiro Wilk Critical Value					N/A
1789	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
1790												
1791	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1792	DL/2 Substitution Method						DL/2 Substitution Method					
1793	Mean					0.373	Mean					-2.73
1794	SD					0.729	SD					1.735
1795	95% DL/2 (t) UCL					0.796	95% H-Stat (DL/2) UCL					4.616
1796												
1797	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
1798	**MLE method failed to converge properly**						Mean in Log Scale					N/A
1799							SD in Log Scale					N/A
1800							Mean in Original Scale					N/A
1801							SD in Original Scale					N/A
1802							95% t UCL					N/A
1803							95% Percentile Bootstrap UCL					N/A
1804							95% BCA Bootstrap UCL					N/A
1805							95% H-UCL					N/A
1806												
1807	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1808	k star (bias corrected)					N/A	**Data do not follow a Discernable Distribution (0.05)**					
1809	Theta Star					N/A						
1810	nu star					N/A						
1811												
1812	A-D Test Statistic					N/A	**Nonparametric Statistics**					
1813	5% A-D Critical Value					N/A	Kaplan-Meier (KM) Method					
1814	K-S Test Statistic					N/A	Mean					1.63
1815	5% K-S Critical Value					N/A	SD					0.09
1816	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.0402
1817							95% KM (t) UCL					1.704
1818	**Assuming Gamma Distribution**						95% KM (z) UCL					1.696
1819	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					1.839
1820	Minimum					N/A	95% KM (bootstrap t) UCL					N/A

1821					Maximum	N/A					95% KM (BCA) UCL	1.9
1822					Mean	N/A					95% KM (Percentile Bootstrap) UCL	1.9
1823					Median	N/A					95% KM (Chebyshev) UCL	1.805
1824					SD	N/A					97.5% KM (Chebyshev) UCL	1.881
1825					k star	N/A					99% KM (Chebyshev) UCL	2.03
1826					Theta star	N/A						
1827					Nu star	N/A					**Potential UCLs to Use**	
1828					AppChi2	N/A					95% KM (t) UCL	1.704
1829				95% Gamma Approximate UCL (Use when n >= 40)		N/A					95% KM (% Bootstrap) UCL	1.9
1830				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
1831	**Note: DL/2 is not a recommended method.**											
1832												
1833	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1834	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1835	**For additional insight, the user may want to consult a statistician.**											
1836												

Surface Water – Landfill Brook

1				General UCL Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	WorkSheet.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	3 & 4 Methylphenol											
10												
11						General Statistics						
12					Number of Valid Data	6			Number of Detected Data	1		
13					Number of Distinct Detected Data	1			Number of Non-Detect Data	5		
14									Percent Non-Detects	83.33%		
15												
16					Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!							
17					It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).							
18												
19					The data set for variable 3 & 4 Methylphenol was not processed!							
20												
21												
22												
23	Benzo(a)anthracene											
24												
25						General Statistics						
26					Number of Valid Data	6			Number of Detected Data	1		
27					Number of Distinct Detected Data	1			Number of Non-Detect Data	5		
28									Percent Non-Detects	83.33%		
29												
30					Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!							
31					It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).							
32												
33					The data set for variable Benzo(a)anthracene was not processed!							
34												
35												
36												
37	Benzo(a)pyrene											
38												
39						General Statistics						
40					Number of Valid Data	6			Number of Detected Data	2		
41					Number of Distinct Detected Data	2			Number of Non-Detect Data	4		
42									Percent Non-Detects	66.67%		
43												
44					Raw Statistics				Log-transformed Statistics			
45					Minimum Detected	0.00017			Minimum Detected	-8.68		
46					Maximum Detected	0.001			Maximum Detected	-6.908		
47					Mean of Detected	0.000585			Mean of Detected	-7.794		
48					SD of Detected	0.0005869			SD of Detected	1.253		
49					Minimum Non-Detect	0.00018			Minimum Non-Detect	-8.623		
50					Maximum Non-Detect	0.00018			Maximum Non-Detect	-8.623		
51												
52												

53	Warning: Data set has only 2 Distinct Detected Values.											
54	This may not be adequate enough to compute meaningful and reliable test statistics and estimates.											
55	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
56												
57	Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.											
58												
59	The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.											
60	Those methods will return a 'N/A' value on your output display!											
61												
62	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
63	However, results obtained using 4 to 9 distinct values may not be reliable.											
64	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
65												
66												
67	UCL Statistics											
68	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
69				Shapiro Wilk Test Statistic	N/A					Shapiro Wilk Test Statistic	N/A	
70				5% Shapiro Wilk Critical Value	N/A					5% Shapiro Wilk Critical Value	N/A	
71	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
72												
73	Assuming Normal Distribution						Assuming Lognormal Distribution					
74				DL/2 Substitution Method						DL/2 Substitution Method		
75				Mean	0.000255					Mean	-8.808	
76				SD	0.0003664					SD	0.965	
77				95% DL/2 (t) UCL	0.0005564					95% H-Stat (DL/2) UCL	0.00134	
78												
79				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
80	MLE method failed to converge properly									Mean in Log Scale	N/A	
81										SD in Log Scale	N/A	
82										Mean in Original Scale	N/A	
83										SD in Original Scale	N/A	
84										95% t UCL	N/A	
85										95% Percentile Bootstrap UCL	N/A	
86										95% BCA Bootstrap UCL	N/A	
87										95% H-UCL	N/A	
88												
89	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
90				k star (bias corrected)	N/A		Data do not follow a Discernable Distribution (0.05)					
91				Theta Star	N/A							
92				nu star	N/A							
93												
94				A-D Test Statistic	N/A		Nonparametric Statistics					
95				5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method		
96				K-S Test Statistic	N/A					Mean	0.0003083	
97				5% K-S Critical Value	N/A					SD	0.0003093	
98	Data not Gamma Distributed at 5% Significance Level									SE of Mean	0.0001786	
99										95% KM (t) UCL	0.0006682	
100	Assuming Gamma Distribution									95% KM (z) UCL	0.0006021	
101				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	N/A	
102				Minimum	N/A					95% KM (bootstrap t) UCL	N/A	
103				Maximum	N/A					95% KM (BCA) UCL	N/A	
104				Mean	N/A					95% KM (Percentile Bootstrap) UCL	N/A	

105					Median	N/A					95% KM (Chebyshev) UCL	0.00109
106					SD	N/A					97.5% KM (Chebyshev) UCL	0.00142
107					k star	N/A					99% KM (Chebyshev) UCL	0.00209
108					Theta star	N/A						
109					Nu star	N/A					**Potential UCLs to Use**	
110					AppChi2	N/A					95% KM (BCA) UCL	N/A
111				95% Gamma Approximate UCL (Use when n >= 40)		N/A						
112				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
113	**Note: DL/2 is not a recommended method.**											
114												
115	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
116	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
117	**For additional insight, the user may want to consult a statistician.**											
118												
119												
120	**Benzo(b)fluoranthene**											
121												
122	**General Statistics**											
123					Number of Valid Data	6					Number of Detected Data	2
124					Number of Distinct Detected Data	2					Number of Non-Detect Data	4
125											Percent Non-Detects	66.67%
126												
127	**Raw Statistics**						**Log-transformed Statistics**					
128					Minimum Detected	0.00013					Minimum Detected	-8.948
129					Maximum Detected	0.0015					Maximum Detected	-6.502
130					Mean of Detected	0.000815					Mean of Detected	-7.725
131					SD of Detected	0.0009687					SD of Detected	1.729
132					Minimum Non-Detect	0.00027					Minimum Non-Detect	-8.217
133					Maximum Non-Detect	0.00027					Maximum Non-Detect	-8.217
134												
135												
136	**Warning: Data set has only 2 Distinct Detected Values.**											
137	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
138	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
139												
140	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
141												
142	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
143	**Those methods will return a 'N/A' value on your output display!**											
144												
145	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
146	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
147	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
148												
149												
150	**UCL Statistics**											
151	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
152					Shapiro Wilk Test Statistic	N/A					Shapiro Wilk Test Statistic	N/A
153					5% Shapiro Wilk Critical Value	N/A					5% Shapiro Wilk Critical Value	N/A
154	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
155												
156	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					

157				DL/2 Substitution Method							DL/2 Substitution Method	
158				Mean	0.0003617						Mean	-8.515
159				SD	0.0005577						SD	0.986
160				95% DL/2 (t) UCL	0.0008204						95% H-Stat (DL/2) UCL	0.00197
161												
162				Maximum Likelihood Estimate(MLE) Method	N/A						Log ROS Method	
163				**MLE method failed to converge properly**							Mean in Log Scale	N/A
164											SD in Log Scale	N/A
165											Mean in Original Scale	N/A
166											SD in Original Scale	N/A
167											95% t UCL	N/A
168											95% Percentile Bootstrap UCL	N/A
169											95% BCA Bootstrap UCL	N/A
170											95% H-UCL	N/A
171												
172				**Gamma Distribution Test with Detected Values Only**							**Data Distribution Test with Detected Values Only**	
173				k star (bias corrected)	N/A						**Data do not follow a Discernable Distribution (0.05)**	
174				Theta Star	N/A							
175				nu star	N/A							
176												
177				A-D Test Statistic	N/A						**Nonparametric Statistics**	
178				5% A-D Critical Value	N/A						Kaplan-Meier (KM) Method	
179				K-S Test Statistic	N/A						Mean	0.0003583
180				5% K-S Critical Value	N/A						SD	0.0005106
181				**Data not Gamma Distributed at 5% Significance Level**							SE of Mean	0.0002948
182											95% KM (t) UCL	0.0009523
183				**Assuming Gamma Distribution**							95% KM (z) UCL	0.0008432
184				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	N/A
185				Minimum	N/A						95% KM (bootstrap t) UCL	N/A
186				Maximum	N/A						95% KM (BCA) UCL	N/A
187				Mean	N/A						95% KM (Percentile Bootstrap) UCL	N/A
188				Median	N/A						95% KM (Chebyshev) UCL	0.00164
189				SD	N/A						97.5% KM (Chebyshev) UCL	0.0022
190				k star	N/A						99% KM (Chebyshev) UCL	0.00329
191				Theta star	N/A							
192				Nu star	N/A						**Potential UCLs to Use**	
193				AppChi2	N/A						97.5% KM (Chebyshev) UCL	0.0022
194				95% Gamma Approximate UCL (Use when n >= 40)	N/A							
195				95% Adjusted Gamma UCL (Use when n < 40)	N/A							
196				**Warning: Recommended UCL exceeds the maximum observation**								
197	**Note: DL/2 is not a recommended method.**											
198												
199				**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**								
200				**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**								
201				**For additional insight, the user may want to consult a statistician.**								
202												
203												
204	**Benzo(ghi)perylene**											
205												
206				**General Statistics**								
207				Number of Valid Data	6						Number of Detected Data	1
208				Number of Distinct Detected Data	1						Number of Non-Detect Data	5

209											Percent Non-Detects	83.33%
210												
211	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
212	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
213												
214	The data set for variable Benzo(ghi)perylene was not processed!											
215												
216												
217												
218	Benzo(k)fluoranthene											
219												
220	General Statistics											
221	Number of Valid Data					6	Number of Detected Data					2
222	Number of Distinct Detected Data					2	Number of Non-Detect Data					4
223							Percent Non-Detects					66.67%
224												
225	Raw Statistics						Log-transformed Statistics					
226	Minimum Detected					0.00015	Minimum Detected					-8.805
227	Maximum Detected					0.00061	Maximum Detected					-7.402
228	Mean of Detected					0.00038	Mean of Detected					-8.103
229	SD of Detected					0.0003253	SD of Detected					0.992
230	Minimum Non-Detect					0.00027	Minimum Non-Detect					-8.217
231	Maximum Non-Detect					0.00027	Maximum Non-Detect					-8.217
232												
233												
234	Warning: Data set has only 2 Distinct Detected Values.											
235	This may not be adequate enough to compute meaningful and reliable test statistics and estimates.											
236	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
237												
238	Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.											
239												
240	The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.											
241	Those methods will return a 'N/A' value on your output display!											
242												
243	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
244	However, results obtained using 4 to 9 distinct values may not be reliable.											
245	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
246												
247												
248	UCL Statistics											
249	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
250	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk Test Statistic					N/A
251	5% Shapiro Wilk Critical Value					N/A	5% Shapiro Wilk Critical Value					N/A
252	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
253												
254	Assuming Normal Distribution						Assuming Lognormal Distribution					
255	DL/2 Substitution Method						DL/2 Substitution Method					
256	Mean					0.0002167	Mean					-8.641
257	SD					0.0001928	SD					0.609
258	95% DL/2 (t) UCL					0.0003753	95% H-Stat (DL/2) UCL					0.00047
259												
260	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					

261	MLE method failed to converge properly						Mean in Log Scale					N/A
262							SD in Log Scale					N/A
263							Mean in Original Scale					N/A
264							SD in Original Scale					N/A
265							95% t UCL					N/A
266							95% Percentile Bootstrap UCL					N/A
267							95% BCA Bootstrap UCL					N/A
268							95% H-UCL					N/A
269												
270	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
271				k star (bias corrected)	N/A		Data do not follow a Discernable Distribution (0.05)					
272				Theta Star	N/A							
273				nu star	N/A							
274												
275				A-D Test Statistic	N/A		Nonparametric Statistics					
276				5% A-D Critical Value	N/A		Kaplan-Meier (KM) Method					
277				K-S Test Statistic	N/A		Mean					0.0002267
278				5% K-S Critical Value	N/A		SD					0.0001714
279	Data not Gamma Distributed at 5% Significance Level						SE of Mean					9.898E-05
280							95% KM (t) UCL					0.0004261
281	Assuming Gamma Distribution						95% KM (z) UCL					0.0003895
282				Gamma ROS Statistics using Extrapolated Data			95% KM (jackknife) UCL					N/A
283				Minimum	N/A		95% KM (bootstrap t) UCL					N/A
284				Maximum	N/A		95% KM (BCA) UCL					N/A
285				Mean	N/A		95% KM (Percentile Bootstrap) UCL					N/A
286				Median	N/A		95% KM (Chebyshev) UCL					0.0006581
287				SD	N/A		97.5% KM (Chebyshev) UCL					0.0008448
288				k star	N/A		99% KM (Chebyshev) UCL					0.00121
289				Theta star	N/A							
290				Nu star	N/A		Potential UCLs to Use					
291				AppChi2	N/A		95% KM (t) UCL					0.0004261
292				95% Gamma Approximate UCL (Use when n >= 40)	N/A		95% KM (% Bootstrap) UCL					N/A
293				95% Adjusted Gamma UCL (Use when n < 40)	N/A							
294	Note: DL/2 is not a recommended method.											
295												
296	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
297	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
298	For additional insight, the user may want to consult a statistician.											
299												
300												
301	Indeno(1,2,3-cd)pyrene											
302												
303	General Statistics											
304				Number of Valid Data	6		Number of Detected Data					2
305				Number of Distinct Detected Data	2		Number of Non-Detect Data					4
306							Percent Non-Detects					66.67%
307												
308	Raw Statistics						Log-transformed Statistics					
309				Minimum Detected	0.0002		Minimum Detected					-8.517
310				Maximum Detected	0.0012		Maximum Detected					-6.725
311				Mean of Detected	0.0007		Mean of Detected					-7.621
312				SD of Detected	0.0007071		SD of Detected					1.267

313				Minimum Non-Detect	0.00045					Minimum Non-Detect	-7.706	
314				Maximum Non-Detect	0.00045					Maximum Non-Detect	-7.706	
315												
316												
317					**Warning: Data set has only 2 Distinct Detected Values.**							
318					**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**							
319					**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**							
320												
321					**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**							
322												
323					**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**							
324					**Those methods will return a 'N/A' value on your output display!**							
325												
326					**It is necessary to have 4 or more Distinct Values for bootstrap methods.**							
327					**However, results obtained using 4 to 9 distinct values may not be reliable.**							
328					**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**							
329												
330												
331					**UCL Statistics**							
332				**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**		
333				Shapiro Wilk Test Statistic	N/A					Shapiro Wilk Test Statistic	N/A	
334				5% Shapiro Wilk Critical Value	N/A					5% Shapiro Wilk Critical Value	N/A	
335				**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**		
336												
337				**Assuming Normal Distribution**						**Assuming Lognormal Distribution**		
338				DL/2 Substitution Method						DL/2 Substitution Method		
339				Mean	0.0003833					Mean	-8.14	
340				SD	0.0004002					SD	0.695	
341				95% DL/2 (t) UCL	0.0007126					95% H-Stat (DL/2) UCL	0.0009895	
342												
343				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
344				**MLE method failed to converge properly**						Mean in Log Scale	N/A	
345										SD in Log Scale	N/A	
346										Mean in Original Scale	N/A	
347										SD in Original Scale	N/A	
348										95% t UCL	N/A	
349										95% Percentile Bootstrap UCL	N/A	
350										95% BCA Bootstrap UCL	N/A	
351										95% H-UCL	N/A	
352												
353				**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**		
354				k star (bias corrected)	N/A					**Data do not follow a Discernable Distribution (0.05)**		
355				Theta Star	N/A							
356				nu star	N/A							
357												
358				A-D Test Statistic	N/A					**Nonparametric Statistics**		
359				5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method		
360				K-S Test Statistic	N/A					Mean	0.0003667	
361				5% K-S Critical Value	N/A					SD	0.0003727	
362				**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.0002152	
363										95% KM (t) UCL	0.0008002	
364				**Assuming Gamma Distribution**						95% KM (z) UCL	0.0007206	

365	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					N/A
366	Minimum					N/A	95% KM (bootstrap t) UCL					N/A
367	Maximum					N/A	95% KM (BCA) UCL					N/A
368	Mean					N/A	95% KM (Percentile Bootstrap) UCL					N/A
369	Median					N/A	95% KM (Chebyshev) UCL					0.0013
370	SD					N/A	97.5% KM (Chebyshev) UCL					0.00171
371	k star					N/A	99% KM (Chebyshev) UCL					0.00251
372	Theta star					N/A						
373	Nu star					N/A	**Potential UCLs to Use**					
374	AppChi2					N/A	95% KM (BCA) UCL					N/A
375	95% Gamma Approximate UCL (Use when n >= 40)					N/A						
376	95% Adjusted Gamma UCL (Use when n < 40)					N/A						
377	**Note: DL/2 is not a recommended method.**											
378												
379	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
380	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
381	**For additional insight, the user may want to consult a statistician.**											
382												
383												
384	**Phenanthrene**											
385												
386	**General Statistics**											
387	Number of Valid Data					6	Number of Detected Data					1
388	Number of Distinct Detected Data					1	Number of Non-Detect Data					5
389							Percent Non-Detects					83.33%
390												
391	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
392	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
393												
394	**The data set for variable Phenanthrene was not processed!**											
395												
396												
397												
398	**Pyrene**											
399												
400	**General Statistics**											
401	Number of Valid Data					6	Number of Detected Data					1
402	Number of Distinct Detected Data					1	Number of Non-Detect Data					5
403							Percent Non-Detects					83.33%
404												
405	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
406	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
407												
408	**The data set for variable Pyrene was not processed!**											
409												
410												
411												
412	**Aluminum**											
413												
414	**General Statistics**											
415	Number of Valid Data					6	Number of Detected Data					4
416	Number of Distinct Detected Data					4	Number of Non-Detect Data					2

417											Percent Non-Detects	33.33%
418												
419	**Raw Statistics**						**Log-transformed Statistics**					
420					Minimum Detected	0.035					Minimum Detected	-3.352
421					Maximum Detected	12					Maximum Detected	2.485
422					Mean of Detected	3.559					Mean of Detected	-0.171
423					SD of Detected	5.65					SD of Detected	2.403
424					Minimum Non-Detect	0.1					Minimum Non-Detect	-2.303
425					Maximum Non-Detect	0.1					Maximum Non-Detect	-2.303
426												
427												
428	**Warning: There are only 4 Distinct Detected Values in this data**											
429	**Note: It should be noted that even though bootstrap may be performed on this data set**											
430	**the resulting calculations may not be reliable enough to draw conclusions**											
431												
432	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
433												
434												
435	**UCL Statistics**											
436	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
437					Shapiro Wilk Test Statistic	0.712					Shapiro Wilk Test Statistic	0.943
438					5% Shapiro Wilk Critical Value	0.748					5% Shapiro Wilk Critical Value	0.748
439	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
440												
441	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
442					DL/2 Substitution Method						DL/2 Substitution Method	
443					Mean	2.389					Mean	-1.113
444					SD	4.737					SD	2.365
445					95% DL/2 (t) UCL	6.286					95% H-Stat (DL/2) UCL	76972
446												
447					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
448	**MLE yields a negative mean**										Mean in Log Scale	-1.259
449											SD in Log Scale	2.564
450											Mean in Original Scale	2.387
451											SD in Original Scale	4.738
452											95% t UCL	6.285
453											95% Percentile Bootstrap UCL	6.178
454											95% BCA Bootstrap UCL	6.5
455											95% H-UCL	567491
456												
457	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
458					k star (bias corrected)	0.279	**Data appear Gamma Distributed at 5% Significance Level**					
459					Theta Star	12.77						
460					nu star	2.23						
461												
462					A-D Test Statistic	0.316	**Nonparametric Statistics**					
463					5% A-D Critical Value	0.687					Kaplan-Meier (KM) Method	
464					K-S Test Statistic	0.687					Mean	2.384
465					5% K-S Critical Value	0.412					SD	4.327
466	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	2.04
467											95% KM (t) UCL	6.494
468	**Assuming Gamma Distribution**										95% KM (z) UCL	5.739

469	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					6.168
470	Minimum				0.000001		95% KM (bootstrap t) UCL					28.71
471	Maximum				12		95% KM (BCA) UCL					6.533
472	Mean				2.373		95% KM (Percentile Bootstrap) UCL					6.406
473	Median				0.518		95% KM (Chebyshev) UCL					11.28
474	SD				4.747		97.5% KM (Chebyshev) UCL					15.12
475	k star				0.181		99% KM (Chebyshev) UCL					22.68
476	Theta star				13.13							
477	Nu star				2.168		**Potential UCLs to Use**					
478	AppChi2				0.176		95% KM (BCA) UCL					6.533
479	95% Gamma Approximate UCL (Use when n >= 40)				29.26							
480	95% Adjusted Gamma UCL (Use when n < 40)				N/A							
481	**Note: DL/2 is not a recommended method.**											
482												
483	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
484	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
485	**For additional insight, the user may want to consult a statistician.**											
486												
487												
488	**Barium**											
489												
490	**General Statistics**											
491	Number of Valid Observations				6		Number of Distinct Observations					6
492												
493	**Raw Statistics**						**Log-transformed Statistics**					
494	Minimum				0.039		Minimum of Log Data					-3.244
495	Maximum				0.26		Maximum of Log Data					-1.347
496	Mean				0.0905		Mean of log Data					-2.664
497	Geometric Mean				0.0697		SD of log Data					0.721
498	Median				0.0545							
499	SD				0.0855							
500	Std. Error of Mean				0.0349							
501	Coefficient of Variation				0.945							
502	Skewness				2.165							
503												
504												
505	**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**											
506												
507	**It is suggested to collect at least 8 to 10 observations using these statistical methods!**											
508	**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
509												
510												
511	**Warning: There are only 6 Values in this data**											
512	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
513	**the resulting calculations may not be reliable enough to draw conclusions**											
514												
515	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											
516												
517	**Relevant UCL Statistics**											
518	**Normal Distribution Test**						**Lognormal Distribution Test**					
519	Shapiro Wilk Test Statistic				0.681		Shapiro Wilk Test Statistic					0.829
520	Shapiro Wilk Critical Value				0.788		Shapiro Wilk Critical Value					0.788

521	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
522												
523	Assuming Normal Distribution						Assuming Lognormal Distribution					
524				95% Student's-t UCL	0.161					95% H-UCL	0.256	
525	95% UCLs (Adjusted for Skewness)									95% Chebyshev (MVUE) UCL	0.196	
526				95% Adjusted-CLT UCL (Chen-1995)	0.181					97.5% Chebyshev (MVUE) UCL	0.243	
527				95% Modified-t UCL (Johnson-1978)	0.166					99% Chebyshev (MVUE) UCL	0.336	
528												
529	Gamma Distribution Test						Data Distribution					
530				k star (bias corrected)	1.142		Data appear Gamma Distributed at 5% Significance Level					
531				Theta Star	0.0792							
532				MLE of Mean	0.0905							
533				MLE of Standard Deviation	0.0847							
534				nu star	13.71							
535				Approximate Chi Square Value (.05)	6.373		Nonparametric Statistics					
536				Adjusted Level of Significance	0.0122					95% CLT UCL	0.148	
537				Adjusted Chi Square Value	4.686					95% Jackknife UCL	0.161	
538										95% Standard Bootstrap UCL	0.142	
539				Anderson-Darling Test Statistic	0.699					95% Bootstrap-t UCL	0.561	
540				Anderson-Darling 5% Critical Value	0.704					95% Hall's Bootstrap UCL	0.459	
541				Kolmogorov-Smirnov Test Statistic	0.321					95% Percentile Bootstrap UCL	0.154	
542				Kolmogorov-Smirnov 5% Critical Value	0.336					95% BCA Bootstrap UCL	0.189	
543	Data appear Gamma Distributed at 5% Significance Level									95% Chebyshev(Mean, Sd) UCL	0.243	
544										97.5% Chebyshev(Mean, Sd) UCL	0.308	
545	Assuming Gamma Distribution									99% Chebyshev(Mean, Sd) UCL	0.438	
546				95% Approximate Gamma UCL (Use when n >= 40)	0.195							
547				95% Adjusted Gamma UCL (Use when n < 40)	0.265							
548												
549	Potential UCL to Use									Use 95% Approximate Gamma UCL	0.195	
550												
551	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
552	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
553	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
554												
555												
556	Cadmium											
557												
558	General Statistics											
559				Number of Valid Data	6					Number of Detected Data	1	
560				Number of Distinct Detected Data	1					Number of Non-Detect Data	5	
561										Percent Non-Detects	83.33%	
562												
563	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
564	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
565												
566	The data set for variable Cadmium was not processed!											
567												
568												
569												
570	Copper											
571												
572	General Statistics											

Number of Valid Observations	6	Number of Distinct Observations 5

Raw Statistics		Log-transformed Statistics	
Minimum	0.0036	Minimum of Log Data	-5.627
Maximum	0.051	Maximum of Log Data	-2.976
Mean	0.0157	Mean of log Data	-4.52
Geometric Mean	0.0109	SD of log Data	0.863
Median	0.00935		
SD	0.0175		
Std. Error of Mean	0.00716		
Coefficient of Variation	1.119		
Skewness	2.308		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set,

the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.647	Shapiro Wilk Test Statistic	0.876
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.0301	95% H-UCL	0.065
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.037
95% Adjusted-CLT UCL (Chen-1995)	0.0346	97.5% Chebyshev (MVUE) UCL	0.0466
95% Modified-t UCL (Johnson-1978)	0.0312	99% Chebyshev (MVUE) UCL	0.0656
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.871	**Data appear Lognormal at 5% Significance Level**	
Theta Star	0.018		
MLE of Mean	0.0157		
MLE of Standard Deviation	0.0168		
nu star	10.45		
Approximate Chi Square Value (.05)	4.227	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	0.0274
Adjusted Chi Square Value	2.923	95% Jackknife UCL	0.0301
		95% Standard Bootstrap UCL	0.0264
Anderson-Darling Test Statistic	0.726	95% Bootstrap-t UCL	0.0859
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	0.0999
Kolmogorov-Smirnov Test Statistic	0.348	95% Percentile Bootstrap UCL	0.029
Kolmogorov-Smirnov 5% Critical Value	0.337	95% BCA Bootstrap UCL	0.0308

625	Data not Gamma Distributed at 5% Significance Level						95% Chebyshev(Mean, Sd) UCL					0.0469
626							97.5% Chebyshev(Mean, Sd) UCL					0.0604
627	Assuming Gamma Distribution						99% Chebyshev(Mean, Sd) UCL					0.0869
628	95% Approximate Gamma UCL (Use when n >= 40)					0.0387						
629	95% Adjusted Gamma UCL (Use when n < 40)					0.056						
630												
631	Potential UCL to Use						Use 95% H-UCL					0.065
632	Recommended UCL exceeds the maximum observation											
633												
634	ProUCL computes and outputs H-statistic based UCLs for historical reasons only.											
635	H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.											
636	It is therefore recommended to avoid the use of H-statistic based 95% UCLs.											
637	Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.											
638												
639	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
640	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
641	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
642												
643												
644	Iron											
645												
646	General Statistics											
647	Number of Valid Observations					6	Number of Distinct Observations					6
648												
649	Raw Statistics						Log-transformed Statistics					
650	Minimum					1.6	Minimum of Log Data					0.47
651	Maximum					33	Maximum of Log Data					3.497
652	Mean					13.7	Mean of log Data					2.168
653	Geometric Mean					8.737	SD of log Data					1.186
654	Median					13.5						
655	SD					11.53						
656	Std. Error of Mean					4.709						
657	Coefficient of Variation					0.842						
658	Skewness					0.807						
659												
660												
661	Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!											
662												
663	It is suggested to collect at least 8 to 10 observations using these statistical methods!											
664	If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
665												
666												
667	Warning: There are only 6 Values in this data											
668	Note: It should be noted that even though bootstrap methods may be performed on this data set,											
669	the resulting calculations may not be reliable enough to draw conclusions											
670												
671	The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.											
672												
673	Relevant UCL Statistics											
674	Normal Distribution Test						Lognormal Distribution Test					
675	Shapiro Wilk Test Statistic					0.923	Shapiro Wilk Test Statistic					0.895
676	Shapiro Wilk Critical Value					0.788	Shapiro Wilk Critical Value					0.788

677	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
678												
679	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
680				95% Student's-t UCL		23.19					95% H-UCL	221.9
681	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	45.9
682			95% Adjusted-CLT UCL (Chen-1995)			23.1					97.5% Chebyshev (MVUE) UCL	59.25
683			95% Modified-t UCL (Johnson-1978)			23.45					99% Chebyshev (MVUE) UCL	85.46
684												
685	**Gamma Distribution Test**						**Data Distribution**					
686				k star (bias corrected)		0.737	**Data appear Normal at 5% Significance Level**					
687				Theta Star		18.59						
688				MLE of Mean		13.7						
689				MLE of Standard Deviation		15.96						
690				nu star		8.845						
691				Approximate Chi Square Value (.05)		3.234	**Nonparametric Statistics**					
692				Adjusted Level of Significance		0.0122					95% CLT UCL	21.45
693				Adjusted Chi Square Value		2.137					95% Jackknife UCL	23.19
694											95% Standard Bootstrap UCL	20.71
695				Anderson-Darling Test Statistic		0.335					95% Bootstrap-t UCL	25.38
696				Anderson-Darling 5% Critical Value		0.711					95% Hall's Bootstrap UCL	25.13
697				Kolmogorov-Smirnov Test Statistic		0.23					95% Percentile Bootstrap UCL	21.43
698				Kolmogorov-Smirnov 5% Critical Value		0.339					95% BCA Bootstrap UCL	21.77
699	**Data appear Gamma Distributed at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	34.23
700											97.5% Chebyshev(Mean, Sd) UCL	43.11
701	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	60.55
702			95% Approximate Gamma UCL (Use when n >= 40)			37.47						
703			95% Adjusted Gamma UCL (Use when n < 40)			56.69						
704												
705	**Potential UCL to Use**										Use 95% Student's-t UCL	23.19
706												
707	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
708	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
709	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
710												
711												
712	**Lead**											
713												
714	**General Statistics**											
715				Number of Valid Data		6					Number of Detected Data	5
716				Number of Distinct Detected Data		5					Number of Non-Detect Data	1
717											Percent Non-Detects	16.67%
718												
719	**Raw Statistics**						**Log-transformed Statistics**					
720				Minimum Detected		0.00042					Minimum Detected	-7.775
721				Maximum Detected		0.24					Maximum Detected	-1.427
722				Mean of Detected		0.0582					Mean of Detected	-4.627
723				SD of Detected		0.102					SD of Detected	2.518
724				Minimum Non-Detect		0.001					Minimum Non-Detect	-6.908
725				Maximum Non-Detect		0.001					Maximum Non-Detect	-6.908
726												
727												
728	**Warning: There are only 5 Detected Values in this data**											

	A	B	C	D	E	F	G	H	I	J	K	L
729	**Note: It should be noted that even though bootstrap may be performed on this data set**											
730	**the resulting calculations may not be reliable enough to draw conclusions**											
731												
732	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
733												
734												
735	**UCL Statistics**											
736	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
737					Shapiro Wilk Test Statistic	0.653					Shapiro Wilk Test Statistic	0.953
738					5% Shapiro Wilk Critical Value	0.762					5% Shapiro Wilk Critical Value	0.762
739	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
740												
741	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
742					DL/2 Substitution Method						DL/2 Substitution Method	
743					Mean	0.0486					Mean	-5.122
744					SD	0.0945					SD	2.558
745					95% DL/2 (t) UCL	0.126					95% H-Stat (DL/2) UCL	11151
746												
747					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
748					Mean	0.0205					Mean in Log Scale	-5.222
749					SD	0.115					SD in Log Scale	2.683
750					95% MLE (t) UCL	0.115					Mean in Original Scale	0.0485
751					95% MLE (Tiku) UCL	0.121					SD in Original Scale	0.0945
752											95% t UCL	0.126
753											95% Percentile Bootstrap UCL	0.12
754											95% BCA Bootstrap UCL	0.133
755											95% H UCL	42002
756												
757	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
758					k star (bias corrected)	0.283	**Data appear Gamma Distributed at 5% Significance Level**					
759					Theta Star	0.206						
760					nu star	2.827						
761												
762					A-D Test Statistic	0.315	**Nonparametric Statistics**					
763					5% A-D Critical Value	0.729					Kaplan-Meier (KM) Method	
764					K-S Test Statistic	0.729					Mean	0.0486
765					5% K-S Critical Value	0.377					SD	0.0863
766	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0394
767											95% KM (t) UCL	0.128
768	**Assuming Gamma Distribution**										95% KM (z) UCL	0.113
769					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.126
770					Minimum	0.000001					95% KM (bootstrap t) UCL	0.437
771					Maximum	0.24					95% KM (BCA) UCL	0.128
772					Mean	0.0485					95% KM (Percentile Bootstrap) UCL	0.124
773					Median	0.0118					95% KM (Chebyshev) UCL	0.22
774					SD	0.0946					97.5% KM (Chebyshev) UCL	0.295
775					k star	0.226					99% KM (Chebyshev) UCL	0.44
776					Theta star	0.214						
777					Nu star	2.713	**Potential UCLs to Use**					
778					AppChi2	0.293					95% KM (Chebyshev) UCL	0.22
779					95% Gamma Approximate UCL (Use when n >= 40)	0.449						
780					95% Adjusted Gamma UCL (Use when n < 40)	0.991						

	A	B	C	D	E	F	G	H	I	J	K	L
781	Note: DL/2 is not a recommended method.											
782												
783	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
784	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
785	For additional insight, the user may want to consult a statistician.											
786												
787												
788	Manganese											
789												
790	General Statistics											
791	Number of Valid Observations					6	Number of Distinct Observations					6
792												
793	Raw Statistics						Log-transformed Statistics					
794	Minimum					0.54	Minimum of Log Data					-0.616
795	Maximum					2.2	Maximum of Log Data					0.788
796	Mean					1.248	Mean of log Data					0.116
797	Geometric Mean					1.123	SD of log Data					0.516
798	Median					1.195						
799	SD					0.61						
800	Std. Error of Mean					0.249						
801	Coefficient of Variation					0.488						
802	Skewness					0.555						
803												
804												
805	Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!											
806												
807	It is suggested to collect at least 8 to 10 observations using these statistical methods!											
808	If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
809												
810												
811	Warning: There are only 6 Values in this data											
812	Note: It should be noted that even though bootstrap methods may be performed on this data set,											
813	the resulting calculations may not be reliable enough to draw conclusions											
814												
815	The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.											
816												
817	Relevant UCL Statistics											
818	Normal Distribution Test						Lognormal Distribution Test					
819	Shapiro Wilk Test Statistic					0.964	Shapiro Wilk Test Statistic					0.981
820	Shapiro Wilk Critical Value					0.788	Shapiro Wilk Critical Value					0.788
821	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
822												
823	Assuming Normal Distribution						Assuming Lognormal Distribution					
824	95% Student's-t UCL					1.75	95% H-UCL					2.378
825	95% UCLs (Adjusted for Skewness)						95% Chebyshev (MVUE) UCL					2.4
826	95% Adjusted-CLT UCL (Chen-1995)					1.718	97.5% Chebyshev (MVUE) UCL					2.897
827	95% Modified-t UCL (Johnson-1978)					1.759	99% Chebyshev (MVUE) UCL					3.872
828												
829	Gamma Distribution Test						Data Distribution					
830	k star (bias corrected)					2.548	Data appear Normal at 5% Significance Level					
831	Theta Star					0.49						
832	MLE of Mean					1.248						

833					MLE of Standard Deviation	0.782						
834					nu star	30.57						
835					Approximate Chi Square Value (.05)	18.94				Nonparametric Statistics		
836					Adjusted Level of Significance	0.0122					95% CLT UCL	1.658
837					Adjusted Chi Square Value	15.73					95% Jackknife UCL	1.75
838											95% Standard Bootstrap UCL	1.617
839					Anderson-Darling Test Statistic	0.174					95% Bootstrap-t UCL	1.893
840					Anderson-Darling 5% Critical Value	0.698					95% Hall's Bootstrap UCL	1.747
841					Kolmogorov-Smirnov Test Statistic	0.158					95% Percentile Bootstrap UCL	1.632
842					Kolmogorov-Smirnov 5% Critical Value	0.333					95% BCA Bootstrap UCL	1.658
843					**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	2.333
844											97.5% Chebyshev(Mean, Sd) UCL	2.803
845					**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	3.725
846					95% Approximate Gamma UCL (Use when n >= 40)	2.015						
847					95% Adjusted Gamma UCL (Use when n < 40)	2.426						
848												
849					**Potential UCL to Use**						Use 95% Student's-t UCL	1.75
850												
851	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
852	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
853	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
854												
855												
856	**Zinc**											
857												
858	**General Statistics**											
859					Number of Valid Data	6				Number of Detected Data		5
860					Number of Distinct Detected Data	5				Number of Non-Detect Data		1
861										Percent Non-Detects		16.67%
862												
863	**Raw Statistics**						**Log-transformed Statistics**					
864					Minimum Detected	0.0073				Minimum Detected		-4.92
865					Maximum Detected	0.5				Maximum Detected		-0.693
866					Mean of Detected	0.136				Mean of Detected		-2.973
867					SD of Detected	0.207				SD of Detected		1.605
868					Minimum Non-Detect	0.05				Minimum Non-Detect		-2.996
869					Maximum Non-Detect	0.05				Maximum Non-Detect		-2.996
870												
871												
872	**Warning: There are only 5 Detected Values in this data**											
873	**Note: It should be noted that even though bootstrap may be performed on this data set**											
874	**the resulting calculations may not be reliable enough to draw conclusions**											
875												
876	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
877												
878												
879	**UCL Statistics**											
880	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
881					Shapiro Wilk Test Statistic	0.705				Shapiro Wilk Test Statistic		0.986
882					5% Shapiro Wilk Critical Value	0.762				5% Shapiro Wilk Critical Value		0.762
883	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
884												

885	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
886	DL/2 Substitution Method						DL/2 Substitution Method					
887	Mean					0.117	Mean					-3.092
888	SD					0.191	SD					1.465
889	95% DL/2 (t) UCL					0.274	95% H-Stat (DL/2) UCL					5.755
890												
891	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
892	**MLE method failed to converge properly**						Mean in Log Scale					-3.136
893							SD in Log Scale					1.49
894							Mean in Original Scale					0.116
895							SD in Original Scale					0.192
896							95% t UCL					0.274
897							95% Percentile Bootstrap UCL					0.259
898							95% BCA Bootstrap UCL					0.29
899							95% H-UCL					6.484
900												
901	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
902	k star (bias corrected)					0.385	**Data appear Gamma Distributed at 5% Significance Level**					
903	Theta Star					0.352						
904	nu star					3.851						
905												
906	A-D Test Statistic					0.332	**Nonparametric Statistics**					
907	5% A-D Critical Value					0.704	Kaplan-Meier (KM) Method					
908	K-S Test Statistic					0.704	Mean					0.117
909	5% K-S Critical Value					0.369	SD					0.175
910	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.0797
911							95% KM (t) UCL					0.278
912	**Assuming Gamma Distribution**						95% KM (z) UCL					0.248
913	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.274
914	Minimum					0.000001	95% KM (bootstrap t) UCL					1.313
915	Maximum					0.5	95% KM (BCA) UCL					0.262
916	Mean					0.113	95% KM (Percentile Bootstrap) UCL					0.262
917	Median					0.0305	95% KM (Chebyshev) UCL					0.464
918	SD					0.194	97.5% KM (Chebyshev) UCL					0.615
919	k star					0.246	99% KM (Chebyshev) UCL					0.91
920	Theta star					0.459						
921	Nu star					2.952	**Potential UCLs to Use**					
922	AppChi2					0.358	95% KM (Chebyshev) UCL					0.464
923	95% Gamma Approximate UCL (Use when n >= 40)					0.931						
924	95% Adjusted Gamma UCL (Use when n < 40)					2.074						
925	**Note: DL/2 is not a recommended method.**											
926												
927	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
928	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
929	**For additional insight, the user may want to consult a statistician.**											
930												
931												
932	**Chloride**											
933												
934	**General Statistics**											
935	Number of Valid Observations					6	Number of Distinct Observations					6
936												

	A	B	C	D	E	F	G	H	I	J	K	L
937	**Raw Statistics**						**Log-transformed Statistics**					
938					Minimum	140				Minimum of Log Data		4.942
939					Maximum	410				Maximum of Log Data		6.016
940					Mean	231.7				Mean of log Data		5.344
941					Geometric Mean	209.4				SD of log Data		0.476
942					Median	165						
943					SD	120.2						
944					Std. Error of Mean	49.09						
945					Coefficient of Variation	0.519						
946					Skewness	1.013						
947												
948												
949	**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**											
950												
951	**It is suggested to collect at least 8 to 10 observations using these statistical methods!**											
952	**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
953												
954												
955	**Warning: There are only 6 Values in this data**											
956	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
957	**the resulting calculations may not be reliable enough to draw conclusions**											
958												
959	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											
960												
961	**Relevant UCL Statistics**											
962	**Normal Distribution Test**						**Lognormal Distribution Test**					
963					Shapiro Wilk Test Statistic	0.754				Shapiro Wilk Test Statistic		0.782
964					Shapiro Wilk Critical Value	0.788				Shapiro Wilk Critical Value		0.788
965	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
966												
967	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
968					95% Student's-t UCL	330.6				95% H-UCL		406.5
969	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL		424.5
970					95% Adjusted-CLT UCL (Chen-1995)	334.1				97.5% Chebyshev (MVUE) UCL		508.7
971					95% Modified-t UCL (Johnson-1978)	334				99% Chebyshev (MVUE) UCL		674.1
972												
973	**Gamma Distribution Test**						**Data Distribution**					
974					k star (bias corrected)	2.666	**Data do not follow a Discernable Distribution (0.05)**					
975					Theta Star	86.91						
976					MLE of Mean	231.7						
977					MLE of Standard Deviation	141.9						
978					nu star	31.99						
979					Approximate Chi Square Value (.05)	20.06	**Nonparametric Statistics**					
980					Adjusted Level of Significance	0.0122				95% CLT UCL		312.4
981					Adjusted Chi Square Value	16.74				95% Jackknife UCL		330.6
982										95% Standard Bootstrap UCL		305.8
983					Anderson-Darling Test Statistic	0.804				95% Bootstrap-t UCL		1008
984					Anderson-Darling 5% Critical Value	0.698				95% Hall's Bootstrap UCL		1247
985					Kolmogorov-Smirnov Test Statistic	0.363				95% Percentile Bootstrap UCL		308.3
986					Kolmogorov-Smirnov 5% Critical Value	0.333				95% BCA Bootstrap UCL		315
987	**Data not Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL		445.6
988										97.5% Chebyshev(Mean, Sd) UCL		538.2

989	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					720.1
990	95% Approximate Gamma UCL (Use when n >= 40)					369.4						
991	95% Adjusted Gamma UCL (Use when n < 40)					442.6						
992												
993	**Potential UCL to Use**						Use 95% Student's-t UCL					330.6
994							or 95% Modified-t UCL					334
995												
996	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
997	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
998	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
999												
1000												
1001	**Nitrogen, as Ammonia**											
1002												
1003	**General Statistics**											
1004	Number of Valid Observations					6	Number of Distinct Observations					6
1005												
1006	**Raw Statistics**						**Log-transformed Statistics**					
1007	Minimum					0.52	Minimum of Log Data					-0.654
1008	Maximum					8.7	Maximum of Log Data					2.163
1009	Mean					4.287	Mean of log Data					1.09
1010	Geometric Mean					2.973	SD of log Data					1.079
1011	Median					4.15						
1012	SD					3.158						
1013	Std. Error of Mean					1.289						
1014	Coefficient of Variation					0.737						
1015	Skewness					0.224						
1016												
1017												
1018	**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**											
1019												
1020	**It is suggested to collect at least 8 to 10 observations using these statistical methods!**											
1021	**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
1022												
1023												
1024	**Warning: There are only 6 Values in this data**											
1025	**Note: It should be noted that even though bootstrap methods may be performed on this data set,**											
1026	**the resulting calculations may not be reliable enough to draw conclusions**											
1027												
1028	**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**											
1029												
1030	**Relevant UCL Statistics**											
1031	**Normal Distribution Test**						**Lognormal Distribution Test**					
1032	Shapiro Wilk Test Statistic					0.958	Shapiro Wilk Test Statistic					0.908
1033	Shapiro Wilk Critical Value					0.788	Shapiro Wilk Critical Value					0.788
1034	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1035												
1036	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1037	95% Student's-t UCL					6.884	95% H-UCL					44.63
1038	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL					13.5
1039	95% Adjusted-CLT UCL (Chen-1995)					6.533	97.5% Chebyshev (MVUE) UCL					17.32
1040	95% Modified-t UCL (Johnson-1978)					6.904	99% Chebyshev (MVUE) UCL					24.81

1041												
1042	**Gamma Distribution Test**						**Data Distribution**					
1043					k star (bias corrected)	0.867	**Data appear Normal at 5% Significance Level**					
1044					Theta Star	4.945						
1045					MLE of Mean	4.287						
1046					MLE of Standard Deviation	4.604						
1047					nu star	10.4						
1048					Approximate Chi Square Value (.05)	4.195	**Nonparametric Statistics**					
1049					Adjusted Level of Significance	0.0122					95% CLT UCL	6.407
1050					Adjusted Chi Square Value	2.898					95% Jackknife UCL	6.884
1051											95% Standard Bootstrap UCL	6.216
1052					Anderson-Darling Test Statistic	0.274					95% Bootstrap-t UCL	7.088
1053					Anderson-Darling 5% Critical Value	0.708					95% Hall's Bootstrap UCL	7.145
1054					Kolmogorov-Smirnov Test Statistic	0.207					95% Percentile Bootstrap UCL	6.283
1055					Kolmogorov-Smirnov 5% Critical Value	0.337					95% BCA Bootstrap UCL	6.283
1056	**Data appear Gamma Distributed at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	9.906
1057											97.5% Chebyshev(Mean, Sd) UCL	12.34
1058	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	17.11
1059					95% Approximate Gamma UCL (Use when n >= 40)	10.63						
1060					95% Adjusted Gamma UCL (Use when n < 40)	15.39						
1061												
1062	**Potential UCL to Use**										Use 95% Student's-t UCL	6.884
1063												
1064	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1065	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1066	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1067												

Surface Water – MMB Wetland

	General UCL Statistics for Data Sets with Non-Detects	
	User Selected Options	
	From File	WorkSheet.wst
	Full Precision	OFF
	Confidence Coefficient	95%
	Number of Bootstrap Operations	2000

3 & 4 Methylphenol

General Statistics

Number of Valid Data	22	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	21
Number of Missing Values	1	Percent Non-Detects	95.45%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 3 & 4 Methylphenol was not processed!

Benzo(a)pyrene

General Statistics

Number of Valid Data	22	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	20
Number of Missing Values	1	Percent Non-Detects	90.91%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.000096	Minimum Detected	-9.251
Maximum Detected	0.00013	Maximum Detected	-8.948
Mean of Detected	0.000113	Mean of Detected	-9.1
SD of Detected	2.404E-05	SD of Detected	0.214
Minimum Non-Detect	0.00018	Minimum Non-Detect	-8.623
Maximum Non-Detect	0.0002	Maximum Non-Detect	-8.517
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	22
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

	A	B	C	D	E	F	G	H	I	J	K	L
53	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
54												
55												
56	**UCL Statistics**											
57	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
58	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk Test Statistic					N/A
59	5% Shapiro Wilk Critical Value					N/A	5% Shapiro Wilk Critical Value					N/A
60	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
61												
62	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
63	DL/2 Substitution Method						DL/2 Substitution Method					
64	Mean					9.391E-05	Mean					-9.277
65	SD					8.997E-06	SD					0.0847
66	95% DL/2 (t) UCL					9.721E-05	95% H-Stat (DL/2) UCL					N/A
67												
68	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
69	**MLE method failed to converge properly**						Mean in Log Scale					N/A
70							SD in Log Scale					N/A
71							Mean in Original Scale					N/A
72							SD in Original Scale					N/A
73							95% t UCL					N/A
74							95% Percentile Bootstrap UCL					N/A
75							95% BCA Bootstrap UCL					N/A
76							95% H-UCL					N/A
77												
78	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
79	k star (bias corrected)					N/A	**Data do not follow a Discernable Distribution (0.05)**					
80	Theta Star					N/A						
81	nu star					N/A						
82												
83	A-D Test Statistic					N/A	**Nonparametric Statistics**					
84	5% A-D Critical Value					N/A	Kaplan-Meier (KM) Method					
85	K-S Test Statistic					N/A	Mean					0.000113
86	5% K-S Critical Value					N/A	SD					0.000017
87	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.000017
88							95% KM (t) UCL					0.0001423
89	**Assuming Gamma Distribution**						95% KM (z) UCL					0.000141
90	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.0001534
91	Minimum					N/A	95% KM (bootstrap t) UCL					N/A
92	Maximum					N/A	95% KM (BCA) UCL					0.00013
93	Mean					N/A	95% KM (Percentile Bootstrap) UCL					0.00013
94	Median					N/A	95% KM (Chebyshev) UCL					0.0001871
95	SD					N/A	97.5% KM (Chebyshev) UCL					0.0002192
96	k star					N/A	99% KM (Chebyshev) UCL					0.0002822
97	Theta star					N/A						
98	Nu star					N/A	**Potential UCLs to Use**					
99	AppChi2					N/A	95% KM (t) UCL					0.0001423
100	95% Gamma Approximate UCL (Use when n >= 40)					N/A	95% KM (% Bootstrap) UCL					0.00013
101	95% Adjusted Gamma UCL (Use when n < 40)					N/A						
102	**Warning: Recommended UCL exceeds the maximum observation**											
103	**Note: DL/2 is not a recommended method.**											
104												

	A	B	C	D	E	F	G	H	I	J	K	L
105	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
106	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
107	For additional insight, the user may want to consult a statistician.											
108												
109												
110	Caprolactam											
111												
112	General Statistics											
113						Number of Valid Data	22				Number of Detected Data	2
114						Number of Distinct Detected Data	1				Number of Non-Detect Data	20
115						Number of Missing Values	1				Percent Non-Detects	90.91%
116												
117	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
118	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
119												
120	The data set for variable Caprolactam was not processed!											
121												
122												
123												
124	N-Nitrosodi-n-propylamine											
125												
126	General Statistics											
127						Number of Valid Data	22				Number of Detected Data	3
128						Number of Distinct Detected Data	3				Number of Non-Detect Data	19
129						Number of Missing Values	1				Percent Non-Detects	86.36%
130												
131	Raw Statistics							Log-transformed Statistics				
132						Minimum Detected	4.4E-07				Minimum Detected	-14.64
133						Maximum Detected	7.8E-07				Maximum Detected	-14.06
134						Mean of Detected	6.267E-07				Mean of Detected	-14.31
135						SD of Detected	1.724E-07				SD of Detected	0.294
136						Minimum Non-Detect	0.0000019				Minimum Non-Detect	-13.17
137						Maximum Non-Detect	0.000038				Maximum Non-Detect	-10.18
138												
139	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	22
140	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
141	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
142												
143	Warning: There are only 3 Distinct Detected Values in this data set											
144	The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.											
145	Those methods will return a 'N/A' value on your output display!											
146												
147	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
148	However, results obtained using 4 to 9 distinct values may not be reliable.											
149	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
150												
151												
152	UCL Statistics											
153	Normal Distribution Test with Detected Values Only							Lognormal Distribution Test with Detected Values Only				
154						Shapiro Wilk Test Statistic	0.972				Shapiro Wilk Test Statistic	0.945
155						5% Shapiro Wilk Critical Value	0.767				5% Shapiro Wilk Critical Value	0.767
156	Data appear Normal at 5% Significance Level							Data appear Lognormal at 5% Significance Level				

	Assuming Normal Distribution	
	DL/2 Substitution Method	
	Mean	4.083E-06
	SD	5.153E-06
	95% DL/2 (t) UCL	5.974E-06
	Maximum Likelihood Estimate(MLE) Method	N/A
	MLE method failed to converge properly	
	Gamma Distribution Test with Detected Values Only	
	k star (bias corrected)	N/A
	Theta Star	N/A
	nu star	N/A
	A-D Test Statistic	N/A
	5% A-D Critical Value	N/A
	K-S Test Statistic	N/A
	5% K-S Critical Value	N/A
	Data not Gamma Distributed at 5% Significance Level	
	Assuming Gamma Distribution	
	Gamma ROS Statistics using Extrapolated Data	
	Minimum	N/A
	Maximum	N/A
	Mean	N/A
	Median	N/A
	SD	N/A
	k star	N/A
	Theta star	N/A
	Nu star	N/A
	AppChi2	N/A
	95% Gamma Approximate UCL (Use when n >= 40)	N/A
	95% Adjusted Gamma UCL (Use when n < 40)	N/A

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-13.16
SD	1.21
95% H-Stat (DL/2) UCL	8.599E-06
Log ROS Method	
Mean in Log Scale	-14.31
SD in Log Scale	0.297
Mean in Original Scale	6.356E-07
SD in Original Scale	1.892E-07
95% t UCL	7.05E-07
95% Percentile Bootstrap UCL	6.993E-07
95% BCA Bootstrap UCL	7.039E-07
95% H-UCL	7.175E-07
Data Distribution Test with Detected Values Only	
Data appear Normal at 5% Significance Level	
Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	6.267E-07
SD	1.408E-07
SE of Mean	9.956E-08
95% KM (t) UCL	7.98E-07
95% KM (z) UCL	7.904E-07
95% KM (jackknife) UCL	8.317E-07
95% KM (bootstrap t) UCL	8.089E-07
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	7.8E-07
95% KM (Chebyshev) UCL	1.061E-06
97.5% KM (Chebyshev) UCL	1.248E-06
99% KM (Chebyshev) UCL	1.617E-06
Potential UCLs to Use	
95% KM (t) UCL	7.98E-07
95% KM (Percentile Bootstrap) UCL	7.8E-07

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Aluminum

General Statistics

209					Number of Valid Data	22					Number of Detected Data	18
210					Number of Distinct Detected Data	18					Number of Non-Detect Data	4
211					Number of Missing Values	1					Percent Non-Detects	18.18%
212												
213					**Raw Statistics**						**Log-transformed Statistics**	
214					Minimum Detected	0.012					Minimum Detected	-4.423
215					Maximum Detected	1.8					Maximum Detected	0.588
216					Mean of Detected	0.196					Mean of Detected	-2.504
217					SD of Detected	0.414					SD of Detected	1.179
218					Minimum Non-Detect	0.1					Minimum Non-Detect	-2.303
219					Maximum Non-Detect	0.1					Maximum Non-Detect	-2.303
220												
221												
222					**UCL Statistics**							
223					**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**	
224					Shapiro Wilk Test Statistic	0.43					Shapiro Wilk Test Statistic	0.94
225					5% Shapiro Wilk Critical Value	0.897					5% Shapiro Wilk Critical Value	0.897
226					**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**	
227												
228					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
229					DL/2 Substitution Method						DL/2 Substitution Method	
230					Mean	0.169					Mean	-2.593
231					SD	0.377					SD	1.078
232					95% DL/2 (t) UCL	0.308					95% H-Stat (DL/2) UCL	0.252
233												
234					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
235					**MLE yields a negative mean**						Mean in Log Scale	-2.611
236											SD in Log Scale	1.113
237											Mean in Original Scale	0.17
238											SD in Original Scale	0.377
239											95% t UCL	0.308
240											95% Percentile Bootstrap UCL	0.32
241											95% BCA Bootstrap UCL	0.435
242											95% H-UCL	0.266
243												
244					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
245					k star (bias corrected)	0.615					**Data appear Lognormal at 5% Significance Level**	
246					Theta Star	0.319						
247					nu star	22.12						
248												
249					A-D Test Statistic	1.522					**Nonparametric Statistics**	
250					5% A-D Critical Value	0.783					Kaplan-Meier (KM) Method	
251					K-S Test Statistic	0.783					Mean	0.17
252					5% K-S Critical Value	0.212					SD	0.369
253					**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.0809
254											95% KM (t) UCL	0.309
255					**Assuming Gamma Distribution**						95% KM (z) UCL	0.303
256					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.309
257					Minimum	0.000001					95% KM (bootstrap t) UCL	0.928
258					Maximum	1.8					95% KM (BCA) UCL	0.326
259					Mean	0.173					95% KM (Percentile Bootstrap) UCL	0.321
260					Median	0.0796					95% KM (Chebyshev) UCL	0.523

261				SD	0.378				97.5% KM (Chebyshev) UCL			0.676
262				k star	0.36				99% KM (Chebyshev) UCL			0.975
263				Theta star	0.48							
264				Nu star	15.83	**Potential UCLs to Use**						
265				AppChi2	7.842				97.5% KM (Chebyshev) UCL			0.676
266			95% Gamma Approximate UCL (Use when n >= 40)		0.349							
267			95% Adjusted Gamma UCL (Use when n < 40)		0.369							
268	**Note: DL/2 is not a recommended method.**											
269												
270	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
271	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
272	**For additional insight, the user may want to consult a statistician.**											
273												
274												
275	**Barium**											
276												
277	**General Statistics**											
278				Number of Valid Observations	22				Number of Distinct Observations			17
279				Number of Missing Values	1							
280												
281	**Raw Statistics**					**Log-transformed Statistics**						
282				Minimum	0.015				Minimum of Log Data			-4.2
283				Maximum	0.15				Maximum of Log Data			-1.897
284				Mean	0.0368				Mean of log Data			-3.453
285				Geometric Mean	0.0316				SD of log Data			0.503
286				Median	0.0295							
287				SD	0.028							
288				Std. Error of Mean	0.00596							
289				Coefficient of Variation	0.759							
290				Skewness	3.436							
291												
292	**Relevant UCL Statistics**											
293	**Normal Distribution Test**					**Lognormal Distribution Test**						
294				Shapiro Wilk Test Statistic	0.604				Shapiro Wilk Test Statistic			0.908
295				Shapiro Wilk Critical Value	0.911				Shapiro Wilk Critical Value			0.911
296	**Data not Normal at 5% Significance Level**					**Data not Lognormal at 5% Significance Level**						
297												
298	**Assuming Normal Distribution**					**Assuming Lognormal Distribution**						
299				95% Student's-t UCL	0.0471				95% H-UCL			0.0447
300	**95% UCLs (Adjusted for Skewness)**								95% Chebyshev (MVUE) UCL			0.053
301				95% Adjusted-CLT UCL (Chen-1995)	0.0513				97.5% Chebyshev (MVUE) UCL			0.0605
302				95% Modified-t UCL (Johnson-1978)	0.0478				99% Chebyshev (MVUE) UCL			0.0753
303												
304	**Gamma Distribution Test**					**Data Distribution**						
305				k star (bias corrected)	3.017	**Data Follow Appr. Gamma Distribution at 5% Significance Level**						
306				Theta Star	0.0122							
307				MLE of Mean	0.0368							
308				MLE of Standard Deviation	0.0212							
309				nu star	132.7							
310				Approximate Chi Square Value (.05)	107.1	**Nonparametric Statistics**						
311				Adjusted Level of Significance	0.0386				95% CLT UCL			0.0466
312				Adjusted Chi Square Value	105.4				95% Jackknife UCL			0.0471

313											95% Standard Bootstrap UCL	0.0466
314					Anderson-Darling Test Statistic	1.036					95% Bootstrap-t UCL	0.0597
315					Anderson-Darling 5% Critical Value	0.748					95% Hall's Bootstrap UCL	0.0884
316					Kolmogorov-Smirnov Test Statistic	0.165					95% Percentile Bootstrap UCL	0.0472
317					Kolmogorov-Smirnov 5% Critical Value	0.186					95% BCA Bootstrap UCL	0.054
318					**Data follow Appr. Gamma Distribution at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	0.0628
319											97.5% Chebyshev(Mean, Sd) UCL	0.074
320					**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	0.0961
321					95% Approximate Gamma UCL (Use when n >= 40)	0.0456						
322					95% Adjusted Gamma UCL (Use when n < 40)	0.0464						
323												
324					**Potential UCL to Use**						Use 95% Approximate Gamma UCL	0.0456
325												
326	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
327	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
328	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
329												
330												
331	**Copper**											
332												
333	**General Statistics**											
334					Number of Valid Data	22					Number of Detected Data	18
335					Number of Distinct Detected Data	17					Number of Non-Detect Data	4
336					Number of Missing Values	1					Percent Non-Detects	18.18%
337												
338					**Raw Statistics**						**Log-transformed Statistics**	
339					Minimum Detected	0.00077					Minimum Detected	-7.169
340					Maximum Detected	0.054					Maximum Detected	-2.919
341					Mean of Detected	0.00559					Mean of Detected	-5.892
342					SD of Detected	0.0122					SD of Detected	0.943
343					Minimum Non-Detect	0.0005					Minimum Non-Detect	-7.601
344					Maximum Non-Detect	0.01					Maximum Non-Detect	-4.605
345												
346	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	21
347	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1
348	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	95.45%
349												
350	**UCL Statistics**											
351	**Normal Distribution Test with Detected Values Only**										**Lognormal Distribution Test with Detected Values Only**	
352					Shapiro Wilk Test Statistic	0.362					Shapiro Wilk Test Statistic	0.838
353					5% Shapiro Wilk Critical Value	0.897					5% Shapiro Wilk Critical Value	0.897
354	**Data not Normal at 5% Significance Level**										**Data not Lognormal at 5% Significance Level**	
355												
356	**Assuming Normal Distribution**										**Assuming Lognormal Distribution**	
357					DL/2 Substitution Method						DL/2 Substitution Method	
358					Mean	0.00483					Mean	-6.192
359					SD	0.0111					SD	1.211
360					95% DL/2 (t) UCL	0.00892					95% H-Stat (DL/2) UCL	0.00914
361												
362					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
363	**MLE method failed to converge properly**										Mean in Log Scale	-6.183
364											SD in Log Scale	1.109

365											Mean in Original Scale	0.00471
366											SD in Original Scale	0.0111
367											95% t UCL	0.0088
368											95% Percentile Bootstrap UCL	0.00936
369											95% BCA Bootstrap UCL	0.0122
370											95% H-UCL	0.0074
371												
372	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
373					k star (bias corrected)	0.735	**Data do not follow a Discernable Distribution (0.05)**					
374					Theta Star	0.00761						
375					nu star	26.45						
376												
377					A-D Test Statistic	2.395	**Nonparametric Statistics**					
378					5% A-D Critical Value	0.774	Kaplan-Meier (KM) Method					
379					K-S Test Statistic	0.774	Mean	0.00479				
380					5% K-S Critical Value	0.211	SD	0.0109				
381	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.00239				
382							95% KM (t) UCL	0.00889				
383	**Assuming Gamma Distribution**						95% KM (z) UCL	0.00871				
384	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.00887				
385					Minimum	0.000001	95% KM (bootstrap t) UCL	0.032				
386					Maximum	0.054	95% KM (BCA) UCL	0.00973				
387					Mean	0.00469	95% KM (Percentile Bootstrap) UCL	0.00933				
388					Median	0.00244	95% KM (Chebyshev) UCL	0.0152				
389					SD	0.0112	97.5% KM (Chebyshev) UCL	0.0197				
390					k star	0.382	99% KM (Chebyshev) UCL	0.0285				
391					Theta star	0.0123						
392					Nu star	16.79	**Potential UCLs to Use**					
393					AppChi2	8.521	95% KM (Chebyshev) UCL	0.0152				
394				95% Gamma Approximate UCL (Use when n >= 40)		0.00923						
395				95% Adjusted Gamma UCL (Use when n < 40)		0.00973						
396	**Note: DL/2 is not a recommended method.**											
397												
398	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
399	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
400	**For additional insight, the user may want to consult a statistician.**											
401												
402												
403	**Iron**											
404												
405	**General Statistics**											
406					Number of Valid Observations	22	Number of Distinct Observations	21				
407					Number of Missing Values	1						
408												
409	**Raw Statistics**						**Log-transformed Statistics**					
410					Minimum	0.39	Minimum of Log Data	-0.942				
411					Maximum	29	Maximum of Log Data	3.367				
412					Mean	3.414	Mean of log Data	0.301				
413					Geometric Mean	1.351	SD of log Data	1.171				
414					Median	1.175						
415					SD	7.02						
416					Std. Error of Mean	1.497						

Coefficient of Variation	2.056	
Skewness	3.184	

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.449	Shapiro Wilk Test Statistic	0.853
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5.99	95% H-UCL	5.53
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.78
95% Adjusted-CLT UCL (Chen-1995)	6.962	97.5% Chebyshev (MVUE) UCL	7.175
95% Modified-t UCL (Johnson-1978)	6.159	99% Chebyshev (MVUE) UCL	9.915
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.598	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.705		
MLE of Mean	3.414		
MLE of Standard Deviation	4.413		
nu star	26.33		
Approximate Chi Square Value (.05)	15.63	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0386	95% CLT UCL	5.876
Adjusted Chi Square Value	15.02	95% Jackknife UCL	5.99
		95% Standard Bootstrap UCL	5.782
Anderson-Darling Test Statistic	2.389	95% Bootstrap-t UCL	20.78
Anderson-Darling 5% Critical Value	0.791	95% Hall's Bootstrap UCL	19.88
Kolmogorov-Smirnov Test Statistic	0.259	95% Percentile Bootstrap UCL	5.935
Kolmogorov-Smirnov 5% Critical Value	0.194	95% BCA Bootstrap UCL	7.096
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9.938
		97.5% Chebyshev(Mean, Sd) UCL	12.76
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	18.31
95% Approximate Gamma UCL (Use when n >= 40)	5.75		
95% Adjusted Gamma UCL (Use when n < 40)	5.985		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	9.938

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Lead

General Statistics

Number of Valid Data	22	Number of Detected Data	18
Number of Distinct Detected Data	15	Number of Non-Detect Data	4
Number of Missing Values	1	Percent Non-Detects	18.18%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.00016	Minimum Detected	-8.74
Maximum Detected	0.11	Maximum Detected	-2.207

	A	B	C	D	E	F	G	H	I	J	K	L
469					Mean of Detected	0.00789					Mean of Detected	-6.63
470					SD of Detected	0.0257					SD of Detected	1.498
471					Minimum Non-Detect	0.0001					Minimum Non-Detect	-9.21
472					Maximum Non-Detect	0.001					Maximum Non-Detect	-6.908
473												
474	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	11
475	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	11
476	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	50.00%
477												
478	**UCL Statistics**											
479	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
480					Shapiro Wilk Test Statistic	0.316					Shapiro Wilk Test Statistic	0.852
481					5% Shapiro Wilk Critical Value	0.897					5% Shapiro Wilk Critical Value	0.897
482	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
483												
484	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
485					DL/2 Substitution Method						DL/2 Substitution Method	
486					Mean	0.00649					Mean	-7.12
487					SD	0.0233					SD	1.772
488					95% DL/2 (t) UCL	0.015					95% H-Stat (DL/2) UCL	0.0168
489												
490					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
491	**MLE yields a negative mean**										Mean in Log Scale	-7.15
492											SD in Log Scale	1.788
493											Mean in Original Scale	0.00648
494											SD in Original Scale	0.0233
495											95% t UCL	0.015
496											95% Percentile Bootstrap UCL	0.0159
497											95% BCA Bootstrap UCL	0.022
498											95% H-UCL	0.0172
499												
500	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
501					k star (bias corrected)	0.347	**Data do not follow a Discernable Distribution (0.05)**					
502					Theta Star	0.0227						
503					nu star	12.5						
504												
505					A-D Test Statistic	3.002	**Nonparametric Statistics**					
506					5% A-D Critical Value	0.827					Kaplan-Meier (KM) Method	
507					K-S Test Statistic	0.827					Mean	0.00649
508					5% K-S Critical Value	0.219					SD	0.0228
509	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	0.00499
510											95% KM (t) UCL	0.0151
511	**Assuming Gamma Distribution**										95% KM (z) UCL	0.0147
512					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.015
513					Minimum	0.000001					95% KM (bootstrap t) UCL	0.184
514					Maximum	0.11					95% KM (BCA) UCL	0.0165
515					Mean	0.00646					95% KM (Percentile Bootstrap) UCL	0.016
516					Median	0.00092					95% KM (Chebyshev) UCL	0.0283
517					SD	0.0233					97.5% KM (Chebyshev) UCL	0.0377
518					k star	0.243					99% KM (Chebyshev) UCL	0.0562
519					Theta star	0.0266						
520					Nu star	10.68	**Potential UCLs to Use**					

521					AppChi2	4.374					97.5% KM (Chebyshev) UCL	0.0377
522				95% Gamma Approximate UCL (Use when n >= 40)		0.0158						
523				95% Adjusted Gamma UCL (Use when n < 40)		0.0169						
524	**Note: DL/2 is not a recommended method.**											
525												
526	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
527	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
528	**For additional insight, the user may want to consult a statistician.**											
529												
530												
531	**Manganese**											
532												
533	**General Statistics**											
534					Number of Valid Observations	22					Number of Distinct Observations	19
535					Number of Missing Values	1						
536												
537	**Raw Statistics**						**Log-transformed Statistics**					
538					Minimum	0.03					Minimum of Log Data	-3.507
539					Maximum	9.3					Maximum of Log Data	2.23
540					Mean	0.908					Mean of log Data	-1.185
541					Geometric Mean	0.306					SD of log Data	1.448
542					Median	0.203						
543					SD	1.957						
544					Std. Error of Mean	0.417						
545					Coefficient of Variation	2.156						
546					Skewness	4.102						
547												
548	**Relevant UCL Statistics**											
549	**Normal Distribution Test**						**Lognormal Distribution Test**					
550					Shapiro Wilk Test Statistic	0.443					Shapiro Wilk Test Statistic	0.963
551					Shapiro Wilk Critical Value	0.911					Shapiro Wilk Critical Value	0.911
552	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
553												
554	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
555					95% Student's-t UCL	1.626					95% H-UCL	2.442
556	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	2.096
557					95% Adjusted-CLT UCL (Chen-1995)	1.984					97.5% Chebyshev (MVUE) UCL	2.657
558					95% Modified-t UCL (Johnson-1978)	1.686					99% Chebyshev (MVUE) UCL	3.758
559												
560	**Gamma Distribution Test**						**Data Distribution**					
561					k star (bias corrected)	0.524	**Data appear Lognormal at 5% Significance Level**					
562					Theta Star	1.732						
563					MLE of Mean	0.908						
564					MLE of Standard Deviation	1.254						
565					nu star	23.06						
566					Approximate Chi Square Value (.05)	13.14	**Nonparametric Statistics**					
567					Adjusted Level of Significance	0.0386					95% CLT UCL	1.594
568					Adjusted Chi Square Value	12.58					95% Jackknife UCL	1.626
569											95% Standard Bootstrap UCL	1.584
570					Anderson-Darling Test Statistic	1.086					95% Bootstrap-t UCL	3.264
571					Anderson-Darling 5% Critical Value	0.798					95% Hall's Bootstrap UCL	4.09
572					Kolmogorov-Smirnov Test Statistic	0.213					95% Percentile Bootstrap UCL	1.671

573				Kolmogorov-Smirnov 5% Critical Value	0.195					95% BCA Bootstrap UCL	2.211
574				**Data not Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	2.726
575										97.5% Chebyshev(Mean, Sd) UCL	3.513
576				**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	5.059
577				95% Approximate Gamma UCL (Use when n >= 40)	1.594						
578				95% Adjusted Gamma UCL (Use when n < 40)	1.664						
579											
580				**Potential UCL to Use**						Use 95% Chebyshev (Mean, Sd) UCL	2.726
581											
582	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
583	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**										
584	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**										
585											
586											
587	**Bromide**										
588											
589	**General Statistics**										
590				Number of Valid Data	22					Number of Detected Data	2
591				Number of Distinct Detected Data	2					Number of Non-Detect Data	20
592				Number of Missing Values	1					Percent Non-Detects	90.91%
593											
594				**Raw Statistics**						**Log-transformed Statistics**	
595				Minimum Detected	0.1					Minimum Detected	-2.303
596				Maximum Detected	0.12					Maximum Detected	-2.12
597				Mean of Detected	0.11					Mean of Detected	-2.211
598				SD of Detected	0.0141					SD of Detected	0.129
599				Minimum Non-Detect	0.1					Minimum Non-Detect	-2.303
600				Maximum Non-Detect	0.1					Maximum Non-Detect	-2.303
601											
602											
603	**Warning: Data set has only 2 Distinct Detected Values.**										
604	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**										
605	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**										
606											
607	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**										
608											
609	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**										
610	**Those methods will return a 'N/A' value on your output display!**										
611											
612	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**										
613	**However, results obtained using 4 to 9 distinct values may not be reliable.**										
614	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**										
615											
616											
617	**UCL Statistics**										
618				**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**	
619				Shapiro Wilk Test Statistic	N/A					Shapiro Wilk Test Statistic	N/A
620				5% Shapiro Wilk Critical Value	N/A					5% Shapiro Wilk Critical Value	N/A
621				**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**	
622											
623				**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
624				DL/2 Substitution Method						DL/2 Substitution Method	

625					Mean	0.0555					Mean	-2.924
626					SD	0.0179					SD	0.232
627					95% DL/2 (t) UCL	0.062					95% H-Stat (DL/2) UCL	0.0604
628												
629					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
630					**MLE method failed to converge properly**						Mean in Log Scale	N/A
631											SD in Log Scale	N/A
632											Mean in Original Scale	N/A
633											SD in Original Scale	N/A
634											95% t UCL	N/A
635											95% Percentile Bootstrap UCL	N/A
636											95% BCA Bootstrap UCL	N/A
637											95% H-UCL	N/A
638												
639					**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**	
640					k star (bias corrected)	N/A					**Data do not follow a Discernable Distribution (0.05)**	
641					Theta Star	N/A						
642					nu star	N/A						
643												
644					A-D Test Statistic	N/A					**Nonparametric Statistics**	
645					5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method	
646					K-S Test Statistic	N/A					Mean	0.101
647					5% K-S Critical Value	N/A					SD	0.00417
648					**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.00126
649											95% KM (t) UCL	0.103
650					**Assuming Gamma Distribution**						95% KM (z) UCL	0.103
651					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	N/A
652					Minimum	N/A					95% KM (bootstrap t) UCL	N/A
653					Maximum	N/A					95% KM (BCA) UCL	N/A
654					Mean	N/A					95% KM (Percentile Bootstrap) UCL	N/A
655					Median	N/A					95% KM (Chebyshev) UCL	0.106
656					SD	N/A					97.5% KM (Chebyshev) UCL	0.109
657					k star	N/A					99% KM (Chebyshev) UCL	0.113
658					Theta star	N/A						
659					Nu star	N/A					**Potential UCLs to Use**	
660					AppChi2	N/A					95% KM (t) UCL	0.103
661					95% Gamma Approximate UCL (Use when n >= 40)	N/A					95% KM (% Bootstrap) UCL	N/A
662					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
663	**Note: DL/2 is not a recommended method.**											
664												
665	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
666	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
667	**For additional insight, the user may want to consult a statistician.**											
668												
669												
670	**Hydrazine**											
671												
672	**General Statistics**											
673					Number of Valid Data	22					Number of Detected Data	1
674					Number of Distinct Detected Data	1					Number of Non-Detect Data	21
675					Number of Missing Values	1					Percent Non-Detects	95.45%
676												

	A	B	C	D	E	F	G	H	I	J	K	L
677	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
678	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
679												
680	**The data set for variable Hydrazine was not processed!**											
681												
682												
683												
684	**Kempore (Azodicarbonamide)**											
685												
686	**General Statistics**											
687						Number of Valid Data	4			Number of Detected Data		1
688						Number of Distinct Detected Data	1			Number of Non-Detect Data		3
689						Number of Missing Values	10			Percent Non-Detects		75.00%
690												
691	**Warning: This data set only has 4 observations!**											
692	**Data set is too small to compute reliable and meaningful statistics and estimates!**											
693	**The data set for variable Kempore (Azodicarbonamide) was not processed!**											
694												
695	**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**											
696	**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
697												
698												

Surface Water – Off-PWD

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Sheet1.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

2,4,4-Trimethyl-1-pentene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00071	Minimum Detected	-7.25
Maximum Detected	0.0071	Maximum Detected	-4.948
Mean of Detected	0.00344	Mean of Detected	-6.063
SD of Detected	0.0033	SD of Detected	1.153
Minimum Non-Detect	0.001	Minimum Non-Detect	-6.908
Maximum Non-Detect	0.001	Maximum Non-Detect	-6.908

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.939	Shapiro Wilk Test Statistic	0.997
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00197	Mean	-6.832
SD	0.00263	SD	1.114
95% DL/2 (t) UCL	0.00413	95% H-Stat (DL/2) UCL	0.0191
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-6.715
		SD in Log Scale	1.099
		Mean in Original Scale	0.00208
		SD in Original Scale	0.00258
		95% t UCL	0.0042
		95% Percentile Bootstrap UCL	0.00391
		95% BCA Bootstrap UCL	0.0045
		95% H-UCL	0.02

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.00207
SD	0.00234
SE of Mean	0.00117
95% KM (t) UCL	0.00443
95% KM (z) UCL	0.004
95% KM (jackknife) UCL	0.00429
95% KM (bootstrap t) UCL	0.00604
95% KM (BCA) UCL	0.0071
95% KM (Percentile Bootstrap) UCL	0.0071
95% KM (Chebyshev) UCL	0.00718
97.5% KM (Chebyshev) UCL	0.00938
99% KM (Chebyshev) UCL	0.0137

Potential UCLs to Use	
95% KM (t) UCL	0.00443
95% KM (Percentile Bootstrap) UCL	0.0071

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

2,4,4-Trimethyl-2-pentene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 2,4,4-Trimethyl-2-pentene was not processed!

Carbon disulfide

General Statistics

Number of Valid Data	6	Number of Detected Data	3

Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.001	Minimum Detected	-6.908
Maximum Detected	0.0025	Maximum Detected	-5.991
Mean of Detected	0.00153	Mean of Detected	-6.571
SD of Detected	0.00084	SD of Detected	0.504
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.8	Shapiro Wilk Test Statistic	0.827
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00327	Mean	-5.934
SD	0.00197	SD	0.766
95% DL/2 (t) UCL	0.00489	95% H-Stat (DL/2) UCL	0.0113
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-6.571
		SD in Log Scale	0.431
		Mean in Original Scale	0.00152
		SD in Original Scale	0.00068
		95% t UCL	0.00208
		95% Percentile Bootstrap UCL	0.00196
		95% BCA Bootstrap UCL	0.00199
		95% H-UCL	0.00248

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.00153
5% K-S Critical Value	N/A	SD	0.00068
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00048
		95% KM (t) UCL	0.00251

Assuming Gamma Distribution		95% KM (z) UCL	0.00233
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.00262
Minimum	N/A	95% KM (bootstrap t) UCL	0.0114
Maximum	N/A	95% KM (BCA) UCL	0.00215
Mean	N/A	95% KM (Percentile Bootstrap) UCL	0.0025
Median	N/A	95% KM (Chebyshev) UCL	0.00364
SD	N/A	97.5% KM (Chebyshev) UCL	0.00456
k star	N/A	99% KM (Chebyshev) UCL	0.00635
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.00251
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	0.0025
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Formaldehyde

General Statistics

Number of Valid Data	4	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	1
		Percent Non-Detects	25.00%

Warning: This data set only has 4 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Formaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Toluene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Toluene was not processed!

3 & 4 Methylphenol

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00073	Minimum Detected	-7.222
Maximum Detected	0.00076	Maximum Detected	-7.182
Mean of Detected	0.00075	Mean of Detected	-7.202
SD of Detected	2.1E-05	SD of Detected	0.0285
Minimum Non-Detect	0.0045	Minimum Non-Detect	-5.404
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00179	Mean	-6.448
SD	0.00082	SD	0.586
95% DL/2 (t) UCL	0.00246	95% H-Stat (DL/2) UCL	0.00397
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A

95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00075
SD	1.5E-05
SE of Mean	1.5E-05
95% KM (t) UCL	0.00078
95% KM (z) UCL	0.00077
95% KM (jackknife) UCL	0.00078
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.00076
95% KM (Percentile Bootstrap) UCL	0.00076
95% KM (Chebyshev) UCL	0.00081
97.5% KM (Chebyshev) UCL	0.00084
99% KM (Chebyshev) UCL	0.00089

Potential UCLs to Use

95% KM (t) UCL	0.00078
95% KM (% Bootstrap) UCL	0.00076

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

4-Nitrophenol

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 4-Nitrophenol was not processed!

Acenaphthene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Acenaphthene was not processed!

Benzo(a)anthracene

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00024	Minimum Detected	-8.335
Maximum Detected	0.002	Maximum Detected	-6.215
Mean of Detected	0.00112	Mean of Detected	-7.275
SD of Detected	0.00124	SD of Detected	1.499
Minimum Non-Detect	0.00027	Minimum Non-Detect	-8.217
Maximum Non-Detect	0.0003	Maximum Non-Detect	-8.112

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	1
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	83.33%

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00047
SD	0.00075
95% DL/2 (t) UCL	0.00109
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-8.348
SD	1.069
95% H-Stat (DL/2) UCL	0.00338
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00053
SD	0.00066
SE of Mean	0.00038
95% KM (t) UCL	0.0013
95% KM (z) UCL	0.00116
95% KM (jackknife) UCL	0.00191
95% KM (bootstrap t) UCL	0.00053
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	0.002
95% KM (Chebyshev) UCL	0.00218
97.5% KM (Chebyshev) UCL	0.0029
99% KM (Chebyshev) UCL	0.0043

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(a)pyrene

General Statistics

Number of Valid Data	6	Number of Detected Data	4

Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00012	Minimum Detected	-9.028
Maximum Detected	0.0042	Maximum Detected	-5.473
Mean of Detected	0.00128	Mean of Detected	-7.589
SD of Detected	0.00196	SD of Detected	1.556
Minimum Non-Detect	0.00018	Minimum Non-Detect	-8.623
Maximum Non-Detect	0.0002	Maximum Non-Detect	-8.517

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	3
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.716	Shapiro Wilk Test Statistic	0.936
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00089	Mean	-8.147
SD	0.00163	SD	1.484
95% DL/2 (t) UCL	0.00223	95% H-Stat (DL/2) UCL	0.0414
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-8.217
		SD in Log Scale	1.549
		Mean in Original Scale	0.00088
		SD in Original Scale	0.00164
		95% t UCL	0.00223
		95% Percentile Bootstrap UCL	0.00217
		95% BCA Bootstrap UCL	0.00231
		95% H-UCL	0.0594

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.331	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	0.00388	
nu star	2.644	
A-D Test Statistic	0.427	**Nonparametric Statistics**
5% A-D Critical Value	0.674	Kaplan-Meier (KM) Method
K-S Test Statistic	0.674	Mean 0.0009
5% K-S Critical Value	0.407	SD 0.00149
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 0.0007

95% KM (t) UCL	0.00231
95% KM (z) UCL	0.00205
95% KM (jackknife) UCL	0.00222
95% KM (bootstrap t) UCL	0.00751
95% KM (BCA) UCL	0.00227
95% KM (Percentile Bootstrap) UCL	0.00221
95% KM (Chebyshev) UCL	0.00395
97.5% KM (Chebyshev) UCL	0.00527
99% KM (Chebyshev) UCL	0.00787

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-06
Maximum	0.0042
Mean	0.00086
Median	0.00017
SD	0.00165
k star	0.246
Theta star	0.00348
Nu star	2.952
AppChi2	0.358
95% Gamma Approximate UCL (Use when n >= 40)	0.00705
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Potential UCLs to Use

95% KM (BCA) UCL 0.00227

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00019	Minimum Detected	-8.568
Maximum Detected	0.0077	Maximum Detected	-4.867
Mean of Detected	0.00232	Mean of Detected	-7.098
SD of Detected	0.00361	SD of Detected	1.665
Minimum Non-Detect	0.00027	Minimum Non-Detect	-8.217
Maximum Non-Detect	0.0003	Maximum Non-Detect	-8.112

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	2
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	66.67%

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.718	Shapiro Wilk Test Statistic	0.921
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.00159
SD	0.00301
95% DL/2 (t) UCL	0.00407
Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-7.685
SD	1.578
95% H-Stat (DL/2) UCL	0.124
Log ROS Method	
Mean in Log Scale	-7.651
SD in Log Scale	1.56
Mean in Original Scale	0.0016
SD in Original Scale	0.00301
95% t UCL	0.00408
95% Percentile Bootstrap UCL	0.00395
95% BCA Bootstrap UCL	0.00519
95% H-UCL	0.113

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.316
Theta Star	0.00733
nu star	2.531
A-D Test Statistic	0.428
5% A-D Critical Value	0.677
K-S Test Statistic	0.677
5% K-S Critical Value	0.408
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-06
Maximum	0.0077
Mean	0.00155
Median	0.00024
SD	0.00304
k star	0.235
Theta star	0.00658
Nu star	2.822
AppChi2	0.322
95% Gamma Approximate UCL (Use when n >= 40)	0.0136
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.00162
SD	0.00274
SE of Mean	0.00129
95% KM (t) UCL	0.00422
95% KM (z) UCL	0.00374
95% KM (jackknife) UCL	0.00407
95% KM (bootstrap t) UCL	0.0126
95% KM (BCA) UCL	0.004
95% KM (Percentile Bootstrap) UCL	0.004
95% KM (Chebyshev) UCL	0.00725
97.5% KM (Chebyshev) UCL	0.00968
99% KM (Chebyshev) UCL	0.0145
Potential UCLs to Use	
95% KM (BCA) UCL	0.004

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(ghi)perylene

General Statistics

Number of Valid Data	6	Number of Detected Data	3

Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00011	Minimum Detected	-9.115
Maximum Detected	0.0046	Maximum Detected	-5.382
Mean of Detected	0.00175	Mean of Detected	-7.34
SD of Detected	0.00248	SD of Detected	1.873
Minimum Non-Detect	0.00045	Minimum Non-Detect	-7.706
Maximum Non-Detect	0.0005	Maximum Non-Detect	-7.601

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	2
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	66.67%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.821	Shapiro Wilk Test Statistic	0.993
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00099	Mean	-7.852
SD	0.00177	SD	1.311
95% DL/2 (t) UCL	0.00245	95% H-Stat (DL/2) UCL	0.0195
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-8.338
		SD in Log Scale	1.664
		Mean in Original Scale	0.00093
		SD in Original Scale	0.00181
		95% t UCL	0.00241
		95% Percentile Bootstrap UCL	0.00234
		95% BCA Bootstrap UCL	0.00249
		95% H-UCL	0.118

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.00093

5% K-S Critical Value	N/A	SD	0.00165
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00082
		95% KM (t) UCL	0.00259
Assuming Gamma Distribution		95% KM (z) UCL	0.00229
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.00235
Minimum	N/A	95% KM (bootstrap t) UCL	0.00696
Maximum	N/A	95% KM (BCA) UCL	0.0046
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	0.00452
SD	N/A	97.5% KM (Chebyshev) UCL	0.00608
k star	N/A	99% KM (Chebyshev) UCL	0.00913
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.00259
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(k)fluoranthene

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.0005	Minimum Detected	-7.601
Maximum Detected	0.0026	Maximum Detected	-5.952
Mean of Detected	0.00155	Mean of Detected	-6.777
SD of Detected	0.00148	SD of Detected	1.166
Minimum Non-Detect	0.00027	Minimum Non-Detect	-8.217
Maximum Non-Detect	0.0003	Maximum Non-Detect	-8.112

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	2
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	66.67%

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00061
SD	0.00099
95% DL/2 (t) UCL	0.00142
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-8.181
SD	1.207
95% H-Stat (DL/2) UCL	0.00794
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00085
SD	0.00078
SE of Mean	0.00045
95% KM (t) UCL	0.00176
95% KM (z) UCL	0.00159
95% KM (jackknife) UCL	0.00249
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.0026
95% KM (Percentile Bootstrap) UCL	0.0026
95% KM (Chebyshev) UCL	0.00282
97.5% KM (Chebyshev) UCL	0.00367
99% KM (Chebyshev) UCL	0.00535

Potential UCLs to Use

95% KM (BCA) UCL	0.0026

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzoic Acid

General Statistics

Number of Valid Data	6	Number of Detected Data	5
Number of Distinct Detected Data	3	Number of Non-Detect Data	1
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0019	Minimum Detected	-6.266
Maximum Detected	0.0042	Maximum Detected	-5.473
Mean of Detected	0.00248	Mean of Detected	-6.047
SD of Detected	0.00097	SD of Detected	0.324
Minimum Non-Detect	0.0045	Minimum Non-Detect	-5.404
Maximum Non-Detect	0.0045	Maximum Non-Detect	-5.404

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.627	Shapiro Wilk Test Statistic	0.662
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00244	Mean	-6.055
SD	0.00087	SD	0.291
95% DL/2 (t) UCL	0.00316	95% H-Stat (DL/2) UCL	0.00326
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-6.047
		SD in Log Scale	0.29
		Mean in Original Scale	0.00246
		SD in Original Scale	0.00086
		95% t UCL	0.00317
		95% Percentile Bootstrap UCL	0.00312
		95% BCA Bootstrap UCL	0.00319
		95% H-UCL	0.00328

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	4.391
Theta Star	0.00056
nu star	43.91
A-D Test Statistic	1.062
5% A-D Critical Value	0.679
K-S Test Statistic	0.679
5% K-S Critical Value	0.358

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0019
Maximum	0.0042
Mean	0.00249
Median	0.0021
SD	0.00086
k star	6.47
Theta star	0.00039
Nu star	77.64
AppChi2	58.34
95% Gamma Approximate UCL (Use when n >= 40)	0.00332
95% Adjusted Gamma UCL (Use when n < 40)	0.0037

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.00248
SD	0.00086
SE of Mean	0.00043
95% KM (t) UCL	0.00335
95% KM (z) UCL	0.00319
95% KM (jackknife) UCL	0.00337
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.00315
95% KM (Percentile Bootstrap) UCL	0.00315
95% KM (Chebyshev) UCL	0.00436
97.5% KM (Chebyshev) UCL	0.00518
99% KM (Chebyshev) UCL	0.00678

Potential UCLs to Use

95% KM (Chebyshev) UCL 0.00436

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Chrysene

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	3	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00018	Minimum Detected	-8.623
Maximum Detected	0.0053	Maximum Detected	-5.24
Mean of Detected	0.00158	Mean of Detected	-7.448
SD of Detected	0.00249	SD of Detected	1.597
Minimum Non-Detect	0.00091	Minimum Non-Detect	-7.002
Maximum Non-Detect	0.001	Maximum Non-Detect	-6.908

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	1
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	83.33%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.698
5% Shapiro Wilk Critical Value	0.748

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00121
SD	0.00201
95% DL/2 (t) UCL	0.00287
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.846
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-7.515
SD	1.242
95% H-Stat (DL/2) UCL	0.0185
Log ROS Method	
Mean in Log Scale	-7.658
SD in Log Scale	1.279
Mean in Original Scale	0.00116
SD in Original Scale	0.00204
95% t UCL	0.00283
95% Percentile Bootstrap UCL	0.00278
95% BCA Bootstrap UCL	0.00287
95% H-UCL	0.0197

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.321
Theta Star	0.00494
nu star	2.565
A-D Test Statistic	0.539
5% A-D Critical Value	0.676
K-S Test Statistic	0.676
5% K-S Critical Value	0.408

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00015
Maximum	0.0053
Mean	0.00111
Median	0.00018
SD	0.00206
k star	0.397
Theta star	0.00279
Nu star	4.762
AppChi2	1.044
95% Gamma Approximate UCL (Use when n >= 40)	0.00504
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00117
SD	0.00186
SE of Mean	0.00088
95% KM (t) UCL	0.00294
95% KM (z) UCL	0.00262
95% KM (jackknife) UCL	0.00286
95% KM (bootstrap t) UCL	0.011
95% KM (BCA) UCL	0.00274
95% KM (Percentile Bootstrap) UCL	0.00274
95% KM (Chebyshev) UCL	0.00501
97.5% KM (Chebyshev) UCL	0.00667
99% KM (Chebyshev) UCL	0.00993

Potential UCLs to Use

95% KM (BCA) UCL	0.00274

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Dibenz(a,h)anthracene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Dibenz(a,h)anthracene was not processed!

Di-n-octylphthalate

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.00081	Minimum Detected	-7.118
Maximum Detected	0.00087	Maximum Detected	-7.047
Mean of Detected	0.00084	Mean of Detected	-7.083
SD of Detected	4.2E-05	SD of Detected	0.0505
Minimum Non-Detect	0.0045	Minimum Non-Detect	-5.404
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00182
SD	0.00077
95% DL/2 (t) UCL	0.00245
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-6.408
SD	0.525
95% H-Stat (DL/2) UCL	0.00356
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00084
SD	0.00003
SE of Mean	0.00003
95% KM (t) UCL	0.0009
95% KM (z) UCL	0.00089
95% KM (jackknife) UCL	0.00092
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.00087
95% KM (Percentile Bootstrap) UCL	0.00087
95% KM (Chebyshev) UCL	0.00097
97.5% KM (Chebyshev) UCL	0.00103
99% KM (Chebyshev) UCL	0.00114

Potential UCLs to Use

95% KM (t) UCL	0.0009
95% KM (% Bootstrap) UCL	0.00087

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Fluoranthene

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.00023	Minimum Detected	-8.377
Maximum Detected	0.0051	Maximum Detected	-5.279
Mean of Detected	0.00162	Mean of Detected	-7.245
SD of Detected	0.00234	SD of Detected	1.461
Minimum Non-Detect	0.00091	Minimum Non-Detect	-7.002
Maximum Non-Detect	0.001	Maximum Non-Detect	-6.908

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	1
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	83.33%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.729	Shapiro Wilk Test Statistic	0.866
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00124	Mean	-7.38
SD	0.00191	SD	1.151
95% DL/2 (t) UCL	0.00281	95% H-Stat (DL/2) UCL	0.0133
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-7.534
		SD in Log Scale	1.223
		Mean in Original Scale	0.00118
		SD in Original Scale	0.00194
		95% t UCL	0.00278
		95% Percentile Bootstrap UCL	0.00267
		95% BCA Bootstrap UCL	0.0029
		95% H-UCL	0.0165

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.349	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.00464		
nu star	2.795		
A-D Test Statistic	0.482	**Nonparametric Statistics**	
5% A-D Critical Value	0.671	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.671	Mean	0.00119
5% K-S Critical Value	0.405	SD	0.00177
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.00084
		95% KM (t) UCL	0.00287
Assuming Gamma Distribution		95% KM (z) UCL	0.00257
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.00279
Minimum	1E-06	95% KM (bootstrap t) UCL	0.00734
Maximum	0.0051	95% KM (BCA) UCL	0.00278
Mean	0.00111	95% KM (Percentile Bootstrap) UCL	0.00267
Median	0.00024	95% KM (Chebyshev) UCL	0.00484
SD	0.00198	97.5% KM (Chebyshev) UCL	0.00641
k star	0.297	99% KM (Chebyshev) UCL	0.00952
Theta star	0.00373		
Nu star	3.559	**Potential UCLs to Use**	
AppChi2	0.556	95% KM (BCA) UCL	0.00278
95% Gamma Approximate UCL (Use when n >= 40)	0.00709		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Fluorene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Fluorene was not processed!

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	6	Number of Detected Data	3

Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	9.8E-05	Minimum Detected	-9.231
Maximum Detected	0.004	Maximum Detected	-5.521
Mean of Detected	0.00153	Mean of Detected	-7.458
SD of Detected	0.00215	SD of Detected	1.86
Minimum Non-Detect	0.00045	Minimum Non-Detect	-7.706
Maximum Non-Detect	0.0005	Maximum Non-Detect	-7.601

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	5
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	1
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	83.33%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.824	Shapiro Wilk Test Statistic	0.994
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00088	Mean	-7.911
SD	0.00153	SD	1.277
95% DL/2 (t) UCL	0.00214	95% H-Stat (DL/2) UCL	0.0152
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-8.346
		SD in Log Scale	1.585
		Mean in Original Scale	0.00082
		SD in Original Scale	0.00157
		95% t UCL	0.00211
		95% Percentile Bootstrap UCL	0.00205
		95% BCA Bootstrap UCL	0.00213
		95% H-UCL	0.0671

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.00083

5% K-S Critical Value	N/A	SD	0.00143
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00071
		95% KM (t) UCL	0.00227
Assuming Gamma Distribution		95% KM (z) UCL	0.002
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.00207
Minimum	N/A	95% KM (bootstrap t) UCL	0.00659
Maximum	N/A	95% KM (BCA) UCL	0.004
Mean	N/A	95% KM (Percentile Bootstrap) UCL	0.004
Median	N/A	95% KM (Chebyshev) UCL	0.00394
SD	N/A	97.5% KM (Chebyshev) UCL	0.00529
k star	N/A	99% KM (Chebyshev) UCL	0.00794
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.00227
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	0.004
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

N-Nitrosodimethylamine

General Statistics

Number of Valid Data	6	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	1
		Percent Non-Detects	16.67%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	5.6E-06	Minimum Detected	-12.09
Maximum Detected	0.00011	Maximum Detected	-9.115
Mean of Detected	5.5E-05	Mean of Detected	-10.22
SD of Detected	4.2E-05	SD of Detected	1.197
Minimum Non-Detect	3.8E-05	Minimum Non-Detect	-10.18
Maximum Non-Detect	3.8E-05	Maximum Non-Detect	-10.18

Warning: There are only 5 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.971	Shapiro Wilk Test Statistic	0.897
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	4.9E-05
SD	4E-05
95% DL/2 (t) UCL	8.2E-05
Maximum Likelihood Estimate(MLE) Method	
Mean	8.3E-05
SD	2.1E-05
95% MLE (t) UCL	1E-04
95% MLE (Tiku) UCL	0.00011

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-10.33
SD	1.103
95% H-Stat (DL/2) UCL	0.00055
Log ROS Method	
Mean in Log Scale	-10.41
SD in Log Scale	1.164
Mean in Original Scale	4.8E-05
SD in Original Scale	4.1E-05
95% t UCL	8.2E-05
95% Percentile Bootstrap UCL	7.4E-05
95% BCA Bootstrap UCL	7.6E-05
95% H UCL	0.00069

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.679
Theta Star	8.1E-05
nu star	6.793
A-D Test Statistic	0.285
5% A-D Critical Value	0.688
K-S Test Statistic	0.688
5% K-S Critical Value	0.362

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	5.6E-06
Maximum	0.00011
Mean	4.8E-05
Median	4.2E-05
SD	4.1E-05
k star	0.737
Theta star	6.5E-05
Nu star	8.846
AppChi2	3.234
95% Gamma Approximate UCL (Use when n >= 40)	0.00013
95% Adjusted Gamma UCL (Use when n < 40)	0.0002

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	4.8E-05
SD	3.7E-05
SE of Mean	1.7E-05
95% KM (t) UCL	8.3E-05
95% KM (z) UCL	7.6E-05
95% KM (jackknife) UCL	8.3E-05
95% KM (bootstrap t) UCL	8.5E-05
95% KM (BCA) UCL	7.6E-05
95% KM (Percentile Bootstrap) UCL	7.7E-05
95% KM (Chebyshev) UCL	0.00012
97.5% KM (Chebyshev) UCL	0.00016
99% KM (Chebyshev) UCL	0.00022

Potential UCLs to Use

95% KM (t) UCL	8.3E-05
95% KM (Percentile Bootstrap) UCL	7.7E-05

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Phenanthrene

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2

Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	8.1E-05	Minimum Detected	-9.421
Maximum Detected	0.0025	Maximum Detected	-5.991
Mean of Detected	0.00075	Mean of Detected	-8.168
SD of Detected	0.00117	SD of Detected	1.571
Minimum Non-Detect	0.00018	Minimum Non-Detect	-8.623
Maximum Non-Detect	0.0002	Maximum Non-Detect	-8.517

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	4
Number treated as Detected	2
Single DL Non-Detect Percentage	66.67%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.701	Shapiro Wilk Test Statistic	0.879
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00053	Mean	-8.533
SD	0.00097	SD	1.343
95% DL/2 (t) UCL	0.00133	95% H-Stat (DL/2) UCL	0.0118
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-8.545
		SD in Log Scale	1.35
		Mean in Original Scale	0.00053
		SD in Original Scale	0.00097
		95% t UCL	0.00133
		95% Percentile Bootstrap UCL	0.0013
		95% BCA Bootstrap UCL	0.00137
		95% H-UCL	0.0122

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.324	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	0.00231	
nu star	2.595	
A-D Test Statistic	0.505	**Nonparametric Statistics**
5% A-D Critical Value	0.675	Kaplan-Meier (KM) Method
K-S Test Statistic	0.675	Mean 0.00053
5% K-S Critical Value	0.408	SD 0.00088
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 0.00042
		95% KM (t) UCL 0.00137

Assuming Gamma Distribution		95% KM (z) UCL	0.00122
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.00133
Minimum	1E-06	95% KM (bootstrap t) UCL	0.034
Maximum	0.0025	95% KM (BCA) UCL	0.0013
Mean	0.0005	95% KM (Percentile Bootstrap) UCL	0.00133
Median	9.1E-05	95% KM (Chebyshev) UCL	0.00235
SD	0.00099	97.5% KM (Chebyshev) UCL	0.00314
k star	0.253	99% KM (Chebyshev) UCL	0.00468
Theta star	0.00198		
Nu star	3.037	**Potential UCLs to Use**	
AppChi2	0.383	95% KM (BCA) UCL	0.0013
95% Gamma Approximate UCL (Use when n >= 40)	0.00396		
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Phenol

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Phenol was not processed!

Pyrene

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00022	Minimum Detected	-8.422
Maximum Detected	0.012	Maximum Detected	-4.423
Mean of Detected	0.0034	Mean of Detected	-6.959
SD of Detected	0.00575	SD of Detected	1.834
Minimum Non-Detect	0.0045	Minimum Non-Detect	-5.404
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Note: Data have multiple DLs - Use of KM Method is recommended — Number treated as Non-Detect 5

For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Detected	1
Single DL Non-Detect Percentage	83.33%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.684
5% Shapiro Wilk Critical Value	0.748

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.879
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.00306
SD	0.00448
95% DL/2 (t) UCL	0.00675

Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-6.654
SD	1.497
95% H-Stat (DL/2) UCL	0.201

Log ROS Method

Mean in Log Scale	-7.203
SD in Log Scale	1.47
Mean in Original Scale	0.00242
SD in Original Scale	0.0047
95% t UCL	0.00629
95% Percentile Bootstrap UCL	0.00619
95% BCA Bootstrap UCL	0.00641
95% H-UCL	0.0972

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.291
Theta Star	0.0117
nu star	2.33
A-D Test Statistic	0.514
5% A-D Critical Value	0.681
K-S Test Statistic	0.681
5% K-S Critical Value	0.41

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	7.6E-05
Maximum	0.012
Mean	0.00229
Median	0.00025
SD	0.00477
k star	0.304
Theta star	0.00755
Nu star	3.642
AppChi2	0.586

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.00244
SD	0.00429
SE of Mean	0.00203
95% KM (t) UCL	0.00653
95% KM (z) UCL	0.00578
95% KM (jackknife) UCL	0.00633
95% KM (bootstrap t) UCL	0.0313
95% KM (BCA) UCL	0.00633
95% KM (Percentile Bootstrap) UCL	0.00614
95% KM (Chebyshev) UCL	0.0113
97.5% KM (Chebyshev) UCL	0.0151
99% KM (Chebyshev) UCL	0.0226

Potential UCLs to Use

95% KM (BCA) UCL	0.00633

95% Gamma Approximate UCL (Use when n >= 40)	0.0143
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Aluminum

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.1	Minimum of Log Data	-2.303
Maximum	1.6	Maximum of Log Data	0.47
Mean	0.82	Mean of log Data	-0.512
Geometric Mean	0.599	SD of log Data	1.022
Median	0.895		
SD	0.541		
Std. Error of Mean	0.221		
Coefficient of Variation	0.66		
Skewness	0.0158		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.97	Shapiro Wilk Test Statistic	0.872
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1.265	95% H-UCL	6.905
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.519
95% Adjusted-CLT UCL (Chen-1995)	1.185	97.5% Chebyshev (MVUE) UCL	3.217
95% Modified-t UCL (Johnson-1978)	1.266	99% Chebyshev (MVUE) UCL	4.59

Gamma Distribution Test **Data Distribution**

k star (bias corrected)	0.982
Theta Star	0.835
MLE of Mean	0.82
MLE of Standard Deviation	0.827
nu star	11.78
Approximate Chi Square Value (.05)	5.085
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	3.62
Anderson-Darling Test Statistic	0.359
Anderson-Darling 5% Critical Value	0.706
Kolmogorov-Smirnov Test Statistic	0.273
Kolmogorov-Smirnov 5% Critical Value	0.337

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	1.9
95% Adjusted Gamma UCL (Use when n < 40)	2.67

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	1.183
95% Jackknife UCL	1.265
95% Standard Bootstrap UCL	1.159
95% Bootstrap-t UCL	1.273
95% Hall's Bootstrap UCL	1.159
95% Percentile Bootstrap UCL	1.138
95% BCA Bootstrap UCL	1.132
95% Chebyshev(Mean, Sd) UCL	1.783
97.5% Chebyshev(Mean, Sd) UCL	2.2
99% Chebyshev(Mean, Sd) UCL	3.019

Potential UCL to Use Use 95% Student's-t UCL 1.265

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0038	Minimum Detected	-5.573
Maximum Detected	0.012	Maximum Detected	-4.423
Mean of Detected	0.0079	Mean of Detected	-4.998
SD of Detected	0.0058	SD of Detected	0.813
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00597
SD	0.00299
95% DL/2 (t) UCL	0.00843
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.198
SD	0.395
95% H-Stat (DL/2) UCL	0.00914
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00517
SD	0.00306
SE of Mean	0.00176
95% KM (t) UCL	0.00872
95% KM (z) UCL	0.00807
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.0129
97.5% KM (Chebyshev) UCL	0.0162
99% KM (Chebyshev) UCL	0.0227

Potential UCLs to Use

95% KM (t) UCL	0.00872
95% KM (% Bootstrap) UCL	N/A

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Barium

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.026	Minimum of Log Data	-3.65
Maximum	0.046	Maximum of Log Data	-3.079
Mean	0.0345	Mean of log Data	-3.388
Geometric Mean	0.0338	SD of log Data	0.224
Median	0.0325		
SD	0.00789		
Std. Error of Mean	0.00322		
Coefficient of Variation	0.229		
Skewness	0.631		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.935
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.041	95% H-UCL	0.0427
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0482
95% Adjusted-CLT UCL (Chen-1995)	0.0407	97.5% Chebyshev (MVUE) UCL	0.0541
95% Modified-t UCL (Johnson-1978)	0.0411	99% Chebyshev (MVUE) UCL	0.0658

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	12.01	**Data appear Normal at 5% Significance Level**
Theta Star	0.00287	
MLE of Mean	0.0345	
MLE of Standard Deviation	0.00995	

nu star	144.2
Approximate Chi Square Value (.05)	117.4
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	108.7
Anderson-Darling Test Statistic	0.318
Anderson-Darling 5% Critical Value	0.697
Kolmogorov-Smirnov Test Statistic	0.225
Kolmogorov-Smirnov 5% Critical Value	0.332

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	0.0424
95% Adjusted Gamma UCL (Use when n < 40)	0.0458

Nonparametric Statistics

95% CLT UCL	0.0398
95% Jackknife UCL	0.041
95% Standard Bootstrap UCL	0.0394
95% Bootstrap-t UCL	0.0462
95% Hall's Bootstrap UCL	0.0834
95% Percentile Bootstrap UCL	0.0393
95% BCA Bootstrap UCL	0.0398
95% Chebyshev(Mean, Sd) UCL	0.0485
97.5% Chebyshev(Mean, Sd) UCL	0.0546
99% Chebyshev(Mean, Sd) UCL	0.0666

Potential UCL to Use Use 95% Student's-t UCL 0.041

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Beryllium

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00017	Minimum Detected	-8.68
Maximum Detected	0.00026	Maximum Detected	-8.255
Mean of Detected	0.00021	Mean of Detected	-8.501
SD of Detected	4.7E-05	SD of Detected	0.22
Minimum Non-Detect	0.001	Minimum Non-Detect	-6.908
Maximum Non-Detect	0.001	Maximum Non-Detect	-6.908

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.907	Shapiro Wilk Test Statistic	0.93
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level **Data appear Lognormal at 5% Significance Level**

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00035
SD	0.00016
95% DL/2 (t) UCL	0.00049
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-8.051
SD	0.512
95% H-Stat (DL/2) UCL	0.00067
Log ROS Method	
Mean in Log Scale	-8.501
SD in Log Scale	0.194
Mean in Original Scale	0.00021
SD in Original Scale	4.1E-05
95% t UCL	0.00024
95% Percentile Bootstrap UCL	0.00023
95% BCA Bootstrap UCL	0.00023
95% H-UCL	0.00025

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00021
SD	3.9E-05
SE of Mean	2.7E-05
95% KM (t) UCL	0.00026
95% KM (z) UCL	0.00025
95% KM (jackknife) UCL	0.00027
95% KM (bootstrap t) UCL	0.00038
95% KM (BCA) UCL	0.00024
95% KM (Percentile Bootstrap) UCL	0.00026
95% KM (Chebyshev) UCL	0.00033
97.5% KM (Chebyshev) UCL	0.00038
99% KM (Chebyshev) UCL	0.00048

Potential UCLs to Use

95% KM (t) UCL	0.00026
95% KM (Percentile Bootstrap) UCL	0.00026

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Calcium

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 6

Raw Statistics

Minimum	6.1
Maximum	28
Mean	18.65
Geometric Mean	15.74
Median	22.5
SD	9.732
Std. Error of Mean	3.973
Coefficient of Variation	0.522
Skewness	-0.736

Log-transformed Statistics

Minimum of Log Data	1.808
Maximum of Log Data	3.332
Mean of log Data	2.756
SD of log Data	0.7

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.822
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.765
Shapiro Wilk Critical Value	0.788

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	26.66

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	23.91
95% Modified-t UCL (Johnson-1978)	26.46

Assuming Lognormal Distribution

95% H-UCL	54.24
95% Chebyshev (MVUE) UCL	42.98
97.5% Chebyshev (MVUE) UCL	53.28
99% Chebyshev (MVUE) UCL	73.49

Gamma Distribution Test

k star (bias corrected)	1.664
Theta Star	11.21
MLE of Mean	18.65
MLE of Standard Deviation	14.46
nu star	19.97
Approximate Chi Square Value (.05)	10.83
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	8.509
Anderson-Darling Test Statistic	0.754
Anderson-Darling 5% Critical Value	0.701
Kolmogorov-Smirnov Test Statistic	0.323
Kolmogorov-Smirnov 5% Critical Value	0.334

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	25.18
95% Jackknife UCL	26.66
95% Standard Bootstrap UCL	24.47
95% Bootstrap-t UCL	25.41
95% Hall's Bootstrap UCL	22.69
95% Percentile Bootstrap UCL	24.67
95% BCA Bootstrap UCL	23.67
95% Chebyshev(Mean, Sd) UCL	35.97

97.5% Chebyshev(Mean, Sd) UCL 43.46
99% Chebyshev(Mean, Sd) UCL 58.18

Assuming Gamma Distribution
95% Approximate Gamma UCL (Use when n >= 40) 34.39
95% Adjusted Gamma UCL (Use when n < 40) 43.78

Potential UCL to Use Use 95% Student's-t UCL 26.66

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

Chromium

General Statistics
Number of Valid Observations 6 Number of Distinct Observations 6

Raw Statistics		Log-transformed Statistics	
Minimum	0.0061	Minimum of Log Data	-5.099
Maximum	0.13	Maximum of Log Data	-2.04
Mean	0.0495	Mean of log Data	-3.586
Geometric Mean	0.0277	SD of log Data	1.238
Median	0.025		
SD	0.0524		
Std. Error of Mean	0.0214		
Coefficient of Variation	1.057		
Skewness	0.955		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.823	Shapiro Wilk Test Statistic	0.918
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution	
95% Student's-t UCL	0.0926
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	0.0936
95% Modified-t UCL (Johnson-1978)	0.094

Assuming Lognormal Distribution	
95% H-UCL	0.922
95% Chebyshev (MVUE) UCL	0.156
97.5% Chebyshev (MVUE) UCL	0.202
99% Chebyshev (MVUE) UCL	0.293

Gamma Distribution Test	
k star (bias corrected)	0.609
Theta Star	0.0813
MLE of Mean	0.0495
MLE of Standard Deviation	0.0635
nu star	7.304
Approximate Chi Square Value (.05)	2.339
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	1.456
Anderson-Darling Test Statistic	0.406
Anderson-Darling 5% Critical Value	0.715
Kolmogorov-Smirnov Test Statistic	0.268
Kolmogorov-Smirnov 5% Critical Value	0.341
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	0.0847
95% Jackknife UCL	0.0926
95% Standard Bootstrap UCL	0.0821
95% Bootstrap-t UCL	0.169
95% Hall's Bootstrap UCL	0.306
95% Percentile Bootstrap UCL	0.0845
95% BCA Bootstrap UCL	0.0887
95% Chebyshev(Mean, Sd) UCL	0.143
97.5% Chebyshev(Mean, Sd) UCL	0.183
99% Chebyshev(Mean, Sd) UCL	0.262

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	0.155
95% Adjusted Gamma UCL (Use when n < 40)	0.248

Potential UCL to Use	Use 95% Student's-t UCL 0.0926

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Cobalt

General Statistics			
Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	0.0033	Minimum of Log Data	-5.714
Maximum	0.018	Maximum of Log Data	-4.017
Mean	0.00972	Mean of log Data	-4.864
Geometric Mean	0.00772	SD of log Data	0.77
Median	0.0083		
SD	0.00665		
Std. Error of Mean	0.00272		
Coefficient of Variation	0.685		
Skewness	0.378		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.853
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.866
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
95% Student's-t UCL	0.0152
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	0.0146
95% Modified-t UCL (Johnson-1978)	0.0153

Assuming Lognormal Distribution	
95% H-UCL	0.0333
95% Chebyshev (MVUE) UCL	0.0231
97.5% Chebyshev (MVUE) UCL	0.0289
99% Chebyshev (MVUE) UCL	0.0402

Gamma Distribution Test	
k star (bias corrected)	1.274
Theta Star	0.00763
MLE of Mean	0.00972
MLE of Standard Deviation	0.00861
nu star	15.28
Approximate Chi Square Value (.05)	7.46
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	5.603
Anderson-Darling Test Statistic	0.448
Anderson-Darling 5% Critical Value	0.703
Kolmogorov-Smirnov Test Statistic	0.208
Kolmogorov-Smirnov 5% Critical Value	0.335

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	0.0199
95% Adjusted Gamma UCL (Use when n < 40)	0.0265

Data Distribution
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	0.0142
95% Jackknife UCL	0.0152
95% Standard Bootstrap UCL	0.0139
95% Bootstrap-t UCL	0.0161
95% Hall's Bootstrap UCL	0.0137
95% Percentile Bootstrap UCL	0.0141
95% BCA Bootstrap UCL	0.0142
95% Chebyshev(Mean, Sd) UCL	0.0216
97.5% Chebyshev(Mean, Sd) UCL	0.0267
99% Chebyshev(Mean, Sd) UCL	0.0367

Potential UCL to Use	Use 95% Student's-t UCL 0.0152

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Copper

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 6

Raw Statistics

Minimum	0.00079
Maximum	0.0061
Mean	0.00402
Geometric Mean	0.00339
Median	0.004
SD	0.00191
Std. Error of Mean	0.00078
Coefficient of Variation	0.477
Skewness	-0.813

Log-transformed Statistics

Minimum of Log Data	-7.143
Maximum of Log Data	-5.099
Mean of log Data	-5.687
SD of log Data	0.75

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.92
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.767
Shapiro Wilk Critical Value	0.788

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.00559

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.00502
95% Modified-t UCL (Johnson-1978)	0.00555

Assuming Lognormal Distribution

95% H-UCL	0.0137
95% Chebyshev (MVUE) UCL	0.0099
97.5% Chebyshev (MVUE) UCL	0.0123
99% Chebyshev (MVUE) UCL	0.0171

Gamma Distribution Test

k star (bias corrected)	1.669
Theta Star	0.00241
MLE of Mean	0.00402
MLE of Standard Deviation	0.00311
nu star	20.02
Approximate Chi Square Value (.05)	10.87
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	8.542
Anderson-Darling Test Statistic	0.578
Anderson-Darling 5% Critical Value	0.701

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.0053
95% Jackknife UCL	0.00559
95% Standard Bootstrap UCL	0.00519
95% Bootstrap-t UCL	0.00529
95% Hall's Bootstrap UCL	0.00545

Kolmogorov-Smirnov Test Statistic	0.296	95% Percentile Bootstrap UCL	0.00518
Kolmogorov-Smirnov 5% Critical Value	0.334	95% BCA Bootstrap UCL	0.00497
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.00742
		97.5% Chebyshev(Mean, Sd) UCL	0.0089
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.0118
95% Approximate Gamma UCL (Use when n >= 40)	0.0074		
95% Adjusted Gamma UCL (Use when n < 40)	0.00941		
Potential UCL to Use		Use 95% Student's-t UCL	0.00559

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

Iron

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	5	Minimum of Log Data	1.609
Maximum	30	Maximum of Log Data	3.401
Mean	16.35	Mean of log Data	2.584
Geometric Mean	13.25	SD of log Data	0.732
Median	12.9		
SD	10.93		
Std. Error of Mean	4.462		
Coefficient of Variation	0.669		
Skewness	0.495		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	**Lognormal Distribution Test**

Shapiro Wilk Test Statistic	0.855
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Shapiro Wilk Test Statistic	0.909
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	25.34

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	24.65
95% Modified-t UCL (Johnson-1978)	25.49

Assuming Lognormal Distribution

95% H-UCL	50.46
95% Chebyshev (MVUE) UCL	37.76
97.5% Chebyshev (MVUE) UCL	46.98
99% Chebyshev (MVUE) UCL	65.09

Gamma Distribution Test

k star (bias corrected)	1.376
Theta Star	11.89
MLE of Mean	16.35
MLE of Standard Deviation	13.94
nu star	16.51
Approximate Chi Square Value (.05)	8.322
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	6.338
Anderson-Darling Test Statistic	0.399
Anderson-Darling 5% Critical Value	0.703
Kolmogorov-Smirnov Test Statistic	0.25
Kolmogorov-Smirnov 5% Critical Value	0.335

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	32.43
95% Adjusted Gamma UCL (Use when n < 40)	42.59

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	23.69
95% Jackknife UCL	25.34
95% Standard Bootstrap UCL	23.03
95% Bootstrap-t UCL	35.11
95% Hall's Bootstrap UCL	23.91
95% Percentile Bootstrap UCL	23.33
95% BCA Bootstrap UCL	23.97
95% Chebyshev(Mean, Sd) UCL	35.8
97.5% Chebyshev(Mean, Sd) UCL	44.22
99% Chebyshev(Mean, Sd) UCL	60.75

Potential UCL to Use

Use 95% Student's-t UCL 25.34

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Lead

General Statistics

Number of Valid Observations	6
Number of Distinct Observations	6

Raw Statistics

Minimum	0.00082
Maximum	0.0058
Mean	0.00268
Geometric Mean	0.00208
Median	0.00225
SD	0.00196
Std. Error of Mean	0.0008
Coefficient of Variation	0.731
Skewness	0.819

Log-transformed Statistics

Minimum of Log Data	-7.106
Maximum of Log Data	-5.15
Mean of log Data	-6.176
SD of log Data	0.807

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.906
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.914
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.00428

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.00427
95% Modified-t UCL (Johnson-1978)	0.00433

Assuming Lognormal Distribution

95% H-UCL	0.0102
95% Chebyshev (MVUE) UCL	0.00655
97.5% Chebyshev (MVUE) UCL	0.00822
99% Chebyshev (MVUE) UCL	0.0115

Gamma Distribution Test

k star (bias corrected)	1.18
Theta Star	0.00227
MLE of Mean	0.00268
MLE of Standard Deviation	0.00246
nu star	14.16
Approximate Chi Square Value (.05)	6.683
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	4.947
Anderson-Darling Test Statistic	0.293
Anderson-Darling 5% Critical Value	0.704
Kolmogorov-Smirnov Test Statistic	0.216
Kolmogorov-Smirnov 5% Critical Value	0.336

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	0.00567
95% Adjusted Gamma UCL (Use when n < 40)	0.00766

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.00399
95% Jackknife UCL	0.00428
95% Standard Bootstrap UCL	0.00385
95% Bootstrap-t UCL	0.00543
95% Hall's Bootstrap UCL	0.00906
95% Percentile Bootstrap UCL	0.00385
95% BCA Bootstrap UCL	0.00405
95% Chebyshev(Mean, Sd) UCL	0.00616
97.5% Chebyshev(Mean, Sd) UCL	0.00766
99% Chebyshev(Mean, Sd) UCL	0.0106

Potential UCL to Use

Use 95% Student's-t UCL 0.00428

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Magnesium

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 4

Raw Statistics		Log-transformed Statistics	
Minimum	1.2	Minimum of Log Data	0.182
Maximum	5.4	Maximum of Log Data	1.686
Mean	3.483	Mean of log Data	1.078
Geometric Mean	2.939	SD of log Data	0.7
Median	4.2		
SD	1.823		
Std. Error of Mean	0.744		
Coefficient of Variation	0.523		
Skewness	-0.705		

Warning: There are only 4 Distinct Values in this data
There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.817	Shapiro Wilk Test Statistic	0.744
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4.983	95% H-UCL	10.14
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	8.029
95% Adjusted-CLT UCL (Chen-1995)	4.478	97.5% Chebyshev (MVUE) UCL	9.952
95% Modified-t UCL (Johnson-1978)	4.947	99% Chebyshev (MVUE) UCL	13.73

Gamma Distribution Test		Data Distribution
k star (bias corrected)	1.661	**Data appear Normal at 5% Significance Level**
Theta Star	2.097	
MLE of Mean	3.483	
MLE of Standard Deviation	2.703	
nu star	19.93	
Approximate Chi Square Value (.05)	10.8	**Nonparametric Statistics**
Adjusted Level of Significance	0.0122	95% CLT UCL 4.707

Adjusted Chi Square Value	8.484	95% Jackknife UCL	4.983
		95% Standard Bootstrap UCL	4.597
Anderson-Darling Test Statistic	0.824	95% Bootstrap-t UCL	4.609
Anderson-Darling 5% Critical Value	0.701	95% Hall's Bootstrap UCL	4.24
Kolmogorov-Smirnov Test Statistic	0.368	95% Percentile Bootstrap UCL	4.583
Kolmogorov-Smirnov 5% Critical Value	0.334	95% BCA Bootstrap UCL	4.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	6.727
		97.5% Chebyshev(Mean, Sd) UCL	8.13
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	10.89
95% Approximate Gamma UCL (Use when n >= 40)	6.428		
95% Adjusted Gamma UCL (Use when n < 40)	8.184		
Potential UCL to Use		Use 95% Student's-t UCL	4.983

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Manganese

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	5

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.27	Minimum of Log Data	-1.309
Maximum	1.5	Maximum of Log Data	0.405
Mean	0.853	Mean of log Data	-0.366
Geometric Mean	0.694	SD of log Data	0.763
Median	0.89		
SD	0.513		
Std. Error of Mean	0.21		
Coefficient of Variation	0.601		
Skewness	-0.0789		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.912
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.838
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
95% Student's-t UCL	1.276
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	1.191
95% Modified-t UCL (Johnson-1978)	1.274

Assuming Lognormal Distribution	
95% H-UCL	2.921
95% Chebyshev (MVUE) UCL	2.06
97.5% Chebyshev (MVUE) UCL	2.572
99% Chebyshev (MVUE) UCL	3.578

Gamma Distribution Test	
k star (bias corrected)	1.396
Theta Star	0.611
MLE of Mean	0.853
MLE of Standard Deviation	0.722
nu star	16.75
Approximate Chi Square Value (.05)	8.491
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	6.483
Anderson-Darling Test Statistic	0.466
Anderson-Darling 5% Critical Value	0.703
Kolmogorov-Smirnov Test Statistic	0.241
Kolmogorov-Smirnov 5% Critical Value	0.335

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	1.683
95% Adjusted Gamma UCL (Use when n < 40)	2.204

Data Distribution
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	1.198
95% Jackknife UCL	1.276
95% Standard Bootstrap UCL	1.17
95% Bootstrap-t UCL	1.24
95% Hall's Bootstrap UCL	1.185
95% Percentile Bootstrap UCL	1.147
95% BCA Bootstrap UCL	1.145
95% Chebyshev(Mean, Sd) UCL	1.767
97.5% Chebyshev(Mean, Sd) UCL	2.162
99% Chebyshev(Mean, Sd) UCL	2.938

Potential UCL to Use	Use 95% Student's-t UCL 1.276

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Nickel

General Statistics

Number of Valid Observations	6
Number of Distinct Observations	6

Raw Statistics **Log-transformed Statistics**

Minimum	0.0041
Maximum	0.018
Mean	0.00897
Geometric Mean	0.00775
Median	0.00735
SD	0.0054
Std. Error of Mean	0.0022
Coefficient of Variation	0.602
Skewness	1.012

Minimum of Log Data	-5.497
Maximum of Log Data	-4.017
Mean of log Data	-4.86
SD of log Data	0.586

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.877
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.912
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.0134

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.0136
95% Modified-t UCL (Johnson-1978)	0.0136

Assuming Lognormal Distribution

95% H-UCL	0.0195
95% Chebyshev (MVUE) UCL	0.0182
97.5% Chebyshev (MVUE) UCL	0.0222
99% Chebyshev (MVUE) UCL	0.0301

Gamma Distribution Test

k star (bias corrected)	1.906
Theta Star	0.00471
MLE of Mean	0.00897
MLE of Standard Deviation	0.0065
nu star	22.87
Approximate Chi Square Value (.05)	12.99
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	10.41
Anderson-Darling Test Statistic	0.386
Anderson-Darling 5% Critical Value	0.701
Kolmogorov-Smirnov Test Statistic	0.286
Kolmogorov-Smirnov 5% Critical Value	0.334

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	0.0158

Nonparametric Statistics

95% CLT UCL	0.0126
95% Jackknife UCL	0.0134
95% Standard Bootstrap UCL	0.0123
95% Bootstrap-t UCL	0.018
95% Hall's Bootstrap UCL	0.0127
95% Percentile Bootstrap UCL	0.0127
95% BCA Bootstrap UCL	0.0129
95% Chebyshev(Mean, Sd) UCL	0.0186
97.5% Chebyshev(Mean, Sd) UCL	0.0227
99% Chebyshev(Mean, Sd) UCL	0.0309

95% Adjusted Gamma UCL (Use when n < 40) 0.0197

Potential UCL to Use Use 95% Student's-t UCL 0.0134

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Potassium

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	1.6	Minimum Detected	0.47
Maximum Detected	2.3	Maximum Detected	0.833
Mean of Detected	2.05	Mean of Detected	0.708
SD of Detected	0.311	SD of Detected	0.163
Minimum Non-Detect	4	Minimum Non-Detect	1.386
Maximum Non-Detect	4	Maximum Non-Detect	1.386

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.855	Shapiro Wilk Test Statistic	0.828
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.033	Mean	0.703
SD	0.242	SD	0.127
95% DL/2 (t) UCL	2.233	95% H-Stat (DL/2) UCL	2.277
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	0.708
		SD in Log Scale	0.138
		Mean in Original Scale	2.046
		SD in Original Scale	0.266
		95% t UCL	2.265
		95% Percentile Bootstrap UCL	2.203
		95% BCA Bootstrap UCL	2.176

95% H-UCL	2.318

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	13.35
Theta Star	0.154
nu star	106.8
A-D Test Statistic	0.496
5% A-D Critical Value	0.656
K-S Test Statistic	0.656
5% K-S Critical Value	0.394

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1.6
Maximum	2.3
Mean	2.057
Median	2.15
SD	0.267
k star	32.99
Theta star	0.0623
Nu star	395.9
AppChi2	350.8
95% Gamma Approximate UCL (Use when n >= 40)	2.321
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.05
SD	0.269
SE of Mean	0.155
95% KM (t) UCL	2.363
95% KM (z) UCL	2.306
95% KM (jackknife) UCL	2.38
95% KM (bootstrap t) UCL	2.272
95% KM (BCA) UCL	2.25
95% KM (Percentile Bootstrap) UCL	2.25
95% KM (Chebyshev) UCL	2.728
97.5% KM (Chebyshev) UCL	3.021
99% KM (Chebyshev) UCL	3.597

Potential UCLs to Use

95% KM (t) UCL	2.363
95% KM (Percentile Bootstrap) UCL	2.25

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Sodium

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics

Minimum	41
Maximum	120
Mean	81
Geometric Mean	74.64
Median	91.5
SD	32.36
Std. Error of Mean	13.21
Coefficient of Variation	0.4
Skewness	-0.482

Log-transformed Statistics

Minimum of Log Data	3.714
Maximum of Log Data	4.787
Mean of log Data	4.313
SD of log Data	0.466

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.871
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	107.6

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	99.95
95% Modified-t UCL (Johnson-1978)	107.2

Gamma Distribution Test

k star (bias corrected)	3.248
Theta Star	24.94
MLE of Mean	81
MLE of Standard Deviation	44.94
nu star	38.98
Approximate Chi Square Value (.05)	25.68
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	21.86
Anderson-Darling Test Statistic	0.622
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.312
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	123
95% Adjusted Gamma UCL (Use when n < 40)	144.4

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.813
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	141.7
95% Chebyshev (MVUE) UCL	149.2
97.5% Chebyshev (MVUE) UCL	178.4
99% Chebyshev (MVUE) UCL	235.8

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	102.7
95% Jackknife UCL	107.6
95% Standard Bootstrap UCL	100.7
95% Bootstrap-t UCL	104.7
95% Hall's Bootstrap UCL	96.83
95% Percentile Bootstrap UCL	99.5
95% BCA Bootstrap UCL	98.33
95% Chebyshev(Mean, Sd) UCL	138.6
97.5% Chebyshev(Mean, Sd) UCL	163.5
99% Chebyshev(Mean, Sd) UCL	212.4

Potential UCL to Use Use 95% Student's-t UCL 107.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits

(e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Vanadium

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0026	Minimum Detected	-5.952
Maximum Detected	0.012	Maximum Detected	-4.423
Mean of Detected	0.00598	Mean of Detected	-5.309
SD of Detected	0.00432	SD of Detected	0.7
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.87	Shapiro Wilk Test Statistic	0.928
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00565	Mean	-5.305
SD	0.00338	SD	0.542
95% DL/2 (t) UCL	0.00843	95% H-Stat (DL/2) UCL	0.0112
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-5.406
		SD in Log Scale	0.587
		Mean in Original Scale	0.00526
		SD in Original Scale	0.00358
		95% t UCL	0.00821
		95% Percentile Bootstrap UCL	0.00776
		95% BCA Bootstrap UCL	0.00887
		95% H-UCL	0.0113

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.869	**Data appear Normal at 5% Significance Level**
Theta Star	0.00688	
nu star	6.95	

A-D Test Statistic	0.337
5% A-D Critical Value	0.66
K-S Test Statistic	0.66
5% K-S Critical Value	0.397

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00235
Maximum	0.012
Mean	0.00537
Median	0.00453
SD	0.00366
k star	1.621
Theta star	0.00331
Nu star	19.46
AppChi2	10.45
95% Gamma Approximate UCL (Use when n >= 40)	0.00999
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00531
SD	0.00333
SE of Mean	0.00167
95% KM (t) UCL	0.00866
95% KM (z) UCL	0.00805
95% KM (jackknife) UCL	0.00868
95% KM (bootstrap t) UCL	0.0108
95% KM (BCA) UCL	0.00813
95% KM (Percentile Bootstrap) UCL	0.00813
95% KM (Chebyshev) UCL	0.0126
97.5% KM (Chebyshev) UCL	0.0157
99% KM (Chebyshev) UCL	0.0219

Potential UCLs to Use

95% KM (t) UCL	0.00866
95% KM (Percentile Bootstrap) UCL	0.00813

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Zinc

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 5

Raw Statistics

Minimum	0.009
Maximum	0.12
Mean	0.0375
Geometric Mean	0.0256
Median	0.019
SD	0.0417
Std. Error of Mean	0.017
Coefficient of Variation	1.112
Skewness	2.146

Log-transformed Statistics

Minimum of Log Data	-4.711
Maximum of Log Data	-2.12
Mean of log Data	-3.666
SD of log Data	0.892

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.692	Shapiro Wilk Test Statistic	0.897
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.0718	95% H-UCL	0.17
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0903
95% Adjusted-CLT UCL (Chen-1995)	0.0814	97.5% Chebyshev (MVUE) UCL	0.114
95% Modified-t UCL (Johnson-1978)	0.0743	99% Chebyshev (MVUE) UCL	0.161
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.837	**ta Follow Appr. Gamma Distribution at 5% Significance Le**	
Theta Star	0.0448		
MLE of Mean	0.0375		
MLE of Standard Deviation	0.041		
nu star	10.05		
Approximate Chi Square Value (.05)	3.971	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	0.0655
Adjusted Chi Square Value	2.719	95% Jackknife UCL	0.0718
		95% Standard Bootstrap UCL	0.0631
Anderson-Darling Test Statistic	0.616	95% Bootstrap-t UCL	0.243
Anderson-Darling 5% Critical Value	0.708	95% Hall's Bootstrap UCL	0.279
Kolmogorov-Smirnov Test Statistic	0.338	95% Percentile Bootstrap UCL	0.0678
Kolmogorov-Smirnov 5% Critical Value	0.338	95% BCA Bootstrap UCL	0.0728
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.112
		97.5% Chebyshev(Mean, Sd) UCL	0.144
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.207
95% Approximate Gamma UCL (Use when n >= 40)	0.0949		
95% Adjusted Gamma UCL (Use when n < 40)	0.139		
Potential UCL to Use		Use 95% Approximate Gamma UCL	0.0949

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Bromide

General Statistics

Number of Valid Data	6	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	1
		Percent Non-Detects	16.67%

Raw Statistics **Log-transformed Statistics**

Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	0.21	Maximum Detected	-1.561
Mean of Detected	0.168	Mean of Detected	-1.82
SD of Detected	0.0466	SD of Detected	0.313
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.762

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.148
SD	0.0637
95% DL/2 (t) UCL	0.201
Maximum Likelihood Estimate(MLE) Method	
Mean	0.152
SD	0.0532
95% MLE (t) UCL	0.196
95% MLE (Tiku) UCL	0.197

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.857
5% Shapiro Wilk Critical Value	0.762

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.016
SD	0.556
95% H-Stat (DL/2) UCL	0.31
Log ROS Method	
Mean in Log Scale	-1.944
SD in Log Scale	0.413
Mean in Original Scale	0.153
SD in Original Scale	0.0558
95% t UCL	0.199
95% Percentile Bootstrap UCL	0.185
95% BCA Bootstrap UCL	0.183
95% H UCL	0.245

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	5.738
Theta Star	0.0293
nu star	57.38
A-D Test Statistic	0.453
5% A-D Critical Value	0.679
K-S Test Statistic	0.679
5% K-S Critical Value	0.357

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0161
Maximum	0.21
Mean	0.143
Median	0.165

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.157
SD	0.0457
SE of Mean	0.0209
95% KM (t) UCL	0.199
95% KM (z) UCL	0.191
95% KM (jackknife) UCL	0.2
95% KM (bootstrap t) UCL	0.19
95% KM (BCA) UCL	0.2
95% KM (Percentile Bootstrap) UCL	0.195
95% KM (Chebyshev) UCL	0.248

SD	0.0747	97.5% KM (Chebyshev) UCL	0.287
k star	1.156	99% KM (Chebyshev) UCL	0.364
Theta star	0.123		
Nu star	13.88	**Potential UCLs to Use**	
AppChi2	6.486	95% KM (t) UCL	0.199
95% Gamma Approximate UCL (Use when n >= 40)	0.305	95% KM (Percentile Bootstrap) UCL	0.195
95% Adjusted Gamma UCL (Use when n < 40)	0.414		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Chloride

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	5

Raw Statistics		**Log-transformed Statistics**	
Minimum	82	Minimum of Log Data	4.407
Maximum	180	Maximum of Log Data	5.193
Mean	139.3	Mean of log Data	4.89
Geometric Mean	132.9	SD of log Data	0.346
Median	150		
SD	43.99		
Std. Error of Mean	17.96		
Coefficient of Variation	0.316		
Skewness	-0.42		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.849	Shapiro Wilk Test Statistic	0.846
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	175.5	95% H-UCL	201.7

95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	165.6
95% Modified-t UCL (Johnson-1978)	175
95% Chebyshev (MVUE) UCL	225.6
97.5% Chebyshev (MVUE) UCL	262.8
99% Chebyshev (MVUE) UCL	335.9

Gamma Distribution Test	
k star (bias corrected)	5.513
Theta Star	25.27
MLE of Mean	139.3
MLE of Standard Deviation	59.34
nu star	66.16
Approximate Chi Square Value (.05)	48.44
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	43.02
Anderson-Darling Test Statistic	0.519
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.281
Kolmogorov-Smirnov 5% Critical Value	0.332
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	190.3
95% Adjusted Gamma UCL (Use when n < 40)	214.3

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	168.9
95% Jackknife UCL	175.5
95% Standard Bootstrap UCL	166.4
95% Bootstrap-t UCL	173.7
95% Hall's Bootstrap UCL	158.2
95% Percentile Bootstrap UCL	165
95% BCA Bootstrap UCL	163.7
95% Chebyshev(Mean, Sd) UCL	217.6
97.5% Chebyshev(Mean, Sd) UCL	251.5
99% Chebyshev(Mean, Sd) UCL	318

Potential UCL to Use	Use 95% Student's-t UCL 175.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Nitrate as N

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Nitrate as N was not processed!

Nitrite as N

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Nitrite as N was not processed!

Nitrogen, as Ammonia

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	17	Minimum of Log Data	2.833
Maximum	66	Maximum of Log Data	4.19
Mean	44.5	Mean of log Data	3.705
Geometric Mean	40.66	SD of log Data	0.498
Median	42.5		
SD	18.45		
Std. Error of Mean	7.531		
Coefficient of Variation	0.415		
Skewness	-0.264		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.943	Shapiro Wilk Test Statistic	0.894
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	59.68	95% H-UCL	82.67

95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	56.02
95% Modified-t UCL (Johnson-1978)	59.54
95% Chebyshev (MVUE) UCL	84.82
97.5% Chebyshev (MVUE) UCL	102
99% Chebyshev (MVUE) UCL	135.9

Gamma Distribution Test	
k star (bias corrected)	2.963
Theta Star	15.02
MLE of Mean	44.5
MLE of Standard Deviation	25.85
nu star	35.56
Approximate Chi Square Value (.05)	22.91
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	19.33
Anderson-Darling Test Statistic	0.32
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.198
Kolmogorov-Smirnov 5% Critical Value	0.333
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	69.06
95% Adjusted Gamma UCL (Use when n < 40)	81.85

Nonparametric Statistics

95% CLT UCL	56.89
95% Jackknife UCL	59.68
95% Standard Bootstrap UCL	55.91
95% Bootstrap-t UCL	61.24
95% Hall's Bootstrap UCL	59.1
95% Percentile Bootstrap UCL	55.5
95% BCA Bootstrap UCL	54.67
95% Chebyshev(Mean, Sd) UCL	77.33
97.5% Chebyshev(Mean, Sd) UCL	91.53
99% Chebyshev(Mean, Sd) UCL	119.4

Potential UCL to Use — Use 95% Student's-t UCL 59.68

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Sulfate

General Statistics

Number of Valid Observations	6
Number of Distinct Observations	6

Raw Statistics	
Minimum	66
Maximum	360
Mean	210.8
Geometric Mean	170.2
Median	225
SD	129.7
Std. Error of Mean	52.95
Coefficient of Variation	0.615
Skewness	-0.125

Log-transformed Statistics	
Minimum of Log Data	4.19
Maximum of Log Data	5.886
Mean of log Data	5.137
SD of log Data	0.769

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.872
Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level	

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.836
Shapiro Wilk Critical Value	0.788
Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution	
95% Student's-t UCL	317.5
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	295.1
95% Modified-t UCL (Johnson-1978)	317.1

Assuming Lognormal Distribution	
95% H-UCL	732.7
95% Chebyshev (MVUE) UCL	510
97.5% Chebyshev (MVUE) UCL	637.2
99% Chebyshev (MVUE) UCL	887

Gamma Distribution Test	
k star (bias corrected)	1.357
Theta Star	155.4
MLE of Mean	210.8
MLE of Standard Deviation	181
nu star	16.29
Approximate Chi Square Value (.05)	8.164
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	6.202
Anderson-Darling Test Statistic	0.51
Anderson-Darling 5% Critical Value	0.703
Kolmogorov-Smirnov Test Statistic	0.27
Kolmogorov-Smirnov 5% Critical Value	0.335
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution
Data appear Normal at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	420.6
95% Adjusted Gamma UCL (Use when n < 40)	553.6

Nonparametric Statistics	
95% CLT UCL	297.9
95% Jackknife UCL	317.5
95% Standard Bootstrap UCL	289.6
95% Bootstrap-t UCL	321.4
95% Hall's Bootstrap UCL	266
95% Percentile Bootstrap UCL	290
95% BCA Bootstrap UCL	283.3
95% Chebyshev(Mean, Sd) UCL	441.6
97.5% Chebyshev(Mean, Sd) UCL	541.5
99% Chebyshev(Mean, Sd) UCL	737.7

Potential UCL to Use	Use 95% Student's-t UCL 317.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Surface Water – South Ditch

1				General UCL Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	WorkSheet.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	Azobenzene											
10												
11						General Statistics						
12						Number of Valid Data	12			Number of Detected Data	2	
13						Number of Distinct Detected Data	2			Number of Non-Detect Data	10	
14						Number of Missing Values	102			Percent Non-Detects	83.33%	
15												
16						Raw Statistics				Log-transformed Statistics		
17						Minimum Detected	0.00046			Minimum Detected	-7.684	
18						Maximum Detected	0.00053			Maximum Detected	-7.543	
19						Mean of Detected	0.000495			Mean of Detected	-7.613	
20						SD of Detected	4.95E-05			SD of Detected	0.1	
21						Minimum Non-Detect	0.00096			Minimum Non-Detect	-6.949	
22						Maximum Non-Detect	0.005			Maximum Non-Detect	-5.298	
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	12	
25	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	0	
26	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	100.00%	
27												
28	Warning: Data set has only 2 Distinct Detected Values.											
29	This may not be adequate enough to compute meaningful and reliable test statistics and estimates.											
30	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
31												
32	Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.											
33												
34	The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.											
35	Those methods will return a 'N/A' value on your output display!											
36												
37	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
38	However, results obtained using 4 to 9 distinct values may not be reliable.											
39	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
40												
41												
42						UCL Statistics						
43						Normal Distribution Test with Detected Values Only				Lognormal Distribution Test with Detected Values Only		
44						Shapiro Wilk Test Statistic	N/A			Shapiro Wilk Test Statistic	N/A	
45						5% Shapiro Wilk Critical Value	N/A			5% Shapiro Wilk Critical Value	N/A	
46						Data not Normal at 5% Significance Level				Data not Lognormal at 5% Significance Level		
47												
48						Assuming Normal Distribution				Assuming Lognormal Distribution		
49						DL/2 Substitution Method				DL/2 Substitution Method		
50						Mean	0.00168			Mean	-6.596	
51						SD	0.0008843			SD	0.758	
52						95% DL/2 (t) UCL	0.00214			95% H-Stat (DL/2) UCL	0.00322	

53												
54	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
55	**MLE method failed to converge properly**						Mean in Log Scale					N/A
56							SD in Log Scale					N/A
57							Mean in Original Scale					N/A
58							SD in Original Scale					N/A
59							95% t UCL					N/A
60							95% Percentile Bootstrap UCL					N/A
61							95% BCA Bootstrap UCL					N/A
62							95% H-UCL					N/A
63												
64	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
65	k star (bias corrected)					N/A	**Data do not follow a Discernable Distribution (0.05)**					
66	Theta Star					N/A						
67	nu star					N/A						
68												
69	A-D Test Statistic					N/A	**Nonparametric Statistics**					
70	5% A-D Critical Value					N/A	Kaplan-Meier (KM) Method					
71	K-S Test Statistic					N/A	Mean					0.000495
72	5% K-S Critical Value					N/A	SD					0.000035
73	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					0.000035
74							95% KM (t) UCL					0.0005579
75	**Assuming Gamma Distribution**						95% KM (z) UCL					0.0005526
76	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.0005801
77	Minimum					N/A	95% KM (bootstrap t) UCL					N/A
78	Maximum					N/A	95% KM (BCA) UCL					0.00053
79	Mean					N/A	95% KM (Percentile Bootstrap) UCL					0.00053
80	Median					N/A	95% KM (Chebyshev) UCL					0.0006476
81	SD					N/A	97.5% KM (Chebyshev) UCL					0.0007136
82	k star					N/A	99% KM (Chebyshev) UCL					0.0008433
83	Theta star					N/A						
84	Nu star					N/A	**Potential UCLs to Use**					
85	AppChi2					N/A	95% KM (t) UCL					0.0005579
86	95% Gamma Approximate UCL (Use when n >= 40)					N/A	95% KM (% Bootstrap) UCL					0.00053
87	95% Adjusted Gamma UCL (Use when n < 40)					N/A						
88	**Warning: Recommended UCL exceeds the maximum observation**											
89	**Note: DL/2 is not a recommended method.**											
90												
91	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
92	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
93	**For additional insight, the user may want to consult a statistician.**											
94												
95												
96	**Benzo(a)pyrene**											
97												
98	**General Statistics**											
99	Number of Valid Data					12	Number of Detected Data					1
100	Number of Distinct Detected Data					1	Number of Non-Detect Data					11
101	Number of Missing Values					102	Percent Non-Detects					91.67%
102												
103	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
104	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											

105												
106	**The data set for variable Benzo(a)pyrene was not processed!**											
107												
108												
109												
110	**Bis(2-Ethylhexyl)phthalate**											
111												
112	**General Statistics**											
113						Number of Valid Data	11			Number of Detected Data	2	
114						Number of Distinct Detected Data	2			Number of Non-Detect Data	9	
115						Number of Missing Values	103			Percent Non-Detects	81.82%	
116												
117	**Raw Statistics**							**Log-transformed Statistics**				
118						Minimum Detected	0.0018			Minimum Detected	-6.32	
119						Maximum Detected	0.0061			Maximum Detected	-5.099	
120						Mean of Detected	0.00395			Mean of Detected	-5.71	
121						SD of Detected	0.00304			SD of Detected	0.863	
122						Minimum Non-Detect	0.0018			Minimum Non-Detect	-6.32	
123						Maximum Non-Detect	0.0089			Maximum Non-Detect	-4.722	
124												
125	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	11	
126	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	0	
127	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	100.00%	
128												
129	**Warning: Data set has only 2 Distinct Detected Values.**											
130	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
131	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
132												
133	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
134												
135	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
136	**Those methods will return a 'N/A' value on your output display!**											
137												
138	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
139	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
140	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
141												
142												
143	**UCL Statistics**											
144	**Normal Distribution Test with Detected Values Only**							**Lognormal Distribution Test with Detected Values Only**				
145						Shapiro Wilk Test Statistic	N/A			Shapiro Wilk Test Statistic	N/A	
146						5% Shapiro Wilk Critical Value	N/A			5% Shapiro Wilk Critical Value	N/A	
147	**Data not Normal at 5% Significance Level**							**Data not Lognormal at 5% Significance Level**				
148												
149	**Assuming Normal Distribution**							**Assuming Lognormal Distribution**				
150						DL/2 Substitution Method				DL/2 Substitution Method		
151						Mean	0.00244			Mean	-6.204	
152						SD	0.00162			SD	0.644	
153						95% DL/2 (t) UCL	0.00333			95% H-Stat (DL/2) UCL	0.00404	
154												
155						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
156	**MLE method failed to converge properly**									Mean in Log Scale	N/A	

157											SD in Log Scale	N/A
158											Mean in Original Scale	N/A
159											SD in Original Scale	N/A
160											95% t UCL	N/A
161											95% Percentile Bootstrap UCL	N/A
162											95% BCA Bootstrap UCL	N/A
163											95% H-UCL	N/A
164												
165	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
166					k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**					
167					Theta Star	N/A						
168					nu star	N/A						
169												
170					A-D Test Statistic	N/A	**Nonparametric Statistics**					
171					5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method	
172					K-S Test Statistic	N/A					Mean	0.00228
173					5% K-S Critical Value	N/A					SD	0.00135
174	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	0.000637
175											95% KM (t) UCL	0.00343
176	**Assuming Gamma Distribution**										95% KM (z) UCL	0.00333
177					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.00522
178					Minimum	N/A					95% KM (bootstrap t) UCL	N/A
179					Maximum	N/A					95% KM (BCA) UCL	N/A
180					Mean	N/A					95% KM (Percentile Bootstrap) UCL	N/A
181					Median	N/A					95% KM (Chebyshev) UCL	0.00505
182					SD	N/A					97.5% KM (Chebyshev) UCL	0.00626
183					k star	N/A					99% KM (Chebyshev) UCL	0.00862
184					Theta star	N/A						
185					Nu star	N/A	**Potential UCLs to Use**					
186					AppChi2	N/A					95% KM (t) UCL	0.00343
187					95% Gamma Approximate UCL (Use when n >= 40)	N/A					95% KM (% Bootstrap) UCL	N/A
188					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
189	**Note: DL/2 is not a recommended method.**											
190												
191	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
192	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
193	**For additional insight, the user may want to consult a statistician.**											
194												
195												
196	**N-Nitrosodi-n-propylamine**											
197												
198	**General Statistics**											
199					Number of Valid Data	12					Number of Detected Data	2
200					Number of Distinct Detected Data	2					Number of Non-Detect Data	10
201					Number of Missing Values	102					Percent Non-Detects	83.33%
202												
203	**Raw Statistics**						**Log-transformed Statistics**					
204					Minimum Detected	0.0000049					Minimum Detected	-12.23
205					Maximum Detected	0.0000093					Maximum Detected	-11.59
206					Mean of Detected	0.0000071					Mean of Detected	-11.91
207					SD of Detected	3.111E-06					SD of Detected	0.453
208					Minimum Non-Detect	0.0000019					Minimum Non-Detect	-13.17

209					Maximum Non-Detect	0.000021					Maximum Non-Detect	-10.77
210												
211	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	12
212	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
213	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
214												
215	**Warning: Data set has only 2 Distinct Detected Values.**											
216	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
217	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
218												
219	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
220												
221	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
222	**Those methods will return a 'N/A' value on your output display!**											
223												
224	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
225	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
226	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
227												
228												
229	**UCL Statistics**											
230	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
231	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk Test Statistic					N/A
232	5% Shapiro Wilk Critical Value					N/A	5% Shapiro Wilk Critical Value					N/A
233	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
234												
235	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
236	DL/2 Substitution Method						DL/2 Substitution Method					
237	Mean					3.508E-06	Mean					-12.99
238	SD					3.411E-06	SD					0.965
239	95% DL/2 (t) UCL					5.277E-06	95% H-Stat (DL/2) UCL					8.315E-06
240												
241	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
242	**MLE method failed to converge properly**						Mean in Log Scale					N/A
243							SD in Log Scale					N/A
244							Mean in Original Scale					N/A
245							SD in Original Scale					N/A
246							95% t UCL					N/A
247							95% Percentile Bootstrap UCL					N/A
248							95% BCA Bootstrap UCL					N/A
249							95% H-UCL					N/A
250												
251	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
252	k star (bias corrected)					N/A	**Data do not follow a Discernable Distribution (0.05)**					
253	Theta Star					N/A						
254	nu star					N/A						
255												
256	A-D Test Statistic					N/A	**Nonparametric Statistics**					
257	5% A-D Critical Value					N/A	Kaplan-Meier (KM) Method					
258	K-S Test Statistic					N/A	Mean					5.389E-06
259	5% K-S Critical Value					N/A	SD					1.383E-06
260	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean					6.519E-07

261											95% KM (t) UCL	6.56E-06
262	**Assuming Gamma Distribution**										95% KM (z) UCL	6.461E-06
263				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	8.368E-06
264					Minimum	N/A					95% KM (bootstrap t) UCL	5.592E-06
265					Maximum	N/A					95% KM (BCA) UCL	0.0000093
266					Mean	N/A					95% KM (Percentile Bootstrap) UCL	N/A
267					Median	N/A					95% KM (Chebyshev) UCL	8.23E-06
268					SD	N/A					97.5% KM (Chebyshev) UCL	9.46E-06
269					k star	N/A					99% KM (Chebyshev) UCL	1.188E-05
270					Theta star	N/A						
271					Nu star	N/A					**Potential UCLs to Use**	
272					AppChi2	N/A					95% KM (t) UCL	6.56E-06
273				95% Gamma Approximate UCL (Use when n >= 40)		N/A					95% KM (% Bootstrap) UCL	N/A
274				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
275	**Note: DL/2 is not a recommended method.**											
276												
277	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
278	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
279	**For additional insight, the user may want to consult a statistician.**											
280												
281	**T - Aluminum**											
282												
283	**General Statistics**											
284					Number of Valid Observations	114					Number of Distinct Observations	81
285												
286	**Raw Statistics**						**Log-transformed Statistics**					
287					Minimum	0.0785					Minimum of Log Data	-2.545
288					Maximum	280					Maximum of Log Data	5.635
289					Mean	5.129					Mean of log Data	-0.0633
290					Geometric Mean	0.939					SD of log Data	1.512
291					Median	1.05						
292					SD	27.58						
293					Std. Error of Mean	2.583						
294					Coefficient of Variation	5.377						
295					Skewness	9.258						
296												
297	**Relevant UCL Statistics**											
298	**Normal Distribution Test**						**Lognormal Distribution Test**					
299					Lilliefors Test Statistic	0.427					Lilliefors Test Statistic	0.0818
300					Lilliefors Critical Value	0.083					Lilliefors Critical Value	0.083
301	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
302												
303	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
304					95% Student's-t UCL	9.413					95% H-UCL	4.355
305	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	5.378
306					95% Adjusted-CLT UCL (Chen-1995)	11.77					97.5% Chebyshev (MVUE) UCL	6.456
307					95% Modified-t UCL (Johnson-1978)	9.787					99% Chebyshev (MVUE) UCL	8.575
308												
309	**Gamma Distribution Test**						**Data Distribution**					
310					k star (bias corrected)	0.385	**Data appear Lognormal at 5% Significance Level**					
311					Theta Star	13.33						
312					MLE of Mean	5.129						

MLE of Standard Deviation	8.269	
nu star	87.73	
Approximate Chi Square Value (.05)	67.14	**Nonparametric Statistics**
Adjusted Level of Significance	0.0479	95% CLT UCL 9.378
Adjusted Chi Square Value	66.91	95% Jackknife UCL 9.413
		95% Standard Bootstrap UCL 9.397
Anderson-Darling Test Statistic	9.865	95% Bootstrap-t UCL 49.35
Anderson-Darling 5% Critical Value	0.846	95% Hall's Bootstrap UCL 28.04
Kolmogorov-Smirnov Test Statistic	0.219	95% Percentile Bootstrap UCL 9.93
Kolmogorov-Smirnov 5% Critical Value	0.0921	95% BCA Bootstrap UCL 14.15
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 16.39
		97.5% Chebyshev(Mean, Sd) UCL 21.26
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 30.83
95% Approximate Gamma UCL (Use when n >= 40)	6.703	
95% Adjusted Gamma UCL (Use when n < 40)	6.726	
Potential UCL to Use		Use 95% H-UCL 4.355

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.

H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.

It is therefore recommended to avoid the use of H-statistic based 95% UCLs.

Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

T - Barium

General Statistics

Number of Valid Observations	12	Number of Distinct Observations	8
Number of Missing Values	102		

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.013	Minimum of Log Data	-4.343
Maximum	0.032	Maximum of Log Data	-3.442
Mean	0.0243	Mean of log Data	-3.74
Geometric Mean	0.0237	SD of log Data	0.225
Median	0.025		
SD	0.00471		
Std. Error of Mean	0.00136		
Coefficient of Variation	0.194		
Skewness	-0.97		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.927	Shapiro Wilk Test Statistic	0.84
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

365	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
366					95% Student's-t UCL	0.0267					95% H-UCL	0.0276
367	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	0.0312
368					95% Adjusted-CLT UCL (Chen-1995)	0.0261					97.5% Chebyshev (MVUE) UCL	0.0342
369					95% Modified-t UCL (Johnson-1978)	0.0266					99% Chebyshev (MVUE) UCL	0.0401
370												
371	**Gamma Distribution Test**						**Data Distribution**					
372					k star (bias corrected)	18.14	**Data appear Normal at 5% Significance Level**					
373					Theta Star	0.00134						
374					MLE of Mean	0.0243						
375					MLE of Standard Deviation	0.00569						
376					nu star	435.4						
377					Approximate Chi Square Value (.05)	388	**Nonparametric Statistics**					
378					Adjusted Level of Significance	0.029					95% CLT UCL	0.0265
379					Adjusted Chi Square Value	381.2					95% Jackknife UCL	0.0267
380											95% Standard Bootstrap UCL	0.0264
381					Anderson-Darling Test Statistic	0.594					95% Bootstrap-t UCL	0.0264
382					Anderson-Darling 5% Critical Value	0.732					95% Hall's Bootstrap UCL	0.0263
383					Kolmogorov-Smirnov Test Statistic	0.184					95% Percentile Bootstrap UCL	0.0263
384					Kolmogorov-Smirnov 5% Critical Value	0.245					95% BCA Bootstrap UCL	0.0259
385	**Data appear Gamma Distributed at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	0.0302
386											97.5% Chebyshev(Mean, Sd) UCL	0.0327
387	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	0.0378
388					95% Approximate Gamma UCL (Use when n >= 40)	0.0272						
389					95% Adjusted Gamma UCL (Use when n < 40)	0.0277						
390												
391	**Potential UCL to Use**										Use 95% Student's-t UCL	0.0267
392												
393	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
394	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
395	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
396												
397	**Note: For highly negative-skewed data, confidence limits**											
398	**(e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
399	**reliable. Chen's and Johnson's methods provide**											
400	**adjustments for positvely skewed data sets.**											
401												
402												
403	**T - Beryllium**											
404												
405	**General Statistics**											
406					Number of Valid Data	12					Number of Detected Data	5
407					Number of Distinct Detected Data	4					Number of Non-Detect Data	7
408					Number of Missing Values	102					Percent Non-Detects	58.33%
409												
410	**Raw Statistics**						**Log-transformed Statistics**					
411					Minimum Detected	0.0003					Minimum Detected	-8.112
412					Maximum Detected	0.0011					Maximum Detected	-6.812
413					Mean of Detected	0.00076					Mean of Detected	-7.287
414					SD of Detected	0.0003476					SD of Detected	0.542
415					Minimum Non-Detect	0.001					Minimum Non-Detect	-6.908
416					Maximum Non-Detect	0.001					Maximum Non-Detect	-6.908

	A	B	C	D	E	F	G	H	I	J	K	L
417												
418												
419	**Warning: There are only 4 Distinct Detected Values in this data**											
420	**Note: It should be noted that even though bootstrap may be performed on this data set**											
421	**the resulting calculations may not be reliable enough to draw conclusions**											
422												
423	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
424												
425												
426	**UCL Statistics**											
427	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
428	Shapiro Wilk Test Statistic					0.907	Shapiro Wilk Test Statistic					0.895
429	5% Shapiro Wilk Critical Value					0.762	5% Shapiro Wilk Critical Value					0.762
430	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
431												
432	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
433	DL/2 Substitution Method						DL/2 Substitution Method					
434	Mean					0.0006083	Mean					-7.47
435	SD					0.0002487	SD					0.365
436	95% DL/2 (t) UCL					0.0007373	95% H-Stat (DL/2) UCL					0.0007583
437												
438	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
439	**MLE method failed to converge properly**						Mean in Log Scale					-7.494
440							SD in Log Scale					0.452
441							Mean in Original Scale					0.0006104
442							SD in Original Scale					0.0002763
443							95% t UCL					0.0007536
444							95% Percentile Bootstrap UCL					0.0007405
445							95% BCA Bootstrap UCL					0.0007679
446							95% H-UCL					0.0008186
447												
448	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
449	k star (bias corrected)					2.113	**Data appear Normal at 5% Significance Level**					
450	Theta Star					0.0003597						
451	nu star					21.13						
452												
453	A-D Test Statistic					0.335	**Nonparametric Statistics**					
454	5% A-D Critical Value					0.681	Kaplan-Meier (KM) Method					
455	K-S Test Statistic					0.681	Mean					0.0006278
456	5% K-S Critical Value					0.358	SD					0.0002679
457	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.0001187
458							95% KM (t) UCL					0.0008409
459	**Assuming Gamma Distribution**						95% KM (z) UCL					0.000823
460	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.0008758
461	Minimum					7.924E-05	95% KM (bootstrap t) UCL					0.0008442
462	Maximum					0.0011	95% KM (BCA) UCL					0.0008425
463	Mean					0.0006287	95% KM (Percentile Bootstrap) UCL					0.0008375
464	Median					0.0006269	95% KM (Chebyshev) UCL					0.00115
465	SD					0.0003227	97.5% KM (Chebyshev) UCL					0.00137
466	k star					2.17	99% KM (Chebyshev) UCL					0.00181
467	Theta star					0.0002898						
468	Nu star					52.07	**Potential UCLs to Use**					

469					AppChi2	36.5					95% KM (t) UCL	0.0008409
470				95% Gamma Approximate UCL (Use when n >= 40)		0.000897					95% KM (Percentile Bootstrap) UCL	0.0008375
471				95% Adjusted Gamma UCL (Use when n < 40)		0.0009485						
472	**Note: DL/2 is not a recommended method.**											
473												
474	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
475	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
476	**For additional insight, the user may want to consult a statistician.**											
477												
478												
479	**T - Chromium**											
480												
481	**General Statistics**											
482					Number of Valid Observations	114					Number of Distinct Observations	82
483												
484	**Raw Statistics**						**Log-transformed Statistics**					
485					Minimum	0.0096					Minimum of Log Data	-4.646
486					Maximum	64					Maximum of Log Data	4.159
487					Mean	1.159					Mean of log Data	-1.8
488					Geometric Mean	0.165					SD of log Data	1.805
489					Median	0.275						
490					SD	6.293						
491					Std. Error of Mean	0.589						
492					Coefficient of Variation	5.43						
493					Skewness	9.295						
494												
495	**Relevant UCL Statistics**											
496	**Normal Distribution Test**						**Lognormal Distribution Test**					
497					Lilliefors Test Statistic	0.428					Lilliefors Test Statistic	0.126
498					Lilliefors Critical Value	0.083					Lilliefors Critical Value	0.083
499	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
500												
501	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
502					95% Student's-t UCL	2.136					95% H-UCL	1.426
503	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	1.724
504					95% Adjusted-CLT UCL (Chen-1995)	2.677					97.5% Chebyshev (MVUE) UCL	2.117
505					95% Modified-t UCL (Johnson-1978)	2.222					99% Chebyshev (MVUE) UCL	2.891
506												
507	**Gamma Distribution Test**						**Data Distribution**					
508					k star (bias corrected)	0.343	**Data do not follow a Discernable Distribution (0.05)**					
509					Theta Star	3.381						
510					MLE of Mean	1.159						
511					MLE of Standard Deviation	1.979						
512					nu star	78.15						
513					Approximate Chi Square Value (.05)	58.78	**Nonparametric Statistics**					
514					Adjusted Level of Significance	0.0479					95% CLT UCL	2.128
515					Adjusted Chi Square Value	58.57					95% Jackknife UCL	2.136
516											95% Standard Bootstrap UCL	2.107
517					Anderson-Darling Test Statistic	8.276					95% Bootstrap-t UCL	10.99
518					Anderson-Darling 5% Critical Value	0.857					95% Hall's Bootstrap UCL	6.491
519					Kolmogorov-Smirnov Test Statistic	0.209					95% Percentile Bootstrap UCL	2.27
520					Kolmogorov-Smirnov 5% Critical Value	0.0926					95% BCA Bootstrap UCL	2.885

521	**Data not Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	3.728				
522							97.5% Chebyshev(Mean, Sd) UCL	4.839				
523	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	7.023				
524	95% Approximate Gamma UCL (Use when n >= 40)	1.541										
525	95% Adjusted Gamma UCL (Use when n < 40)	1.546										
526												
527	**Potential UCL to Use**						Use 95% Chebyshev (Mean, Sd) UCL	3.728				
528												
529	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
530	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
531	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
532												
533												
534	**T - Cobalt**											
535												
536	**General Statistics**											
537	Number of Valid Observations	12					Number of Distinct Observations	11				
538	Number of Missing Values	102										
539												
540	**Raw Statistics**						**Log-transformed Statistics**					
541	Minimum	0.0053					Minimum of Log Data	-5.24				
542	Maximum	0.05					Maximum of Log Data	-2.996				
543	Mean	0.0285					Mean of log Data	-3.763				
544	Geometric Mean	0.0232					SD of log Data	0.751				
545	Median	0.033										
546	SD	0.0154										
547	Std. Error of Mean	0.00446										
548	Coefficient of Variation	0.542										
549	Skewness	-0.272										
550												
551	**Relevant UCL Statistics**											
552	**Normal Distribution Test**						**Lognormal Distribution Test**					
553	Shapiro Wilk Test Statistic	0.925					Shapiro Wilk Test Statistic	0.861				
554	Shapiro Wilk Critical Value	0.859					Shapiro Wilk Critical Value	0.859				
555	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
556												
557	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
558	95% Student's-t UCL	0.0365					95% H-UCL	0.0541				
559	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL	0.0595				
560	95% Adjusted-CLT UCL (Chen-1995)	0.0355					97.5% Chebyshev (MVUE) UCL	0.0723				
561	95% Modified-t UCL (Johnson-1978)	0.0364					99% Chebyshev (MVUE) UCL	0.0974				
562												
563	**Gamma Distribution Test**						**Data Distribution**					
564	k star (bias corrected)	1.998					**Data appear Normal at 5% Significance Level**					
565	Theta Star	0.0143										
566	MLE of Mean	0.0285										
567	MLE of Standard Deviation	0.0202										
568	nu star	47.95										
569	Approximate Chi Square Value (.05)	33.05					**Nonparametric Statistics**					
570	Adjusted Level of Significance	0.029					95% CLT UCL	0.0358				
571	Adjusted Chi Square Value	31.18					95% Jackknife UCL	0.0365				
572							95% Standard Bootstrap UCL	0.0356				

573				Anderson-Darling Test Statistic	0.637					95% Bootstrap-t UCL	0.0361	
574				Anderson-Darling 5% Critical Value	0.74					95% Hall's Bootstrap UCL	0.035	
575				Kolmogorov-Smirnov Test Statistic	0.238					95% Percentile Bootstrap UCL	0.0355	
576				Kolmogorov-Smirnov 5% Critical Value	0.248					95% BCA Bootstrap UCL	0.0354	
577				**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	0.0479	
578										97.5% Chebyshev(Mean, Sd) UCL	0.0563	
579				**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	0.0729	
580				95% Approximate Gamma UCL (Use when n >= 40)	0.0413							
581				95% Adjusted Gamma UCL (Use when n < 40)	0.0438							
582												
583				**Potential UCL to Use**						Use 95% Student's-t UCL	0.0365	
584												
585	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
586	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
587	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
588												
589	**Note: For highly negative-skewed data, confidence limits**											
590	**(e.g., Chen, Johnson, Lognormal, and Gamma) may not be**											
591	**reliable. Chen's and Johnson's methods provide**											
592	**adjustments for positvely skewed data sets.**											
593												
594												
595	**T - Copper**											
596												
597	**General Statistics**											
598				Number of Valid Observations	12					Number of Distinct Observations	11	
599				Number of Missing Values	102							
600												
601				**Raw Statistics**						**Log-transformed Statistics**		
602				Minimum	0.00021					Minimum of Log Data	-8.468	
603				Maximum	0.026					Maximum of Log Data	-3.65	
604				Mean	0.00902					Mean of log Data	-5.245	
605				Geometric Mean	0.00527					SD of log Data	1.399	
606				Median	0.00845							
607				SD	0.0076							
608				Std. Error of Mean	0.00219							
609				Coefficient of Variation	0.842							
610				Skewness	1.267							
611												
612	**Relevant UCL Statistics**											
613				**Normal Distribution Test**						**Lognormal Distribution Test**		
614				Shapiro Wilk Test Statistic	0.857					Shapiro Wilk Test Statistic	0.82	
615				Shapiro Wilk Critical Value	0.859					Shapiro Wilk Critical Value	0.859	
616				**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**		
617												
618				**Assuming Normal Distribution**						**Assuming Lognormal Distribution**		
619				95% Student's-t UCL	0.013					95% H-UCL	0.0665	
620				**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL	0.0359	
621				95% Adjusted-CLT UCL (Chen-1995)	0.0135					97.5% Chebyshev (MVUE) UCL	0.0461	
622				95% Modified-t UCL (Johnson-1978)	0.0131					99% Chebyshev (MVUE) UCL	0.0661	
623												
624				**Gamma Distribution Test**						**Data Distribution**		

625					k star (bias corrected)	0.856	**Data appear Gamma Distributed at 5% Significance Level**					
626					Theta Star	0.0105						
627					MLE of Mean	0.00902						
628					MLE of Standard Deviation	0.00975						
629					nu star	20.54						
630					Approximate Chi Square Value (.05)	11.25	**Nonparametric Statistics**					
631					Adjusted Level of Significance	0.029					95% CLT UCL	0.0126
632					Adjusted Chi Square Value	10.21					95% Jackknife UCL	0.013
633											95% Standard Bootstrap UCL	0.0125
634					Anderson-Darling Test Statistic	0.582					95% Bootstrap-t UCL	0.0154
635					Anderson-Darling 5% Critical Value	0.755					95% Hall's Bootstrap UCL	0.0389
636					Kolmogorov-Smirnov Test Statistic	0.193					95% Percentile Bootstrap UCL	0.0125
637					Kolmogorov-Smirnov 5% Critical Value	0.252					95% BCA Bootstrap UCL	0.0135
638					**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	0.0186
639											97.5% Chebyshev(Mean, Sd) UCL	0.0227
640					**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	0.0308
641					95% Approximate Gamma UCL (Use when n >= 40)	0.0165						
642					95% Adjusted Gamma UCL (Use when n < 40)	0.0181						
643												
644					**Potential UCL to Use**						Use 95% Approximate Gamma UCL	0.0165
645												
646	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
647	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
648	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
649												
650												
651	**T - Iron**											
652												
653	**General Statistics**											
654					Number of Valid Observations	12	Number of Distinct Observations	11				
655					Number of Missing Values	102						
656												
657	**Raw Statistics**						**Log-transformed Statistics**					
658					Minimum	1.5	Minimum of Log Data	0.405				
659					Maximum	13	Maximum of Log Data	2.565				
660					Mean	5.913	Mean of log Data	1.567				
661					Geometric Mean	4.792	SD of log Data	0.696				
662					Median	4.725						
663					SD	3.888						
664					Std. Error of Mean	1.122						
665					Coefficient of Variation	0.658						
666					Skewness	0.816						
667												
668	**Relevant UCL Statistics**											
669	**Normal Distribution Test**						**Lognormal Distribution Test**					
670					Shapiro Wilk Test Statistic	0.895	Shapiro Wilk Test Statistic	0.962				
671					Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859				
672	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
673												
674	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
675					95% Student's-t UCL	7.928	95% H-UCL	10.13				
676	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL	11.41				

677	95% Adjusted-CLT UCL (Chen-1995)					8.041	97.5% Chebyshev (MVUE) UCL					13.76
678	95% Modified-t UCL (Johnson-1978)					7.972	99% Chebyshev (MVUE) UCL					18.39
679												
680	**Gamma Distribution Test**						**Data Distribution**					
681	k star (bias corrected)					1.956	**Data appear Normal at 5% Significance Level**					
682	Theta Star					3.022						
683	MLE of Mean					5.913						
684	MLE of Standard Deviation					4.227						
685	nu star					46.95						
686	Approximate Chi Square Value (.05)					32.23	**Nonparametric Statistics**					
687	Adjusted Level of Significance					0.029	95% CLT UCL					7.759
688	Adjusted Chi Square Value					30.38	95% Jackknife UCL					7.928
689							95% Standard Bootstrap UCL					7.682
690	Anderson-Darling Test Statistic					0.249	95% Bootstrap-t UCL					8.268
691	Anderson-Darling 5% Critical Value					0.74	95% Hall's Bootstrap UCL					8.032
692	Kolmogorov-Smirnov Test Statistic					0.126	95% Percentile Bootstrap UCL					7.779
693	Kolmogorov-Smirnov 5% Critical Value					0.248	95% BCA Bootstrap UCL					7.892
694	**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					10.81
695							97.5% Chebyshev(Mean, Sd) UCL					12.92
696	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					17.08
697	95% Approximate Gamma UCL (Use when n >= 40)					8.614						
698	95% Adjusted Gamma UCL (Use when n < 40)					9.139						
699												
700	**Potential UCL to Use**						Use 95% Student's-t UCL					7.928
701												
702	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
703	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
704	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
705												
706												
707	**T - Manganese**											
708												
709	**General Statistics**											
710	Number of Valid Observations					12	Number of Distinct Observations					12
711	Number of Missing Values					102						
712												
713	**Raw Statistics**						**Log-transformed Statistics**					
714	Minimum					0.5	Minimum of Log Data					-0.693
715	Maximum					2.2	Maximum of Log Data					0.788
716	Mean					1.493	Mean of log Data					0.314
717	Geometric Mean					1.369	SD of log Data					0.466
718	Median					1.65						
719	SD					0.565						
720	Std. Error of Mean					0.163						
721	Coefficient of Variation					0.379						
722	Skewness					-0.504						
723												
724	**Relevant UCL Statistics**											
725	**Normal Distribution Test**						**Lognormal Distribution Test**					
726	Shapiro Wilk Test Statistic					0.927	Shapiro Wilk Test Statistic					0.876
727	Shapiro Wilk Critical Value					0.859	Shapiro Wilk Critical Value					0.859
728	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					

Assuming Normal Distribution		**Assuming Lognormal Distribution**
95% Student's-t UCL	1.785	95% H-UCL	2.052
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.418
95% Adjusted-CLT UCL (Chen-1995)	1.735	97.5% Chebyshev (MVUE) UCL	2.81
95% Modified-t UCL (Johnson-1978)	1.781	99% Chebyshev (MVUE) UCL	3.58
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	4.534	**Data appear Normal at 5% Significance Level**	
Theta Star	0.329		
MLE of Mean	1.493		
MLE of Standard Deviation	0.701		
nu star	108.8		
Approximate Chi Square Value (.05)	85.74	**Nonparametric Statistics**	
Adjusted Level of Significance	0.029	95% CLT UCL	1.761
Adjusted Chi Square Value	82.62	95% Jackknife UCL	1.785
		95% Standard Bootstrap UCL	1.752
Anderson-Darling Test Statistic	0.557	95% Bootstrap-t UCL	1.759
Anderson-Darling 5% Critical Value	0.732	95% Hall's Bootstrap UCL	1.732
Kolmogorov-Smirnov Test Statistic	0.204	95% Percentile Bootstrap UCL	1.75
Kolmogorov-Smirnov 5% Critical Value	0.246	95% BCA Bootstrap UCL	1.743
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2.203
		97.5% Chebyshev(Mean, Sd) UCL	2.511
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.115
95% Approximate Gamma UCL (Use when n >= 40)	1.894		
95% Adjusted Gamma UCL (Use when n < 40)	1.966		
Potential UCL to Use		Use 95% Student's-t UCL	1.785

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

T - Silver

General Statistics

Number of Valid Data	12	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	11
Number of Missing Values	102	Percent Non-Detects	91.67%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable T - Silver was not processed!

	A	B	C	D	E	F	G	H	I	J	K	L
781												
782	**Bromide**											
783												
784						**General Statistics**							
785						Number of Valid Data	12				Number of Detected Data	10
786						Number of Distinct Detected Data	9				Number of Non-Detect Data	2
787						Number of Missing Values	102				Percent Non-Detects	16.67%
788												
789				**Raw Statistics**					**Log-transformed Statistics**			
790						Minimum Detected	0.14				Minimum Detected	-1.966
791						Maximum Detected	0.48				Maximum Detected	-0.734
792						Mean of Detected	0.36				Mean of Detected	-1.092
793						SD of Detected	0.118				SD of Detected	0.426
794						Minimum Non-Detect	0.2				Minimum Non-Detect	-1.609
795						Maximum Non-Detect	0.2				Maximum Non-Detect	-1.609
796												
797												
798						**UCL Statistics**							
799				**Normal Distribution Test with Detected Values Only**					**Lognormal Distribution Test with Detected Values Only**			
800						Shapiro Wilk Test Statistic	0.855				Shapiro Wilk Test Statistic	0.78
801						5% Shapiro Wilk Critical Value	0.842				5% Shapiro Wilk Critical Value	0.842
802				**Data appear Normal at 5% Significance Level**					**Data not Lognormal at 5% Significance Level**			
803												
804				**Assuming Normal Distribution**					**Assuming Lognormal Distribution**			
805						DL/2 Substitution Method					DL/2 Substitution Method	
806						Mean	0.316				Mean	-1.293
807						SD	0.147				SD	0.609
808						95% DL/2 (t) UCL	0.393				95% H-Stat (DL/2) UCL	0.502
809												
810						Maximum Likelihood Estimate(MLE) Method					Log ROS Method	
811						Mean	0.41				Mean in Log Scale	-1.188
812						SD	0.0543				SD in Log Scale	0.448
813						95% MLE (t) UCL	0.438				Mean in Original Scale	0.331
814						95% MLE (Tiku) UCL	0.444				SD in Original Scale	0.126
815											95% t UCL	0.397
816											95% Percentile Bootstrap UCL	0.386
817											95% BCA Bootstrap UCL	0.387
818											95% H UCL	0.447
819												
820				**Gamma Distribution Test with Detected Values Only**					**Data Distribution Test with Detected Values Only**			
821						k star (bias corrected)	5.292		**Data appear Normal at 5% Significance Level**			
822						Theta Star	0.0679					
823						nu star	105.8					
824												
825						A-D Test Statistic	0.901		**Nonparametric Statistics**			
826						5% A-D Critical Value	0.727				Kaplan-Meier (KM) Method	
827						K-S Test Statistic	0.727				Mean	0.326
828						5% K-S Critical Value	0.267				SD	0.127
829				**Data follow Appr. Gamma Distribution at 5% Significance Level**							SE of Mean	0.0389
830											95% KM (t) UCL	0.396
831				**Assuming Gamma Distribution**							95% KM (z) UCL	0.39
832						Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL	0.396

833					Minimum	0.122					95% KM (bootstrap t) UCL	0.392
834					Maximum	0.48					95% KM (BCA) UCL	0.406
835					Mean	0.328					95% KM (Percentile Bootstrap) UCL	0.401
836					Median	0.35					95% KM (Chebyshev) UCL	0.495
837					SD	0.132					97.5% KM (Chebyshev) UCL	0.569
838					k star	4.023					99% KM (Chebyshev) UCL	0.713
839					Theta star	0.0814						
840					Nu star	96.54					**Potential UCLs to Use**	
841					AppChi2	74.88					95% KM (t) UCL	0.396
842				95% Gamma Approximate UCL (Use when n >= 40)		0.422					95% KM (Percentile Bootstrap) UCL	0.401
843				95% Adjusted Gamma UCL (Use when n < 40)		0.439						
844	**Note: DL/2 is not a recommended method.**											
845												
846	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
847	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
848	**For additional insight, the user may want to consult a statistician.**											
849												
850												
851	**Chloride**											
852												
853	**General Statistics**											
854	Number of Valid Observations					114	Number of Distinct Observations					26
855												
856	**Raw Statistics**						**Log-transformed Statistics**					
857	Minimum					60	Minimum of Log Data					4.094
858	Maximum					300	Maximum of Log Data					5.704
859	Mean					157.4	Mean of log Data					5.009
860	Geometric Mean					149.8	SD of log Data					0.321
861	Median					150						
862	SD					48.43						
863	Std. Error of Mean					4.536						
864	Coefficient of Variation					0.308						
865	Skewness					0.38						
866												
867	**Relevant UCL Statistics**											
868	**Normal Distribution Test**						**Lognormal Distribution Test**					
869	Lilliefors Test Statistic					0.105	Lilliefors Test Statistic					0.0723
870	Lilliefors Critical Value					0.083	Lilliefors Critical Value					0.083
871	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
872												
873	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
874	95% Student's-t UCL					164.9	95% H-UCL					166.3
875	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL					178.9
876	95% Adjusted-CLT UCL (Chen-1995)					165	97.5% Chebyshev (MVUE) UCL					188
877	95% Modified-t UCL (Johnson-1978)					164.9	99% Chebyshev (MVUE) UCL					206
878												
879	**Gamma Distribution Test**						**Data Distribution**					
880	k star (bias corrected)					10.09	**Data appear Gamma Distributed at 5% Significance Level**					
881	Theta Star					15.6						
882	MLE of Mean					157.4						
883	MLE of Standard Deviation					49.54						
884	nu star					2300						

885	Approximate Chi Square Value (.05)					2190	**Nonparametric Statistics**					
886	Adjusted Level of Significance					0.0479	95% CLT UCL					164.8
887	Adjusted Chi Square Value					2188	95% Jackknife UCL					164.9
888							95% Standard Bootstrap UCL					164.8
889	Anderson-Darling Test Statistic					0.626	95% Bootstrap-t UCL					165.3
890	Anderson-Darling 5% Critical Value					0.752	95% Hall's Bootstrap UCL					165.2
891	Kolmogorov-Smirnov Test Statistic					0.074	95% Percentile Bootstrap UCL					165
892	Kolmogorov-Smirnov 5% Critical Value					0.0858	95% BCA Bootstrap UCL					164.7
893	**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL					177.1
894							97.5% Chebyshev(Mean, Sd) UCL					185.7
895	**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL					202.5
896	95% Approximate Gamma UCL (Use when n >= 40)					165.3						
897	95% Adjusted Gamma UCL (Use when n < 40)					165.4						
898												
899	**Potential UCL to Use**						Use 95% Approximate Gamma UCL					165.3
900												
901	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
902	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
903	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
904												
905												
906	**Nitrite as N**											
907												
908	**General Statistics**											
909	Number of Valid Data					108	Number of Detected Data					5
910	Number of Distinct Detected Data					4	Number of Non-Detect Data					103
911	Number of Missing Values					6	Percent Non-Detects					95.37%
912												
913	**Raw Statistics**						**Log-transformed Statistics**					
914	Minimum Detected					0.01	Minimum Detected					-4.605
915	Maximum Detected					0.043	Maximum Detected					-3.147
916	Mean of Detected					0.0218	Mean of Detected					-3.944
917	SD of Detected					0.0126	SD of Detected					0.53
918	Minimum Non-Detect					0.01	Minimum Non-Detect					-4.605
919	Maximum Non-Detect					0.1	Maximum Non-Detect					-2.303
920												
921	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					108
922	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					0
923	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					100.00%
924												
925	**Warning: There are only 4 Distinct Detected Values in this data**											
926	**Note: It should be noted that even though bootstrap may be performed on this data set**											
927	**the resulting calculations may not be reliable enough to draw conclusions**											
928												
929	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
930												
931												
932	**UCL Statistics**											
933	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
934	Shapiro Wilk Test Statistic					0.843	Shapiro Wilk Test Statistic					0.947
935	5% Shapiro Wilk Critical Value					0.762	5% Shapiro Wilk Critical Value					0.762
936	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					

937												
938	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
939				DL/2 Substitution Method						DL/2 Substitution Method		
940				Mean	0.0323					Mean	-3.846	
941				SD	0.0211					SD	1.065	
942				95% DL/2 (t) UCL	0.0357					95% H-Stat (DL/2) UCL	0.0476	
943												
944				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
945	**MLE method failed to converge properly**									Mean in Log Scale	-6.629	
946										SD in Log Scale	1.568	
947										Mean in Original Scale	0.00409	
948										SD in Original Scale	0.00768	
949										95% t UCL	0.00531	
950										95% Percentile Bootstrap UCL	0.00537	
951										95% BCA Bootstrap UCL	0.00568	
952										95% H-UCL	0.0069	
953												
954	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
955				k star (bias corrected)	1.897		**Data appear Normal at 5% Significance Level**					
956				Theta Star	0.0115							
957				nu star	18.97							
958												
959				A-D Test Statistic	0.363		**Nonparametric Statistics**					
960				5% A-D Critical Value	0.681					Kaplan-Meier (KM) Method		
961				K-S Test Statistic	0.681					Mean	0.0114	
962				5% K-S Critical Value	0.358					SD	0.00551	
963	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean	0.0009626	
964										95% KM (t) UCL	0.013	
965	**Assuming Gamma Distribution**									95% KM (z) UCL	0.013	
966				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.0157	
967				Minimum	0.000001					95% KM (bootstrap t) UCL	0.0136	
968				Maximum	0.043					95% KM (BCA) UCL	0.022	
969				Mean	0.00234					95% KM (Percentile Bootstrap) UCL	0.0207	
970				Median	0.000001					95% KM (Chebyshev) UCL	0.0156	
971				SD	0.00765					97.5% KM (Chebyshev) UCL	0.0175	
972				k star	0.122					99% KM (Chebyshev) UCL	0.021	
973				Theta star	0.0192							
974				Nu star	26.32		**Potential UCLs to Use**					
975				AppChi2	15.63					95% KM (t) UCL	0.013	
976				95% Gamma Approximate UCL (Use when n >= 40)	0.00394					95% KM (Percentile Bootstrap) UCL	0.0207	
977				95% Adjusted Gamma UCL (Use when n < 40)	0.00397							
978	**Note: DL/2 is not a recommended method.**											
979												
980	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
981	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
982	**For additional insight, the user may want to consult a statistician.**											
983												
984												
985	**Nitrogen, as Ammonia**											
986												
987	**General Statistics**											
988				Number of Valid Observations	114					Number of Distinct Observations	65	

Raw Statistics		
Minimum	14	
Maximum	250	
Mean	52.66	
Geometric Mean	41.43	
Median	36.75	
SD	41.69	
Std. Error of Mean	3.905	
Coefficient of Variation	0.792	
Skewness	1.996	

Log-transformed Statistics	
Minimum of Log Data	2.639
Maximum of Log Data	5.521
Mean of log Data	3.724
SD of log Data	0.671

Relevant UCL Statistics

Normal Distribution Test	
Lilliefors Test Statistic	0.183
Lilliefors Critical Value	0.083
Data not Normal at 5% Significance Level	
Assuming Normal Distribution	
95% Student's-t UCL	59.13
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	59.86
95% Modified-t UCL (Johnson-1978)	59.26
Gamma Distribution Test	
k star (bias corrected)	2.184
Theta Star	24.11
MLE of Mean	52.66
MLE of Standard Deviation	35.63
nu star	497.9
Approximate Chi Square Value (.05)	447.2
Adjusted Level of Significance	0.0479
Adjusted Chi Square Value	446.5
Anderson-Darling Test Statistic	2.433
Anderson-Darling 5% Critical Value	0.764
Kolmogorov-Smirnov Test Statistic	0.132
Kolmogorov-Smirnov 5% Critical Value	0.0868
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	58.63
95% Adjusted Gamma UCL (Use when n < 40)	58.71
Potential UCL to Use	

Lognormal Distribution Test	
Lilliefors Test Statistic	0.0932
Lilliefors Critical Value	0.083
Data not Lognormal at 5% Significance Level	
Assuming Lognormal Distribution	
95% H-UCL	58.67
95% Chebyshev (MVUE) UCL	67.33
97.5% Chebyshev (MVUE) UCL	74.06
99% Chebyshev (MVUE) UCL	87.29
Data Distribution	
Data do not follow a Discernable Distribution (0.05)	
Nonparametric Statistics	
95% CLT UCL	59.08
95% Jackknife UCL	59.13
95% Standard Bootstrap UCL	59.02
95% Bootstrap-t UCL	59.98
95% Hall's Bootstrap UCL	60.03
95% Percentile Bootstrap UCL	59.12
95% BCA Bootstrap UCL	59.86
95% Chebyshev(Mean, Sd) UCL	69.68
97.5% Chebyshev(Mean, Sd) UCL	77.04
99% Chebyshev(Mean, Sd) UCL	91.51
Use 95% Chebyshev (Mean, Sd) UCL	69.68

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Hydrazine

1041												
1042	**General Statistics**											
1043					Number of Valid Data	10				Number of Detected Data		2
1044					Number of Distinct Detected Data	2				Number of Non-Detect Data		8
1045					Number of Missing Values	103				Percent Non-Detects		80.00%
1046												
1047	**Raw Statistics**						**Log-transformed Statistics**					
1048					Minimum Detected	0.000076				Minimum Detected		-9.485
1049					Maximum Detected	0.00008				Maximum Detected		-9.433
1050					Mean of Detected	0.000078				Mean of Detected		-9.459
1051					SD of Detected	2.828E-06				SD of Detected		0.0363
1052					Minimum Non-Detect	0.0001				Minimum Non-Detect		-9.21
1053					Maximum Non-Detect	0.0001				Maximum Non-Detect		-9.21
1054												
1055												
1056	**Warning: Data set has only 2 Distinct Detected Values.**											
1057	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
1058	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
1059												
1060	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
1061												
1062	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
1063	**Those methods will return a 'N/A' value on your output display!**											
1064												
1065	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
1066	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
1067	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
1068												
1069												
1070	**UCL Statistics**											
1071	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1072					Shapiro Wilk Test Statistic	N/A				Shapiro Wilk Test Statistic		N/A
1073					5% Shapiro Wilk Critical Value	N/A				5% Shapiro Wilk Critical Value		N/A
1074	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
1075												
1076	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1077					DL/2 Substitution Method					DL/2 Substitution Method		
1078					Mean	0.0000556				Mean		-9.815
1079					SD	1.184E-05				SD		0.188
1080					95% DL/2 (t) UCL	6.247E-05				95% H-Stat (DL/2) UCL		6.253E-05
1081												
1082					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
1083	**MLE method failed to converge properly**									Mean in Log Scale		N/A
1084										SD in Log Scale		N/A
1085										Mean in Original Scale		N/A
1086										SD in Original Scale		N/A
1087										95% t UCL		N/A
1088										95% Percentile Bootstrap UCL		N/A
1089										95% BCA Bootstrap UCL		N/A
1090										95% H-UCL		N/A
1091												
1092	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					

1093					k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**					
1094					Theta Star	N/A						
1095					nu star	N/A						
1096												
1097					A-D Test Statistic	N/A	**Nonparametric Statistics**					
1098					5% A-D Critical Value	N/A				Kaplan-Meier (KM) Method		
1099					K-S Test Statistic	N/A				Mean		0.000078
1100					5% K-S Critical Value	N/A				SD		0.000002
1101			**Data not Gamma Distributed at 5% Significance Level**							SE of Mean		0.000002
1102										95% KM (t) UCL		8.167E-05
1103			**Assuming Gamma Distribution**							95% KM (z) UCL		8.129E-05
1104					Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL		N/A
1105					Minimum	N/A				95% KM (bootstrap t) UCL		N/A
1106					Maximum	N/A				95% KM (BCA) UCL		N/A
1107					Mean	N/A				95% KM (Percentile Bootstrap) UCL		N/A
1108					Median	N/A				95% KM (Chebyshev) UCL		8.672E-05
1109					SD	N/A				97.5% KM (Chebyshev) UCL		9.049E-05
1110					k star	N/A				99% KM (Chebyshev) UCL		0.0000979
1111					Theta star	N/A						
1112					Nu star	N/A	**Potential UCLs to Use**					
1113					AppChi2	N/A				95% KM (t) UCL		8.167E-05
1114					95% Gamma Approximate UCL (Use when n >= 40)	N/A				95% KM (% Bootstrap) UCL		N/A
1115					95% Adjusted Gamma UCL (Use when n < 40)	N/A						
1116	**Warning: Recommended UCL exceeds the maximum observation**											
1117	**Note: DL/2 is not a recommended method.**											
1118												
1119	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1120	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1121	**For additional insight, the user may want to consult a statistician.**											
1122												
1123												
1124	**4,4'-Isopropylidenediphenol**											
1125												
1126	**General Statistics**											
1127					Number of Valid Data	9	Number of Detected Data	3				
1128					Number of Distinct Detected Data	3	Number of Non-Detect Data	6				
1129					Number of Missing Values	103	Percent Non-Detects	66.67%				
1130												
1131	**Raw Statistics**						**Log-transformed Statistics**					
1132					Minimum Detected	0.00065	Minimum Detected	-7.339				
1133					Maximum Detected	0.00096	Maximum Detected	-6.949				
1134					Mean of Detected	0.0008267	Mean of Detected	-7.111				
1135					SD of Detected	0.0001595	SD of Detected	0.203				
1136					Minimum Non-Detect	0.00094	Minimum Non-Detect	-6.97				
1137					Maximum Non-Detect	0.00098	Maximum Non-Detect	-6.928				
1138												
1139	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect	9				
1140	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected	0				
1141	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage	100.00%				
1142												
1143	**Warning: There are only 3 Distinct Detected Values in this data set**											
1144	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											

1145	Those methods will return a 'N/A' value on your output display!											
1146												
1147	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
1148	However, results obtained using 4 to 9 distinct values may not be reliable.											
1149	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
1150												
1151												
1152	UCL Statistics											
1153	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
1154				Shapiro Wilk Test Statistic	0.945					Shapiro Wilk Test Statistic	0.924	
1155				5% Shapiro Wilk Critical Value	0.767					5% Shapiro Wilk Critical Value	0.767	
1156	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
1157												
1158	Assuming Normal Distribution						Assuming Lognormal Distribution					
1159				DL/2 Substitution Method						DL/2 Substitution Method		
1160				Mean	0.0005933					Mean	-7.47	
1161				SD	0.0001924					SD	0.288	
1162				95% DL/2 (t) UCL	0.0007126					95% H-Stat (DL/2) UCL	0.000728	
1163												
1164				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
1165	MLE method failed to converge properly									Mean in Log Scale	-7.17	
1166										SD in Log Scale	0.123	
1167										Mean in Original Scale	0.0007745	
1168										SD in Original Scale	9.722E-05	
1169										95% t UCL	0.0008348	
1170										95% Percentile Bootstrap UCL	0.0008253	
1171										95% BCA Bootstrap UCL	0.0008319	
1172										95% H-UCL	0.0008397	
1173												
1174	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
1175				k star (bias corrected)	N/A		Data appear Normal at 5% Significance Level					
1176				Theta Star	N/A							
1177				nu star	N/A							
1178												
1179				A-D Test Statistic	N/A		Nonparametric Statistics					
1180				5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method		
1181				K-S Test Statistic	N/A					Mean	0.0007886	
1182				5% K-S Critical Value	N/A					SD	0.0001236	
1183	Data not Gamma Distributed at 5% Significance Level									SE of Mean	8.785E-05	
1184										95% KM (t) UCL	0.0009519	
1185	Assuming Gamma Distribution									95% KM (z) UCL	0.0009331	
1186				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.00102	
1187				Minimum	N/A					95% KM (bootstrap t) UCL	0.0009288	
1188				Maximum	N/A					95% KM (BCA) UCL	0.00096	
1189				Mean	N/A					95% KM (Percentile Bootstrap) UCL	0.00096	
1190				Median	N/A					95% KM (Chebyshev) UCL	0.00117	
1191				SD	N/A					97.5% KM (Chebyshev) UCL	0.00134	
1192				k star	N/A					99% KM (Chebyshev) UCL	0.00166	
1193				Theta star	N/A							
1194				Nu star	N/A		Potential UCLs to Use					
1195				AppChi2	N/A					95% KM (t) UCL	0.0009519	
1196				95% Gamma Approximate UCL (Use when n >= 40)	N/A					95% KM (Percentile Bootstrap) UCL	0.00096	

1197	95% Adjusted Gamma UCL (Use when n < 40)				N/A							
1198	**Note: DL/2 is not a recommended method.**											
1199												
1200	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1201	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1202	**For additional insight, the user may want to consult a statistician.**											
1203												
1204												
1205	**4-Nonylphenol (Tech_)**											
1206												
1207	**General Statistics**											
1208	Number of Valid Data				9	Number of Detected Data						7
1209	Number of Distinct Detected Data				7	Number of Non-Detect Data						2
1210	Number of Missing Values				103	Percent Non-Detects						22.22%
1211												
1212	**Raw Statistics**					**Log-transformed Statistics**						
1213	Minimum Detected				0.0056	Minimum Detected						-5.185
1214	Maximum Detected				0.018	Maximum Detected						-4.017
1215	Mean of Detected				0.0119	Mean of Detected						-4.528
1216	SD of Detected				0.00528	SD of Detected						0.499
1217	Minimum Non-Detect				0.0047	Minimum Non-Detect						-5.36
1218	Maximum Non-Detect				0.0048	Maximum Non-Detect						-5.339
1219												
1220	Note: Data have multiple DLs - Use of KM Method is recommended					Number treated as Non-Detect						2
1221	For all methods (except KM, DL/2, and ROS Methods),					Number treated as Detected						7
1222	Observations < Largest ND are treated as NDs					Single DL Non-Detect Percentage						22.22%
1223												
1224	**Warning: There are only 7 Detected Values in this data**											
1225	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1226	**the resulting calculations may not be reliable enough to draw conclusions**											
1227												
1228	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1229												
1230												
1231	**UCL Statistics**											
1232	**Normal Distribution Test with Detected Values Only**					**Lognormal Distribution Test with Detected Values Only**						
1233	Shapiro Wilk Test Statistic				0.866	Shapiro Wilk Test Statistic						0.849
1234	5% Shapiro Wilk Critical Value				0.803	5% Shapiro Wilk Critical Value						0.803
1235	**Data appear Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**						
1236												
1237	**Assuming Normal Distribution**					**Assuming Lognormal Distribution**						
1238	DL/2 Substitution Method					DL/2 Substitution Method						
1239	Mean				0.00981	Mean						-4.865
1240	SD				0.00622	SD						0.796
1241	95% DL/2 (t) UCL				0.0137	95% H-Stat (DL/2) UCL						0.0233
1242												
1243	Maximum Likelihood Estimate(MLE) Method					Log ROS Method						
1244	Mean				0.00952	Mean in Log Scale						-4.788
1245	SD				0.00641	SD in Log Scale						0.673
1246	95% MLE (t) UCL				0.0135	Mean in Original Scale						0.01
1247	95% MLE (Tiku) UCL				0.0136	SD in Original Scale						0.00593
1248						95% t UCL						0.0137

1249											95% Percentile Bootstrap UCL	0.0133
1250											95% BCA Bootstrap UCL	0.0131
1251											95% H UCL	0.0193
1252												
1253	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
1254					k star (bias corrected)	3.072	Data appear Normal at 5% Significance Level					
1255					Theta Star	0.00388						
1256					nu star	43.01						
1257												
1258					A-D Test Statistic	0.566	Nonparametric Statistics					
1259					5% A-D Critical Value	0.71					Kaplan-Meier (KM) Method	
1260					K-S Test Statistic	0.71					Mean	0.0105
1261					5% K-S Critical Value	0.313					SD	0.00505
1262	Data appear Gamma Distributed at 5% Significance Level										SE of Mean	0.00182
1263											95% KM (t) UCL	0.0139
1264	Assuming Gamma Distribution										95% KM (z) UCL	0.0135
1265					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.0138
1266					Minimum	0.000001					95% KM (bootstrap t) UCL	0.0142
1267					Maximum	0.018					95% KM (BCA) UCL	0.0146
1268					Mean	0.00928					95% KM (Percentile Bootstrap) UCL	0.0139
1269					Median	0.0077					95% KM (Chebyshev) UCL	0.0184
1270					SD	0.00697					97.5% KM (Chebyshev) UCL	0.0219
1271					k star	0.308					99% KM (Chebyshev) UCL	0.0286
1272					Theta star	0.0301						
1273					Nu star	5.551	Potential UCLs to Use					
1274					AppChi2	1.415					95% KM (t) UCL	0.0139
1275					95% Gamma Approximate UCL (Use when n >= 40)	0.0364					95% KM (Percentile Bootstrap) UCL	0.0139
1276					95% Adjusted Gamma UCL (Use when n < 40)	0.0503						
1277	Note: DL/2 is not a recommended method.											
1278												
1279	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1280	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1281	For additional insight, the user may want to consult a statistician.											
1282												
1283												
1284	Kempore (Azodicarbonamide)											
1285												
1286	General Statistics											
1287					Number of Valid Data	10					Number of Detected Data	3
1288					Number of Distinct Detected Data	3					Number of Non-Detect Data	7
1289					Number of Missing Values	103					Percent Non-Detects	70.00%
1290												
1291	Raw Statistics						Log-transformed Statistics					
1292					Minimum Detected	1.1					Minimum Detected	0.0953
1293					Maximum Detected	1.4					Maximum Detected	0.336
1294					Mean of Detected	1.233					Mean of Detected	0.205
1295					SD of Detected	0.153					SD of Detected	0.122
1296					Minimum Non-Detect	1					Minimum Non-Detect	0
1297					Maximum Non-Detect	1.1					Maximum Non-Detect	0.0953
1298												
1299	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	7
1300	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	3

1301	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	70.00%
1302												
1303	**Warning: There are only 3 Distinct Detected Values in this data set**											
1304	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
1305	**Those methods will return a 'N/A' value on your output display!**											
1306												
1307	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
1308	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
1309	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
1310												
1311												
1312	**UCL Statistics**											
1313	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1314	Shapiro Wilk Test Statistic				0.964		Shapiro Wilk Test Statistic				0.975	
1315	5% Shapiro Wilk Critical Value				0.767		5% Shapiro Wilk Critical Value				0.767	
1316	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1317												
1318	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1319	DL/2 Substitution Method						DL/2 Substitution Method					
1320	Mean				0.725		Mean				-0.414	
1321	SD				0.358		SD				0.432	
1322	95% DL/2 (t) UCL				0.933		95% H-Stat (DL/2) UCL				0.986	
1323												
1324	Maximum Likelihood Estimate(MLE) Method						Log ROS Method					
1325	Mean				0.98		Mean in Log Scale				-0.17	
1326	SD				0.222		SD in Log Scale				0.304	
1327	95% MLE (t) UCL				1.109		Mean in Original Scale				0.88	
1328	95% MLE (Tiku) UCL				1.205		SD in Original Scale				0.275	
1329							95% t UCL				1.039	
1330							95% Percentile Bootstrap UCL				1.019	
1331							95% BCA Bootstrap UCL				1.042	
1332							95% H UCL				1.08	
1333												
1334	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1335	k star (bias corrected)				N/A		**Data appear Normal at 5% Significance Level**					
1336	Theta Star				N/A							
1337	nu star				N/A							
1338												
1339	A-D Test Statistic				N/A		**Nonparametric Statistics**					
1340	5% A-D Critical Value				N/A		Kaplan-Meier (KM) Method					
1341	K-S Test Statistic				N/A		Mean				1.14	
1342	5% K-S Critical Value				N/A		SD				0.0917	
1343	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean				0.0355	
1344							95% KM (t) UCL				1.205	
1345	**Assuming Gamma Distribution**						95% KM (z) UCL				1.198	
1346	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL				1.217	
1347	Minimum				N/A		95% KM (bootstrap t) UCL				1.19	
1348	Maximum				N/A		95% KM (BCA) UCL				N/A	
1349	Mean				N/A		95% KM (Percentile Bootstrap) UCL				N/A	
1350	Median				N/A		95% KM (Chebyshev) UCL				1.295	
1351	SD				N/A		97.5% KM (Chebyshev) UCL				1.362	
1352	k star				N/A		99% KM (Chebyshev) UCL				1.493	

1353					Theta star	N/A						
1354					Nu star	N/A	**Potential UCLs to Use**					
1355					AppChi2	N/A					95% KM (t) UCL	1.205
1356				95% Gamma Approximate UCL (Use when n >= 40)		N/A					95% KM (Percentile Bootstrap) UCL	N/A
1357				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
1358	**Note: DL/2 is not a recommended method.**											
1359												
1360	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1361	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1362	**For additional insight, the user may want to consult a statistician.**											
1363												
1364	**T - Lead**											
1365												
1366	**General Statistics**											
1367					Number of Valid Data	12					Number of Detected Data	10
1368					Number of Distinct Detected Data	10					Number of Non-Detect Data	2
1369											Percent Non-Detects	16.67%
1370												
1371	**Raw Statistics**						**Log-transformed Statistics**					
1372					Minimum Detected	0.00028					Minimum Detected	-8.181
1373					Maximum Detected	0.0021					Maximum Detected	-6.166
1374					Mean of Detected	0.000697					Mean of Detected	-7.477
1375					SD of Detected	0.0005619					SD of Detected	0.63
1376					Minimum Non-Detect	0.0001					Minimum Non-Detect	-9.21
1377					Maximum Non-Detect	0.001					Maximum Non-Detect	-6.908
1378												
1379	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	10
1380	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	2
1381	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	83.33%
1382												
1383	**UCL Statistics**											
1384	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1385					Shapiro Wilk Test Statistic	0.729					Shapiro Wilk Test Statistic	0.905
1386					5% Shapiro Wilk Critical Value	0.842					5% Shapiro Wilk Critical Value	0.842
1387	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1388												
1389	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1390					DL/2 Substitution Method						DL/2 Substitution Method	
1391					Mean	0.0006267					Mean	-7.689
1392					SD	0.0005427					SD	0.901
1393					95% DL/2 (t) UCL	0.000908					95% H-Stat (DL/2) UCL	0.00145
1394												
1395					Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method	
1396	**MLE method failed to converge properly**										Mean in Log Scale	-7.622
1397											SD in Log Scale	0.705
1398											Mean in Original Scale	0.0006267
1399											SD in Original Scale	0.0005374
1400											95% t UCL	0.0009053
1401											95% Percentile Bootstrap UCL	0.0008954
1402											95% BCA Bootstrap UCL	0.00101
1403											95% H-UCL	0.00105
1404												

	A	B	C	D	E	F	G	H	I	J	K	L
1405	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1406					k star (bias corrected)	1.858	**Data appear Gamma Distributed at 5% Significance Level**					
1407					Theta Star	0.0003752						
1408					nu star	37.15						
1409												
1410					A-D Test Statistic	0.657	**Nonparametric Statistics**					
1411					5% A-D Critical Value	0.734					Kaplan-Meier (KM) Method	
1412					K-S Test Statistic	0.734					Mean	0.0006407
1413					5% K-S Critical Value	0.269					SD	0.0005054
1414	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0001544
1415											95% KM (t) UCL	0.000918
1416	**Assuming Gamma Distribution**										95% KM (z) UCL	0.0008947
1417				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	0.0009147
1418					Minimum	0.000001					95% KM (bootstrap t) UCL	0.00138
1419					Maximum	0.0021					95% KM (BCA) UCL	0.0009408
1420					Mean	0.0006221					95% KM (Percentile Bootstrap) UCL	0.0008992
1421					Median	0.0004623					95% KM (Chebyshev) UCL	0.00131
1422					SD	0.0005477					97.5% KM (Chebyshev) UCL	0.0016
1423					k star	0.745					99% KM (Chebyshev) UCL	0.00218
1424					Theta star	0.0008346						
1425					Nu star	17.89	**Potential UCLs to Use**					
1426					AppChi2	9.312					95% KM (BCA) UCL	0.0009408
1427				95% Gamma Approximate UCL (Use when n >= 40)		0.0012						
1428				95% Adjusted Gamma UCL (Use when n < 40)		0.00133						
1429	**Note: DL/2 is not a recommended method.**											
1430												
1431	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1432	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1433	**For additional insight, the user may want to consult a statistician.**											
1434												
1435	**F - Chromium**											
1436												
1437	**General Statistics**											
1438					Number of Valid Observations	102					Number of Distinct Observations	69
1439					Number of Missing Values	9						
1440												
1441	**Raw Statistics**						**Log-transformed Statistics**					
1442					Minimum	0.004					Minimum of Log Data	-5.521
1443					Maximum	1.2					Maximum of Log Data	0.182
1444					Mean	0.15					Mean of log Data	-2.926
1445					Geometric Mean	0.0536					SD of log Data	1.503
1446					Median	0.052						
1447					SD	0.217						
1448					Std. Error of Mean	0.0215						
1449					Coefficient of Variation	1.449						
1450					Skewness	2.222						
1451												
1452	**Relevant UCL Statistics**											
1453	**Normal Distribution Test**						**Lognormal Distribution Test**					
1454					Lilliefors Test Statistic	0.264					Lilliefors Test Statistic	0.132
1455					Lilliefors Critical Value	0.0877					Lilliefors Critical Value	0.0877
1456	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					

	A	B	C	D	E	F	G	H	I	J	K	L
1457												
1458	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1459					95% Student's-t UCL	0.185					95% H-UCL	0.249
1460	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	0.308
1461					95% Adjusted-CLT UCL (Chen-1995)	0.19					97.5% Chebyshev (MVUE) UCL	0.372
1462					95% Modified-t UCL (Johnson-1978)	0.186					99% Chebyshev (MVUE) UCL	0.496
1463												
1464	**Gamma Distribution Test**						**Data Distribution**					
1465					k star (bias corrected)	0.59	**Data do not follow a Discernable Distribution (0.05)**					
1466					Theta Star	0.254						
1467					MLE of Mean	0.15						
1468					MLE of Standard Deviation	0.195						
1469					nu star	120.4						
1470					Approximate Chi Square Value (.05)	96.04	**Nonparametric Statistics**					
1471					Adjusted Level of Significance	0.0476					95% CLT UCL	0.185
1472					Adjusted Chi Square Value	95.73					95% Jackknife UCL	0.185
1473											95% Standard Bootstrap UCL	0.185
1474					Anderson-Darling Test Statistic	3.767					95% Bootstrap-t UCL	0.193
1475					Anderson-Darling 5% Critical Value	0.809					95% Hall's Bootstrap UCL	0.193
1476					Kolmogorov-Smirnov Test Statistic	0.144					95% Percentile Bootstrap UCL	0.187
1477					Kolmogorov-Smirnov 5% Critical Value	0.0934					95% BCA Bootstrap UCL	0.19
1478	**Data not Gamma Distributed at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	0.243
1479											97.5% Chebyshev(Mean, Sd) UCL	0.284
1480	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	0.364
1481					95% Approximate Gamma UCL (Use when n >= 40)	0.188						
1482					95% Adjusted Gamma UCL (Use when n < 40)	0.188						
1483												
1484	**Potential UCL to Use**										Use 95% Chebyshev (Mean, Sd) UCL	0.243
1485												
1486	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1487	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1488	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1489												
1490												
1491	**F - Aluminum**											
1492												
1493	**General Statistics**											
1494					Number of Valid Data	102					Number of Detected Data	97
1495					Number of Distinct Detected Data	64					Number of Non-Detect Data	5
1496					Number of Missing Values	9					Percent Non-Detects	4.90%
1497												
1498	**Raw Statistics**						**Log-transformed Statistics**					
1499					Minimum Detected	0.02					Minimum Detected	-3.912
1500					Maximum Detected	3.6					Maximum Detected	1.281
1501					Mean of Detected	0.503					Mean of Detected	-1.413
1502					SD of Detected	0.663					SD of Detected	1.204
1503					Minimum Non-Detect	0.017					Minimum Non-Detect	-4.075
1504					Maximum Non-Detect	0.1					Maximum Non-Detect	-2.303
1505												
1506	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	29
1507	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	73
1508	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	28.43%

1509												
1510	**UCL Statistics**											
1511	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1512				Lilliefors Test Statistic	0.255					Lilliefors Test Statistic	0.145	
1513				5% Lilliefors Critical Value	0.09					5% Lilliefors Critical Value	0.09	
1514	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
1515												
1516	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1517				DL/2 Substitution Method						DL/2 Substitution Method		
1518				Mean	0.481					Mean	-1.508	
1519				SD	0.654					SD	1.257	
1520				95% DL/2 (t) UCL	0.588					95% H-Stat (DL/2) UCL	0.663	
1521												
1522				Maximum Likelihood Estimate(MLE) Method						Log ROS Method		
1523				Mean	0.327					Mean in Log Scale	-1.505	
1524				SD	0.818					SD in Log Scale	1.255	
1525				95% MLE (t) UCL	0.462					Mean in Original Scale	0.481	
1526				95% MLE (Tiku) UCL	0.466					SD in Original Scale	0.654	
1527										95% t UCL	0.589	
1528										95% Percentile Bootstrap UCL	0.594	
1529										95% BCA Bootstrap UCL	0.611	
1530										95% H UCL	0.663	
1531												
1532	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1533				k star (bias corrected)	0.797		**Data do not follow a Discernable Distribution (0.05)**					
1534				Theta Star	0.632							
1535				nu star	154.5							
1536												
1537				A-D Test Statistic	4.068		**Nonparametric Statistics**					
1538				5% A-D Critical Value	0.792					Kaplan-Meier (KM) Method		
1539				K-S Test Statistic	0.792					Mean	0.481	
1540				5% K-S Critical Value	0.0942					SD	0.651	
1541	**Data not Gamma Distributed at 5% Significance Level**									SE of Mean	0.0648	
1542										95% KM (t) UCL	0.589	
1543	**Assuming Gamma Distribution**									95% KM (z) UCL	0.588	
1544				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	0.589	
1545				Minimum	0.000001					95% KM (bootstrap t) UCL	0.609	
1546				Maximum	3.6					95% KM (BCA) UCL	0.596	
1547				Mean	0.479					95% KM (Percentile Bootstrap) UCL	0.593	
1548				Median	0.158					95% KM (Chebyshev) UCL	0.764	
1549				SD	0.656					97.5% KM (Chebyshev) UCL	0.886	
1550				k star	0.487					99% KM (Chebyshev) UCL	1.126	
1551				Theta star	0.982							
1552				Nu star	99.41		**Potential UCLs to Use**					
1553				AppChi2	77.41					95% KM (Chebyshev) UCL	0.764	
1554				95% Gamma Approximate UCL (Use when n >= 40)	0.615							
1555				95% Adjusted Gamma UCL (Use when n < 40)	0.617							
1556	**Note: DL/2 is not a recommended method.**											
1557												
1558	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1559	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1560	**For additional insight, the user may want to consult a statistician.**											

	A	B	C	D	E	F	G	H	I	J	K	L
1561												

Sediment – Upper South Ditch

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Bis(2-Ethylhexyl)phthalate

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Bis(2-Ethylhexyl)phthalate was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Diphenyl ether

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Diphenyl ether was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Arsenic

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Arsenic was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Chromium, Hexavalent

General Statistics

Number of Valid Data	4	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	3
Number of Missing Values	21	Percent Non-Detects	75.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Chromium, Hexavalent was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Silver

General Statistics

Number of Valid Observations 4	Number of Distinct Observations 4
Number of Missing Values 21	

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Silver was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Chloride

General Statistics

Number of Valid Observations 4	Number of Distinct Observations 4
Number of Missing Values 21	

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Chloride was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Nitrogen, as Ammonia

General Statistics

Number of Valid Observations 4	Number of Distinct Observations 4
Number of Missing Values 21	

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Nitrogen, as Ammonia was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Sulfate

General Statistics

Number of Valid Observations 4	Number of Distinct Observations 4
Number of Missing Values 21	

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Sulfate was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

C11-C22 Aromatics

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable C11-C22 Aromatics was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2,4,4-Trimethyl-1-pentene

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2,4,4-Trimethyl-1-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2,4,4-Trimethyl-2-pentene

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2,4,4-Trimethyl-2-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

4-iso-Propyltoluene

General Statistics

Number of Valid Data	4	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	3
Number of Missing Values	21	Percent Non-Detects	75.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 4-iso-Propyltoluene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Acetaldehyde

General Statistics

Number of Valid Data	4	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	1
Number of Missing Values	21	Percent Non-Detects	25.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Acetaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Formaldehyde

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Formaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

3 & 4 Methylphenol

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 3 & 4 Methylphenol was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Acetophenone

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Acetophenone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Benzaldehyde

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4

Number of Missing Values 21

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Benzaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

C19-C36 Aliphatics

General Statistics

Number of Valid Observations 4 Number of Distinct Observations 4
Number of Missing Values 21

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable C19-C36 Aliphatics was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Caprolactam

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Caprolactam was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Diphenylmethanone

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Diphenylmethanone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Phenol

General Statistics

Number of Valid Observations 4 Number of Distinct Observations 4
Number of Missing Values 21

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Phenol was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Barium

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Barium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Beryllium

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Beryllium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Vanadium

General Statistics

Number of Valid Observations	4	Number of Distinct Observations	4
Number of Missing Values	21		

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Vanadium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Hydrazine

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Hydrazine was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Dimethylformamide

General Statistics

Number of Valid Data	4	Number of Detected Data	2
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	21	Percent Non-Detects	50.00%

Warning: This data set only has 4 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Dimethylformamide was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Iron

General Statistics

Number of Valid Observations 24
Number of Distinct Observations 18

Raw Statistics

Minimum	6200
Maximum	23000
Mean	13281
Geometric Mean	12626
Median	13250
SD	4270
Std. Error of Mean	871.7
Coefficient of Variation	0.322
Skewness	0.513

Log-transformed Statistics

Minimum of Log Data	8.732
Maximum of Log Data	10.04
Mean of log Data	9.444
SD of log Data	0.329

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.969
Shapiro Wilk Critical Value	0.916

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.982
Shapiro Wilk Critical Value	0.916

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	14775

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	14813
95% Modified-t UCL (Johnson-1978)	14790

Assuming Lognormal Distribution

95% H-UCL	15132
95% Chebyshev (MVUE) UCL	17267
97.5% Chebyshev (MVUE) UCL	18984
99% Chebyshev (MVUE) UCL	22356

Gamma Distribution Test

k star (bias corrected)	8.82
Theta Star	1506
MLE of Mean	13281
MLE of Standard Deviation	4472
nu star	423.3
Approximate Chi Square Value (.05)	376.6
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	373.5
Anderson-Darling Test Statistic	0.171
Anderson-Darling 5% Critical Value	0.744
Kolmogorov-Smirnov Test Statistic	0.108
Kolmogorov-Smirnov 5% Critical Value	0.178

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	14928
95% Adjusted Gamma UCL (Use when n < 40)	15051

Nonparametric Statistics

95% CLT UCL	14715
95% Jackknife UCL	14775
95% Standard Bootstrap UCL	14652
95% Bootstrap-t UCL	14841
95% Hall's Bootstrap UCL	14853
95% Percentile Bootstrap UCL	14729
95% BCA Bootstrap UCL	14704
95% Chebyshev(Mean, Sd) UCL	17081
97.5% Chebyshev(Mean, Sd) UCL	18725
99% Chebyshev(Mean, Sd) UCL	21954

Potential UCL to Use — Use 95% Student's-t UCL 14775

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Chromium

General Statistics

Number of Valid Observations 24 — Number of Distinct Observations 21

Raw Statistics

Minimum	20
Maximum	1800
Mean	362
Geometric Mean	164.5
Median	130
SD	506
Std. Error of Mean	103.3
Coefficient of Variation	1.398
Skewness	2.08

Log-transformed Statistics

Minimum of Log Data	2.996
Maximum of Log Data	7.496
Mean of log Data	5.103
SD of log Data	1.307

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.661
Shapiro Wilk Critical Value	0.916

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.916

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	539

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	578.7
95% Modified-t UCL (Johnson-1978)	546.3

Assuming Lognormal Distribution

95% H-UCL	870.9
95% Chebyshev (MVUE) UCL	869.2
97.5% Chebyshev (MVUE) UCL	1088
99% Chebyshev (MVUE) UCL	1517

Gamma Distribution Test

k star (bias corrected)	0.691
Theta Star	523.9
MLE of Mean	362
MLE of Standard Deviation	435.5
nu star	33.16
Approximate Chi Square Value (.05)	21
Adjusted Level of Significance	0.0392
Adjusted Chi Square Value	20.31
Anderson-Darling Test Statistic	0.763
Anderson-Darling 5% Critical Value	0.782
Kolmogorov-Smirnov Test Statistic	0.18
Kolmogorov-Smirnov 5% Critical Value	0.185

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	571.7
95% Adjusted Gamma UCL (Use when n < 40)	590.9

Nonparametric Statistics

95% CLT UCL	531.8
95% Jackknife UCL	539
95% Standard Bootstrap UCL	525.2
95% Bootstrap-t UCL	625.2
95% Hall's Bootstrap UCL	544.1
95% Percentile Bootstrap UCL	537.8
95% BCA Bootstrap UCL	586.9
95% Chebyshev(Mean, Sd) UCL	812.1
97.5% Chebyshev(Mean, Sd) UCL	1007
99% Chebyshev(Mean, Sd) UCL	1390

Potential UCL to Use — Use 95% Approximate Gamma UCL 571.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Sediment – Lower South Ditch

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Sheet1_b.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

2,4,4-Trimethyl-1-pentene

General Statistics

Number of Valid Data	3	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	1
Number of Missing Values	3	Percent Non-Detects	33.33%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2,4,4-Trimethyl-1-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2,4,4-Trimethyl-2-pentene

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2,4,4-Trimethyl-2-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2-Butanone

General Statistics

Number of Valid Data	3	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	1
Number of Missing Values	3	Percent Non-Detects	33.33%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2-Butanone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Acetaldehyde

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	4	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Acetaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Acetone

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Acetone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Cis-1,2-Dichloroethene

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Cis-1,2-Dichloroethene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Formaldehyde

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2

Number of Missing Values 4

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Formaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

trans-1,2-Dichloroethene

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable trans-1,2-Dichloroethene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Aniline

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aniline was not processed!

Benzaldehyde

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Benzaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Benzo(a)anthracene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.31	Minimum Detected	-1.171
Maximum Detected	3.1	Maximum Detected	1.131
Mean of Detected	1.307	Mean of Detected	-0.238
SD of Detected	1.556	SD of Detected	1.212
Minimum Non-Detect	0.29	Minimum Non-Detect	-1.238
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.803	Shapiro Wilk Test Statistic	0.903
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.153	Mean	-0.586
SD	1.365	SD	1.359
95% DL/2 (t) UCL	2.276	95% H-Stat (DL/2) UCL	36.79
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.684
		SD in Log Scale	1.929
		Mean in Original Scale	0.691
		SD in Original Scale	1.194
		95% t UCL	1.674
		95% Percentile Bootstrap UCL	1.609
		95% BCA Bootstrap UCL	1.718

95% H-UCL	732.6

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.908
SD	1.099
SE of Mean	0.602
95% KM (t) UCL	2.121
95% KM (z) UCL	1.898
95% KM (jackknife) UCL	2.01
95% KM (bootstrap t) UCL	9.037
95% KM (BCA) UCL	3.1
95% KM (Percentile Bootstrap) UCL	3.1
95% KM (Chebyshev) UCL	3.531
97.5% KM (Chebyshev) UCL	4.666
99% KM (Chebyshev) UCL	6.896

Potential UCLs to Use

95% KM (t) UCL	2.121
95% KM (Percentile Bootstrap) UCL	3.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(a)pyrene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics

Minimum Detected	0.032
Maximum Detected	0.099
Mean of Detected	0.0603
SD of Detected	0.0347
Minimum Non-Detect	0.29
Maximum Non-Detect	5.4

Log-transformed Statistics

Minimum Detected	-3.442
Maximum Detected	-2.313
Mean of Detected	-2.917
SD of Detected	0.569
Minimum Non-Detect	-1.238
Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	6
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.933
5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.53
SD	1.064
95% DL/2 (t) UCL	1.406
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.986
5% Shapiro Wilk Critical Value	0.767

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.925
SD	1.557
95% H-Stat (DL/2) UCL	33.87
Log ROS Method	
Mean in Log Scale	-2.917
SD in Log Scale	0.36
Mean in Original Scale	0.0572
SD in Original Scale	0.0222
95% t UCL	0.0755
95% Percentile Bootstrap UCL	0.0722
95% BCA Bootstrap UCL	0.0729
95% H-UCL	0.084

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0603
SD	0.0283
SE of Mean	0.02
95% KM (t) UCL	0.101
95% KM (z) UCL	0.0933
95% KM (jackknife) UCL	0.105
95% KM (bootstrap t) UCL	0.166
95% KM (BCA) UCL	0.099
95% KM (Percentile Bootstrap) UCL	0.099
95% KM (Chebyshev) UCL	0.148
97.5% KM (Chebyshev) UCL	0.185
99% KM (Chebyshev) UCL	0.26

Potential UCLs to Use

95% KM (t) UCL	0.101
95% KM (Percentile Bootstrap) UCL	0.099

95% Adjusted Gamma UCL (Use when n < 40) N/A

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.046	Minimum Detected	-3.079
Maximum Detected	0.067	Maximum Detected	-2.703
Mean of Detected	0.0565	Mean of Detected	-2.891
SD of Detected	0.0148	SD of Detected	0.266
Minimum Non-Detect	0.088	Minimum Non-Detect	-2.43
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	N/A	Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.526	Mean	-1.951

SD	1.066	SD	1.542
95% DL/2 (t) UCL	1.403	95% H-Stat (DL/2) UCL	29.87
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% t UCL	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
		95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0565
SD	0.0105
SE of Mean	0.0105
95% KM (t) UCL	0.0777
95% KM (z) UCL	0.0738
95% KM (jackknife) UCL	0.0838
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.067
95% KM (Percentile Bootstrap) UCL	0.067
95% KM (Chebyshev) UCL	0.102
97.5% KM (Chebyshev) UCL	0.122
99% KM (Chebyshev) UCL	0.161

Potential UCLs to Use

95% KM (t) UCL	0.0777
95% KM (% Bootstrap) UCL	0.067

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(ghi)perylene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	2	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics	
Minimum Detected	0.13
Maximum Detected	0.64
Mean of Detected	0.3
SD of Detected	0.294
Minimum Non-Detect	0.29
Maximum Non-Detect	5.4

Log-transformed Statistics	
Minimum Detected	-2.04
Maximum Detected	-0.446
Mean of Detected	-1.509
SD of Detected	0.92
Minimum Non-Detect	-1.238
Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	6
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.75
5% Shapiro Wilk Critical Value	0.767

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.75
5% Shapiro Wilk Critical Value	0.767

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.65
SD	1.024
95% DL/2 (t) UCL	1.492
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-1.221
SD	1.246
95% H-Stat (DL/2) UCL	10.26
Log ROS Method	
Mean in Log Scale	-1.694
SD in Log Scale	0.622
Mean in Original Scale	0.227
SD in Original Scale	0.203
95% t UCL	0.394
95% Percentile Bootstrap UCL	0.389
95% BCA Bootstrap UCL	0.397
95% H-UCL	0.507

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.232
SD	0.204
SE of Mean	0.112
95% KM (t) UCL	0.457
95% KM (z) UCL	0.416
95% KM (jackknife) UCL	0.442
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	0.436
95% KM (Percentile Bootstrap) UCL	0.64
95% KM (Chebyshev) UCL	0.719
97.5% KM (Chebyshev) UCL	0.93
99% KM (Chebyshev) UCL	1.344

Potential UCLs to Use

95% KM (t) UCL	0.457
95% KM (% Bootstrap) UCL	0.64

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzo(k)fluoranthene

General Statistics

Number of Valid Data	6	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	66.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.014	Minimum Detected	-4.269
Maximum Detected	0.025	Maximum Detected	-3.689
Mean of Detected	0.0195	Mean of Detected	-3.979
SD of Detected	0.00778	SD of Detected	0.41
Minimum Non-Detect	0.088	Minimum Non-Detect	-2.43
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.514
SD	1.073
95% DL/2 (t) UCL	1.396
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	N/A
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.314
SD	1.879
95% H-Stat (DL/2) UCL	257.2
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% t UCL	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A
95% H-UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0195
SD	0.0055
SE of Mean	0.0055
95% KM (t) UCL	0.0306
95% KM (z) UCL	0.0285
95% KM (jackknife) UCL	0.0338
95% KM (bootstrap t) UCL	0.0305
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	0.025
95% KM (Chebyshev) UCL	0.0435
97.5% KM (Chebyshev) UCL	0.0538
99% KM (Chebyshev) UCL	0.0742

Potential UCLs to Use

95% KM (t) UCL	0.0306
95% KM (% Bootstrap) UCL	0.025

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Benzoic Acid

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzoic Acid was not processed!

Biphenyl

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Biphenyl was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Bis(2-Ethylhexyl)phthalate

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	11	Minimum of Log Data	2.398
Maximum	920	Maximum of Log Data	6.824
Mean	322	Mean of log Data	4.969
Geometric Mean	143.8	SD of log Data	1.7
Median	245		
SD	340.1		

Std. Error of Mean	138.8
Coefficient of Variation	1.056
Skewness	1.232

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.917
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	601.8

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	625
95% Modified-t UCL (Johnson-1978)	613.4

Assuming Lognormal Distribution

95% H-UCL	92297
95% Chebyshev (MVUE) UCL	1550
97.5% Chebyshev (MVUE) UCL	2043
99% Chebyshev (MVUE) UCL	3011

Gamma Distribution Test

k star (bias corrected)	0.483
Theta Star	666.7
MLE of Mean	322
MLE of Standard Deviation	463.3
nu star	5.795
Approximate Chi Square Value (.05)	1.536
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	0.878
Anderson-Darling Test Statistic	0.238
Anderson-Darling 5% Critical Value	0.721
Kolmogorov-Smirnov Test Statistic	0.189
Kolmogorov-Smirnov 5% Critical Value	0.344

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	1215
95% Adjusted Gamma UCL (Use when n < 40)	2126

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	550.4
95% Jackknife UCL	601.8
95% Standard Bootstrap UCL	531.8
95% Bootstrap-t UCL	863.9
95% Hall's Bootstrap UCL	1865
95% Percentile Bootstrap UCL	547
95% BCA Bootstrap UCL	581.7
95% Chebyshev(Mean, Sd) UCL	927.2
97.5% Chebyshev(Mean, Sd) UCL	1189
99% Chebyshev(Mean, Sd) UCL	1703

Potential UCL to Use Use 95% Student's-t UCL 601.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Chrysene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.061	Minimum Detected	-2.797
Maximum Detected	0.44	Maximum Detected	-0.821
Mean of Detected	0.188	Mean of Detected	-2.122
SD of Detected	0.218	SD of Detected	1.127
Minimum Non-Detect	0.29	Minimum Non-Detect	-1.238
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.756	Shapiro Wilk Test Statistic	0.768
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.594	Mean	-1.528
SD	1.041	SD	1.431
95% DL/2 (t) UCL	1.451	95% H-Stat (DL/2) UCL	22.13
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-2.351
		SD in Log Scale	0.762
		Mean in Original Scale	0.132
		SD in Original Scale	0.151
		95% t UCL	0.257
		95% Percentile Bootstrap UCL	0.252
		95% BCA Bootstrap UCL	0.262
		95% H-UCL	0.401

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.138
SD	0.151
SE of Mean	0.0827
95% KM (t) UCL	0.305
95% KM (z) UCL	0.274
95% KM (jackknife) UCL	0.293
95% KM (bootstrap t) UCL	8.602
95% KM (BCA) UCL	0.44
95% KM (Percentile Bootstrap) UCL	0.44
95% KM (Chebyshev) UCL	0.499
97.5% KM (Chebyshev) UCL	0.655
99% KM (Chebyshev) UCL	0.961

Potential UCLs to Use	
95% KM (BCA) UCL	0.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Dibenz(a,h)anthracene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.028	Minimum Detected	-3.576
Maximum Detected	0.26	Maximum Detected	-1.347
Mean of Detected	0.112	Mean of Detected	-2.653
SD of Detected	0.129	SD of Detected	1.163
Minimum Non-Detect	0.29	Minimum Non-Detect	-1.238
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.814
5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.556
SD	1.054
95% DL/2 (t) UCL	1.423
Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.918
5% Shapiro Wilk Critical Value	0.767
Data appear Lognormal at 5% Significance Level	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-1.794
SD	1.594
95% H-Stat (DL/2) UCL	50.03
Log ROS Method	
Mean in Log Scale	-2.653
SD in Log Scale	0.735
Mean in Original Scale	0.0912
SD in Original Scale	0.0844
95% t UCL	0.161
95% Percentile Bootstrap UCL	0.158
95% BCA Bootstrap UCL	0.161
95% H-UCL	0.271

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.112
SD	0.105
SE of Mean	0.0742
95% KM (t) UCL	0.262
95% KM (z) UCL	0.234
95% KM (jackknife) UCL	0.279
95% KM (bootstrap t) UCL	1.285
95% KM (BCA) UCL	0.26
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.436
97.5% KM (Chebyshev) UCL	0.576
99% KM (Chebyshev) UCL	0.851
Potential UCLs to Use	
95% KM (t) UCL	0.262
95% KM (Percentile Bootstrap) UCL	N/A

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Di-n-octylphthalate

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Di-n-octylphthalate was not processed!

Diphenyl ether

General Statistics

Number of Valid Data	3	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	1
Number of Missing Values	3	Percent Non-Detects	33.33%

Warning: This data set only has 3 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Diphenyl ether was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Diphenylamine

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	4	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Diphenylamine was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Fluoranthene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.13	Minimum Detected	-2.04
Maximum Detected	1.8	Maximum Detected	0.588
Mean of Detected	0.707	Mean of Detected	-1.038
SD of Detected	0.947	SD of Detected	1.42
Minimum Non-Detect	0.29	Minimum Non-Detect	-1.238
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.777	Shapiro Wilk Test Statistic	0.856
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.853	Mean	-0.986
SD	1.119	SD	1.387
95% DL/2 (t) UCL	1.774	95% H-Stat (DL/2) UCL	29.21
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.336
		SD in Log Scale	0.965
		Mean in Original Scale	0.452
		SD in Original Scale	0.661
		95% t UCL	0.996
		95% Percentile Bootstrap UCL	0.982
		95% BCA Bootstrap UCL	1.012
		95% H-UCL	2.348

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.488
SD	0.657
SE of Mean	0.36
95% KM (t) UCL	1.213
95% KM (z) UCL	1.08
95% KM (jackknife) UCL	1.165
95% KM (bootstrap t) UCL	8.718
95% KM (BCA) UCL	1.8
95% KM (Percentile Bootstrap) UCL	1.8
95% KM (Chebyshev) UCL	2.057
97.5% KM (Chebyshev) UCL	2.736
99% KM (Chebyshev) UCL	4.069

Potential UCLs to Use

95% KM (t) UCL	1.213
95% KM (Percentile Bootstrap) UCL	1.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Indeno(1,2,3-cd)pyrene was not processed!

Naphthalene

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5

Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Naphthalene was not processed!

N-Nitrosodiphenylamine

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.065	Minimum Detected	-2.733
Maximum Detected	1.6	Maximum Detected	0.47
Mean of Detected	0.799	Mean of Detected	-0.992
SD of Detected	0.814	SD of Detected	1.636
Minimum Non-Detect	2.2	Minimum Non-Detect	0.788
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.808	Shapiro Wilk Test Statistic	0.841
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.166	Mean	-0.48
SD	0.989	SD	1.522
95% DL/2 (t) UCL	1.979	95% H-Stat (DL/2) UCL	113.8
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-0.992
		SD in Log Scale	1.268
		Mean in Original Scale	0.656
		SD in Original Scale	0.668

95% t UCL	1.206
95% Percentile Bootstrap UCL	1.083
95% BCA Bootstrap UCL	1.117
95% H-UCL	14.51

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.361
Theta Star	2.214
nu star	2.887
A-D Test Statistic	0.517
5% A-D Critical Value	0.67
K-S Test Statistic	0.67
5% K-S Critical Value	0.405

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.065
Maximum	1.6
Mean	0.724
Median	0.575
SD	0.641
k star	0.657
Theta star	1.102
Nu star	7.89
AppChi2	2.671
95% Gamma Approximate UCL (Use when n >= 40)	2.139
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.799
SD	0.705
SE of Mean	0.407
95% KM (t) UCL	1.619
95% KM (z) UCL	1.468
95% KM (jackknife) UCL	1.664
95% KM (bootstrap t) UCL	1.7
95% KM (BCA) UCL	1.467
95% KM (Percentile Bootstrap) UCL	1.5
95% KM (Chebyshev) UCL	2.573
97.5% KM (Chebyshev) UCL	3.341
99% KM (Chebyshev) UCL	4.85

Potential UCLs to Use

95% KM (t) UCL	1.619
95% KM (Percentile Bootstrap) UCL	1.5

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Phenanthrene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics

Minimum Detected	0.038
Maximum Detected	0.1
Mean of Detected	0.0647
SD of Detected	0.0319
Minimum Non-Detect	0.35
Maximum Non-Detect	6.4

Log-transformed Statistics

Minimum Detected	-3.27
Maximum Detected	-2.303
Mean of Detected	-2.818
SD of Detected	0.487
Minimum Non-Detect	-1.05
Maximum Non-Detect	1.856

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	6
Number treated as Detected	0
Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.945
5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.626
SD	1.263
95% DL/2 (t) UCL	1.664
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.987
5% Shapiro Wilk Critical Value	0.767

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.787
SD	1.574
95% H-Stat (DL/2) UCL	43.62
Log ROS Method	
Mean in Log Scale	-2.818
SD in Log Scale	0.308
Mean in Original Scale	0.0622
SD in Original Scale	0.0204
95% t UCL	0.0789
95% Percentile Bootstrap UCL	0.0762
95% BCA Bootstrap UCL	0.078
95% H-UCL	0.0852

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0647
SD	0.026
SE of Mean	0.0184
95% KM (t) UCL	0.102
95% KM (z) UCL	0.095
95% KM (jackknife) UCL	0.106
95% KM (bootstrap t) UCL	0.155
95% KM (BCA) UCL	0.1
95% KM (Percentile Bootstrap) UCL	0.1
95% KM (Chebyshev) UCL	0.145
97.5% KM (Chebyshev) UCL	0.18
99% KM (Chebyshev) UCL	0.248

Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	0.102
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	0.1
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Phenol

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Phenol was not processed!

Pyrene

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.052	Minimum Detected	-2.957
Maximum Detected	0.16	Maximum Detected	-1.833
Mean of Detected	0.097	Mean of Detected	-2.442
SD of Detected	0.0562	SD of Detected	0.568
Minimum Non-Detect	0.29	Minimum Non-Detect	-1.238
Maximum Non-Detect	5.4	Maximum Non-Detect	1.686

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.923
5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.549
SD	1.055
95% DL/2 (t) UCL	1.416
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.979
5% Shapiro Wilk Critical Value	0.767

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.688
SD	1.388
95% H-Stat (DL/2) UCL	14.51
Log ROS Method	
Mean in Log Scale	-2.442
SD in Log Scale	0.359
Mean in Original Scale	0.092
SD in Original Scale	0.036
95% t UCL	0.122
95% Percentile Bootstrap UCL	0.116
95% BCA Bootstrap UCL	0.122
95% H-UCL	0.135

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.097
SD	0.0459
SE of Mean	0.0324
95% KM (t) UCL	0.162
95% KM (z) UCL	0.15
95% KM (jackknife) UCL	0.17
95% KM (bootstrap t) UCL	0.281
95% KM (BCA) UCL	0.16
95% KM (Percentile Bootstrap) UCL	0.16
95% KM (Chebyshev) UCL	0.238
97.5% KM (Chebyshev) UCL	0.3
99% KM (Chebyshev) UCL	0.42

Potential UCLs to Use

95% KM (t) UCL	0.162
95% KM (Percentile Bootstrap) UCL	0.16

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

4,4'-DDT

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
		Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 4,4'-DDT was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Hexachlorobenzene

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
		Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Hexachlorobenzene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Aluminum

General Statistics

Number of Valid Observations 6 Number of Distinct Observations 6

Raw Statistics		**Log-transformed Statistics**	
Minimum	3900	Minimum of Log Data	8.269
Maximum	15000	Maximum of Log Data	9.616
Mean	8533	Mean of log Data	8.97
Geometric Mean	7860	SD of log Data	0.451
Median	8000		
SD	3769		
Std. Error of Mean	1539		
Coefficient of Variation	0.442		
Skewness	0.912		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.946
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	11634

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	11676
95% Modified-t UCL (Johnson-1978)	11729

Assuming Lognormal Distribution

95% H-UCL	14477
95% Chebyshev (MVUE) UCL	15398
97.5% Chebyshev (MVUE) UCL	18363
99% Chebyshev (MVUE) UCL	24187

Gamma Distribution Test

k star (bias corrected)	3.235
Theta Star	2638
MLE of Mean	8533
MLE of Standard Deviation	4745
nu star	38.82
Approximate Chi Square Value (.05)	25.55
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	21.74
Anderson-Darling Test Statistic	0.207
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.165
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	12966
95% Adjusted Gamma UCL (Use when n < 40)	15236

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	11064
95% Jackknife UCL	11634
95% Standard Bootstrap UCL	10821
95% Bootstrap-t UCL	12741
95% Hall's Bootstrap UCL	28498
95% Percentile Bootstrap UCL	11000
95% BCA Bootstrap UCL	11033
95% Chebyshev(Mean, Sd) UCL	15240
97.5% Chebyshev(Mean, Sd) UCL	18142
99% Chebyshev(Mean, Sd) UCL	23842

Potential UCL to Use Use 95% Student's-t UCL 11634

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 6

Raw Statistics

Minimum	2.1
Maximum	6.7
Mean	4.95
Geometric Mean	4.589
Median	5.6
SD	1.843
Std. Error of Mean	0.752
Coefficient of Variation	0.372
Skewness	-0.82

Log-transformed Statistics

Minimum of Log Data	0.742
Maximum of Log Data	1.902
Mean of log Data	1.524
SD of log Data	0.457

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.885
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.844
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	6.466

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	5.918
95% Modified-t UCL (Johnson-1978)	6.424

Assuming Lognormal Distribution

95% H-UCL	8.551
95% Chebyshev (MVUE) UCL	9.06
97.5% Chebyshev (MVUE) UCL	10.82
99% Chebyshev (MVUE) UCL	14.27

Gamma Distribution Test

k star (bias corrected)	3.496
Theta Star	1.416
MLE of Mean	4.95
MLE of Standard Deviation	2.647
nu star	41.96
Approximate Chi Square Value (.05)	28.11
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	24.09

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	6.187
95% Jackknife UCL	6.466
95% Standard Bootstrap UCL	6.068

Anderson-Darling Test Statistic	0.494
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.269
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	7.389
95% Adjusted Gamma UCL (Use when n < 40)	8.62

95% Bootstrap-t UCL	6.206
95% Hall's Bootstrap UCL	5.812
95% Percentile Bootstrap UCL	6.067
95% BCA Bootstrap UCL	5.9
95% Chebyshev(Mean, Sd) UCL	8.229
97.5% Chebyshev(Mean, Sd) UCL	9.648
99% Chebyshev(Mean, Sd) UCL	12.43

Potential UCL to Use Use 95% Student's-t UCL 6.466

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

Barium

General Statistics

Number of Valid Observations	6
Number of Distinct Observations	6

Raw Statistics

Minimum	7
Maximum	23
Mean	12.83
Geometric Mean	11.99
Median	11.5
SD	5.492
Std. Error of Mean	2.242
Coefficient of Variation	0.428
Skewness	1.493

Log-transformed Statistics

Minimum of Log Data	1.946
Maximum of Log Data	3.135
Mean of log Data	2.484
SD of log Data	0.395

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.877
Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level	

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.966
Shapiro Wilk Critical Value	0.788
Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution	
95% Student's-t UCL	17.35
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	17.98
95% Modified-t UCL (Johnson-1978)	17.58

Assuming Lognormal Distribution	
95% H-UCL	19.81
95% Chebyshev (MVUE) UCL	21.76
97.5% Chebyshev (MVUE) UCL	25.65
99% Chebyshev (MVUE) UCL	33.27

Gamma Distribution Test	
k star (bias corrected)	3.883
Theta Star	3.305
MLE of Mean	12.83
MLE of Standard Deviation	6.512
nu star	46.6
Approximate Chi Square Value (.05)	31.93
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	27.62
Anderson-Darling Test Statistic	0.297
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.192
Kolmogorov-Smirnov 5% Critical Value	0.333
Data appear Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	18.73
95% Adjusted Gamma UCL (Use when n < 40)	21.65

Data Distribution
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	16.52
95% Jackknife UCL	17.35
95% Standard Bootstrap UCL	16.29
95% Bootstrap-t UCL	20.67
95% Hall's Bootstrap UCL	37.6
95% Percentile Bootstrap UCL	16.5
95% BCA Bootstrap UCL	17.33
95% Chebyshev(Mean, Sd) UCL	22.61
97.5% Chebyshev(Mean, Sd) UCL	26.84
99% Chebyshev(Mean, Sd) UCL	35.14

Potential UCL to Use	Use 95% Student's-t UCL 17.35

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Beryllium

General Statistics

Number of Valid Data	6	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	1
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.64	Minimum Detected	-0.446
Maximum Detected	1.9	Maximum Detected	0.642
Mean of Detected	1.122	Mean of Detected	0.0393
SD of Detected	0.502	SD of Detected	0.43
Minimum Non-Detect	0.3	Minimum Non-Detect	-1.204

Maximum Non-Detect	0.3	Maximum Non-Detect	-1.204

Warning: There are only 5 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.924	Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.96	Mean	-0.283
SD	0.599	SD	0.879
95% DL/2 (t) UCL	1.453	95% H-Stat (DL/2) UCL	4.767
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.934	Mean in Log Scale	-0.149
SD	0.597	SD in Log Scale	0.6
95% MLE (t) UCL	1.425	Mean in Original Scale	0.991
95% MLE (Tiku) UCL	1.44	SD in Original Scale	0.552
		95% t UCL	1.445
		95% Percentile Bootstrap UCL	1.329
		95% BCA Bootstrap UCL	1.362
		95% H UCL	2.242

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.837	**Data appear Normal at 5% Significance Level**	
Theta Star	0.396		
nu star	28.37		
A-D Test Statistic	0.226	**Nonparametric Statistics**	
5% A-D Critical Value	0.68	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.68	Mean	1.042
5% K-S Critical Value	0.358	SD	0.448
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.204
		95% KM (t) UCL	1.453
Assuming Gamma Distribution		95% KM (z) UCL	1.378
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.443
Minimum	1E-06	95% KM (bootstrap t) UCL	1.761
Maximum	1.9	95% KM (BCA) UCL	1.423
Mean	0.935	95% KM (Percentile Bootstrap) UCL	1.4
Median	0.885	95% KM (Chebyshev) UCL	1.932
SD	0.641	97.5% KM (Chebyshev) UCL	2.317
k star	0.267	99% KM (Chebyshev) UCL	3.074
Theta star	3.506		
Nu star	3.201	**Potential UCLs to Use**	
AppChi2	0.434	95% KM (t) UCL	1.453

95% Gamma Approximate UCL (Use when n >= 40)	6.892	95% KM (Percentile Bootstrap) UCL	1.4
95% Adjusted Gamma UCL (Use when n < 40)	15.22		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Cadmium

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
		Percent Non-Detects	33.33%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.32	Minimum Detected	-1.139
Maximum Detected	1.2	Maximum Detected	0.182
Mean of Detected	0.76	Mean of Detected	-0.391
SD of Detected	0.388	SD of Detected	0.583
Minimum Non-Detect	0.28	Minimum Non-Detect	-1.273
Maximum Non-Detect	0.3	Maximum Non-Detect	-1.204

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	2
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	4
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	33.33%

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.979	Shapiro Wilk Test Statistic	0.959
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.555	Mean	-0.904
SD	0.437	SD	0.915
95% DL/2 (t) UCL	0.915	95% H-Stat (DL/2) UCL	2.937
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.5	Mean in Log Scale	-0.92
SD	0.482	SD in Log Scale	0.936
95% MLE (t) UCL	0.897	Mean in Original Scale	0.553
95% MLE (Tiku) UCL	0.929	SD in Original Scale	0.44

95% t UCL	0.915
95% Percentile Bootstrap UCL	0.833
95% BCA Bootstrap UCL	0.833
95% H UCL	3.142

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.28
Theta Star	0.594
nu star	10.24
A-D Test Statistic	0.24
5% A-D Critical Value	0.659
K-S Test Statistic	0.659
5% K-S Critical Value	0.396

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-06
Maximum	1.2
Mean	0.507
Median	0.45
SD	0.494
k star	0.201
Theta star	2.526
Nu star	2.407
AppChi2	0.221
95% Gamma Approximate UCL (Use when n >= 40)	5.523
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.613
SD	0.344
SE of Mean	0.162
95% KM (t) UCL	0.94
95% KM (z) UCL	0.88
95% KM (jackknife) UCL	0.936
95% KM (bootstrap t) UCL	0.896
95% KM (BCA) UCL	1.027
95% KM (Percentile Bootstrap) UCL	1.027
95% KM (Chebyshev) UCL	1.32
97.5% KM (Chebyshev) UCL	1.626
99% KM (Chebyshev) UCL	2.227

Potential UCLs to Use

95% KM (t) UCL	0.94
95% KM (Percentile Bootstrap) UCL	1.027

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Calcium

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 6

Raw Statistics

Minimum	820
Maximum	1900
Mean	1142
Geometric Mean	1089
Median	995
SD	414.7
Std. Error of Mean	169.3
Coefficient of Variation	0.363
Skewness	1.529

Log-transformed Statistics

Minimum of Log Data	6.709
Maximum of Log Data	7.55
Mean of log Data	6.993
SD of log Data	0.326

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.825
Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level	

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.876
Shapiro Wilk Critical Value	0.788
Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution	
95% Student's-t UCL	1483
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	1533
95% Modified-t UCL (Johnson-1978)	1500

Assuming Lognormal Distribution	
95% H-UCL	1598
95% Chebyshev (MVUE) UCL	1796
97.5% Chebyshev (MVUE) UCL	2082
99% Chebyshev (MVUE) UCL	2641

Gamma Distribution Test	
k star (bias corrected)	5.461
Theta Star	209.1
MLE of Mean	1142
MLE of Standard Deviation	488.5
nu star	65.53
Approximate Chi Square Value (.05)	47.9
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	42.51
Anderson-Darling Test Statistic	0.458
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.251
Kolmogorov-Smirnov 5% Critical Value	0.332
Data appear Gamma Distributed at 5% Significance Level	

Data Distribution
Data appear Normal at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	1562
95% Adjusted Gamma UCL (Use when n < 40)	1760

Nonparametric Statistics	
95% CLT UCL	1420
95% Jackknife UCL	1483
95% Standard Bootstrap UCL	1388
95% Bootstrap-t UCL	1800
95% Hall's Bootstrap UCL	2569
95% Percentile Bootstrap UCL	1440
95% BCA Bootstrap UCL	1487
95% Chebyshev(Mean, Sd) UCL	1880
97.5% Chebyshev(Mean, Sd) UCL	2199
99% Chebyshev(Mean, Sd) UCL	2826

Potential UCL to Use	Use 95% Student's-t UCL 1483

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Chromium

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 6

Raw Statistics

Minimum	570
Maximum	3000
Mean	1922
Geometric Mean	1627
Median	2150
SD	1023
Std. Error of Mean	417.8
Coefficient of Variation	0.533
Skewness	-0.432

Log-transformed Statistics

Minimum of Log Data	6.346
Maximum of Log Data	8.006
Mean of log Data	7.394
SD of log Data	0.689

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.898
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.86
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	2764

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	2530
95% Modified-t UCL (Johnson-1978)	2751

Assuming Lognormal Distribution

95% H-UCL	5420
95% Chebyshev (MVUE) UCL	4376
97.5% Chebyshev (MVUE) UCL	5417
99% Chebyshev (MVUE) UCL	7461

Gamma Distribution Test

k star (bias corrected)	1.69
Theta Star	1137
MLE of Mean	1922
MLE of Standard Deviation	1478
nu star	20.28
Approximate Chi Square Value (.05)	11.06
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	8.706
Anderson-Darling Test Statistic	0.453

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	2609
95% Jackknife UCL	2764
95% Standard Bootstrap UCL	2533
95% Bootstrap-t UCL	2680

Anderson-Darling 5% Critical Value	0.701
Kolmogorov-Smirnov Test Statistic	0.25
Kolmogorov-Smirnov 5% Critical Value	0.334
Data appear Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	3524
95% Adjusted Gamma UCL (Use when n < 40)	4476

95% Hall's Bootstrap UCL	2387
95% Percentile Bootstrap UCL	2528
95% BCA Bootstrap UCL	2512
95% Chebyshev(Mean, Sd) UCL	3743
97.5% Chebyshev(Mean, Sd) UCL	4531
99% Chebyshev(Mean, Sd) UCL	6079

Potential UCL to Use Use 95% Student's-t UCL 2764

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Chromium, Hexavalent

General Statistics

Number of Valid Data	5	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	1
Number of Missing Values	1	Percent Non-Detects	20.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	7.9	Minimum Detected	2.067
Maximum Detected	28	Maximum Detected	3.332
Mean of Detected	17.23	Mean of Detected	2.674
SD of Detected	10.78	SD of Detected	0.696
Minimum Non-Detect	6.9	Minimum Non-Detect	1.932
Maximum Non-Detect	6.9	Maximum Non-Detect	1.932

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.797	Shapiro Wilk Test Statistic	0.775
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution	**Assuming Lognormal Distribution**
DL/2 Substitution Method	DL/2 Substitution Method

Mean	14.47
SD	11.18
95% DL/2 (t) UCL	25.13

Mean	2.387
SD	0.881
95% H-Stat (DL/2) UCL	111.1

Maximum Likelihood Estimate(MLE) Method	
Mean	13.81
SD	11.06
95% MLE (t) UCL	24.36
95% MLE (Tiku) UCL	24.44

Log ROS Method	
Mean in Log Scale	2.332
SD in Log Scale	0.974
Mean in Original Scale	14.3
SD in Original Scale	11.39
95% t UCL	25.17
95% Percentile Bootstrap UCL	22.32
95% BCA Bootstrap UCL	22.78
95% H UCL	171.1

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.932
Theta Star	18.47
nu star	7.46
A-D Test Statistic	0.615
5% A-D Critical Value	0.659
K-S Test Statistic	0.659
5% K-S Critical Value	0.397

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-06
Maximum	28
Mean	13.78
Median	8
SD	12.1
k star	0.222
Theta star	61.94
Nu star	2.225
AppChi2	0.185
95% Gamma Approximate UCL (Use when n >= 40)	165.3
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	15.36
SD	9.145
SE of Mean	4.723
95% KM (t) UCL	25.43
95% KM (z) UCL	23.13
95% KM (jackknife) UCL	25.11
95% KM (bootstrap t) UCL	20.92
95% KM (BCA) UCL	25.6
95% KM (Percentile Bootstrap) UCL	25.6
95% KM (Chebyshev) UCL	35.95
97.5% KM (Chebyshev) UCL	44.85
99% KM (Chebyshev) UCL	62.35

Potential UCLs to Use

95% KM (t) UCL	25.43
95% KM (Percentile Bootstrap) UCL	25.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Cobalt

General Statistics

Number of Valid Observations	6
Number of Distinct Observations	6

Raw Statistics

Minimum	3.3

Log-transformed Statistics

Minimum of Log Data	1.194

Maximum	21
Mean	10.03
Geometric Mean	8.014
Median	7.1
SD	7.279
Std. Error of Mean	2.972
Coefficient of Variation	0.725
Skewness	0.859

Maximum of Log Data	3.045
Mean of log Data	2.081
SD of log Data	0.737

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.862
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	16.02

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	16.03
95% Modified-t UCL (Johnson-1978)	16.19

Gamma Distribution Test

k star (bias corrected)	1.3
Theta Star	7.716
MLE of Mean	10.03
MLE of Standard Deviation	8.798
nu star	15.6
Approximate Chi Square Value (.05)	7.684
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	5.793
Anderson-Darling Test Statistic	0.357
Anderson-Darling 5% Critical Value	0.703
Kolmogorov-Smirnov Test Statistic	0.231
Kolmogorov-Smirnov 5% Critical Value	0.335

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	20.38
95% Adjusted Gamma UCL (Use when n < 40)	27.03

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	30.99
95% Chebyshev (MVUE) UCL	22.99
97.5% Chebyshev (MVUE) UCL	28.62
99% Chebyshev (MVUE) UCL	39.67

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	14.92
95% Jackknife UCL	16.02
95% Standard Bootstrap UCL	14.42
95% Bootstrap-t UCL	27.4
95% Hall's Bootstrap UCL	25.98
95% Percentile Bootstrap UCL	14.67
95% BCA Bootstrap UCL	15.17
95% Chebyshev(Mean, Sd) UCL	22.99
97.5% Chebyshev(Mean, Sd) UCL	28.59
99% Chebyshev(Mean, Sd) UCL	39.6

Potential UCL to Use Use 95% Student's-t UCL 16.02

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Copper

General Statistics

Number of Valid Observations 6 Number of Distinct Observations 6

Raw Statistics		Log-transformed Statistics	
Minimum	5.9	Minimum of Log Data	1.775
Maximum	22	Maximum of Log Data	3.091
Mean	15.9	Mean of log Data	2.665
Geometric Mean	14.37	SD of log Data	0.534
Median	18.5		
SD	6.666		
Std. Error of Mean	2.722		
Coefficient of Variation	0.419		
Skewness	-0.843		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.862	Shapiro Wilk Test Statistic	0.822
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	21.38	95% H-UCL	31.75
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	31.48
95% Adjusted-CLT UCL (Chen-1995)	19.38	97.5% Chebyshev (MVUE) UCL	38.11
95% Modified-t UCL (Johnson-1978)	21.23	99% Chebyshev (MVUE) UCL	51.14

Gamma Distribution Test		Data Distribution
k star (bias corrected)	2.662	**Data appear Normal at 5% Significance Level**

Theta Star	5.973
MLE of Mean	15.9
MLE of Standard Deviation	9.745
nu star	31.94
Approximate Chi Square Value (.05)	20.03
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	16.71
Anderson-Darling Test Statistic	0.572
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.285
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	25.36
95% Adjusted Gamma UCL (Use when n < 40)	30.39

Nonparametric Statistics

95% CLT UCL	20.38
95% Jackknife UCL	21.38
95% Standard Bootstrap UCL	19.98
95% Bootstrap-t UCL	20.15
95% Hall's Bootstrap UCL	18.73
95% Percentile Bootstrap UCL	19.83
95% BCA Bootstrap UCL	19.42
95% Chebyshev(Mean, Sd) UCL	27.76
97.5% Chebyshev(Mean, Sd) UCL	32.9
99% Chebyshev(Mean, Sd) UCL	42.98

Potential UCL to Use Use 95% Student's-t UCL 21.38

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Iron

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics

Minimum	4200
Maximum	8100
Mean	5283
Geometric Mean	5126
Median	4550
SD	1530
Std. Error of Mean	624.7
Coefficient of Variation	0.29
Skewness	1.641

Log-transformed Statistics

Minimum of Log Data	8.343
Maximum of Log Data	9
Mean of log Data	8.542
SD of log Data	0.259

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!

If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.775	Shapiro Wilk Test Statistic	0.811
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	6542	95% H-UCL	6807
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	7701
95% Adjusted-CLT UCL (Chen-1995)	6758	97.5% Chebyshev (MVUE) UCL	8752
95% Modified-t UCL (Johnson-1978)	6612	99% Chebyshev (MVUE) UCL	10818

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	8.488	**Data appear Gamma Distributed at 5% Significance Level**
Theta Star	622.5	
MLE of Mean	5283	
MLE of Standard Deviation	1813	
nu star	101.9	
Approximate Chi Square Value (.05)	79.57	**Nonparametric Statistics**
Adjusted Level of Significance	0.0122	95% CLT UCL 6311
Adjusted Chi Square Value	72.47	95% Jackknife UCL 6542
		95% Standard Bootstrap UCL 6246
Anderson-Darling Test Statistic	0.66	95% Bootstrap-t UCL 11639
Anderson-Darling 5% Critical Value	0.697	95% Hall's Bootstrap UCL 12524
Kolmogorov-Smirnov Test Statistic	0.317	95% Percentile Bootstrap UCL 6350
Kolmogorov-Smirnov 5% Critical Value	0.332	95% BCA Bootstrap UCL 6567
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 8006
		97.5% Chebyshev(Mean, Sd) UCL 9185
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 11499
95% Approximate Gamma UCL (Use when n >= 40)	6763	
95% Adjusted Gamma UCL (Use when n < 40)	7425	

Potential UCL to Use	Use 95% Approximate Gamma UCL 6763

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Lead

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	5

Raw Statistics	
Minimum	5.1
Maximum	18
Mean	10.08
Geometric Mean	9.25
Median	10.2
SD	4.611
Std. Error of Mean	1.883
Coefficient of Variation	0.457
Skewness	0.935

Log-transformed Statistics	
Minimum of Log Data	1.629
Maximum of Log Data	2.89
Mean of log Data	2.225
SD of log Data	0.457

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.91
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.947
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
95% Student's-t UCL	13.88
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	13.95
95% Modified-t UCL (Johnson-1978)	14

Assuming Lognormal Distribution	
95% H-UCL	17.26
95% Chebyshev (MVUE) UCL	18.28
97.5% Chebyshev (MVUE) UCL	21.82
99% Chebyshev (MVUE) UCL	28.79

Gamma Distribution Test	
k star (bias corrected)	3.091
Theta Star	3.262
MLE of Mean	10.08
MLE of Standard Deviation	5.735
nu star	37.09
Approximate Chi Square Value (.05)	24.15
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	20.46
Anderson-Darling Test Statistic	0.295
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.196
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	13.18
95% Jackknife UCL	13.88
95% Standard Bootstrap UCL	12.94
95% Bootstrap-t UCL	14.56
95% Hall's Bootstrap UCL	15.2
95% Percentile Bootstrap UCL	13.13
95% BCA Bootstrap UCL	13.33
95% Chebyshev(Mean, Sd) UCL	18.29
97.5% Chebyshev(Mean, Sd) UCL	21.84
99% Chebyshev(Mean, Sd) UCL	28.82

95% Approximate Gamma UCL (Use when n >= 40) 15.49
95% Adjusted Gamma UCL (Use when n < 40) 18.28

Potential UCL to Use Use 95% Student's-t UCL 13.88

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Magnesium

General Statistics

Number of Valid Observations 6 Number of Distinct Observations 6

Raw Statistics		Log-transformed Statistics	
Minimum	410	Minimum of Log Data	6.016
Maximum	660	Maximum of Log Data	6.492
Mean	540	Mean of log Data	6.277
Geometric Mean	532.2	SD of log Data	0.189
Median	540		
SD	99.8		
Std. Error of Mean	40.74		
Coefficient of Variation	0.185		
Skewness	-0.0905		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.913
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	622.1	95% H-UCL	644.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	721.5
95% Adjusted-CLT UCL (Chen-1995)	605.4	97.5% Chebyshev (MVUE) UCL	800
95% Modified-t UCL (Johnson-1978)	621.8	99% Chebyshev (MVUE) UCL	954.2

Gamma Distribution Test

k star (bias corrected)	17.27
Theta Star	31.27
MLE of Mean	540
MLE of Standard Deviation	129.9
nu star	207.2
Approximate Chi Square Value (.05)	174.9
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	164.1
Anderson-Darling Test Statistic	0.387
Anderson-Darling 5% Critical Value	0.697
Kolmogorov-Smirnov Test Statistic	0.253
Kolmogorov-Smirnov 5% Critical Value	0.332

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	639.8
95% Adjusted Gamma UCL (Use when n < 40)	681.7

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	607
95% Jackknife UCL	622.1
95% Standard Bootstrap UCL	600.1
95% Bootstrap-t UCL	620.1
95% Hall's Bootstrap UCL	589
95% Percentile Bootstrap UCL	601.7
95% BCA Bootstrap UCL	595
95% Chebyshev(Mean, Sd) UCL	717.6
97.5% Chebyshev(Mean, Sd) UCL	794.4
99% Chebyshev(Mean, Sd) UCL	945.4

Potential UCL to Use

Use 95% Student's-t UCL 622.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Manganese

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	5

Raw Statistics

Minimum	38
Maximum	87
Mean	55
Geometric Mean	52.54
Median	50
SD	18.96
Std. Error of Mean	7.742
Coefficient of Variation	0.345
Skewness	1.073

Log-transformed Statistics

Minimum of Log Data	3.638
Maximum of Log Data	4.466
Mean of log Data	3.962
SD of log Data	0.325

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.882
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.914
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
95% Student's-t UCL	70.6
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	71.36
95% Modified-t UCL (Johnson-1978)	71.17

Assuming Lognormal Distribution	
95% H-UCL	77.08
95% Chebyshev (MVUE) UCL	86.66
97.5% Chebyshev (MVUE) UCL	100.4
99% Chebyshev (MVUE) UCL	127.4

Gamma Distribution Test	
k star (bias corrected)	5.656
Theta Star	9.724
MLE of Mean	55
MLE of Standard Deviation	23.13
nu star	67.87
Approximate Chi Square Value (.05)	49.91
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	44.4
Anderson-Darling Test Statistic	0.351
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.225
Kolmogorov-Smirnov 5% Critical Value	0.332

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL (Use when n >= 40)	74.79
95% Adjusted Gamma UCL (Use when n < 40)	84.08

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	67.73
95% Jackknife UCL	70.6
95% Standard Bootstrap UCL	66.59
95% Bootstrap-t UCL	85.23
95% Hall's Bootstrap UCL	157.9
95% Percentile Bootstrap UCL	68
95% BCA Bootstrap UCL	67.67
95% Chebyshev(Mean, Sd) UCL	88.75
97.5% Chebyshev(Mean, Sd) UCL	103.3
99% Chebyshev(Mean, Sd) UCL	132

Potential UCL to Use Use 95% Student's-t UCL 70.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Mercury

General Statistics

Number of Valid Data	6	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	1
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.045	Minimum Detected	-3.101
Maximum Detected	0.39	Maximum Detected	-0.942
Mean of Detected	0.201	Mean of Detected	-1.838
SD of Detected	0.132	SD of Detected	0.838
Minimum Non-Detect	0.12	Minimum Non-Detect	-2.12
Maximum Non-Detect	0.12	Maximum Non-Detect	-2.12

Warning: There are only 5 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.968	Shapiro Wilk Test Statistic	0.938
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.178	Mean	-2.001
SD	0.132	SD	0.849
95% DL/2 (t) UCL	0.286	95% H-Stat (DL/2) UCL	0.766
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.286	Mean in Log Scale	-1.971
SD	0.0759	SD in Log Scale	0.817
95% MLE (t) UCL	0.348	Mean in Original Scale	0.179
95% MLE (Tiku) UCL	0.373	SD in Original Scale	0.13
		95% t UCL	0.286
		95% Percentile Bootstrap UCL	0.259
		95% BCA Bootstrap UCL	0.283
		95% H UCL	0.706

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.05	**Data appear Normal at 5% Significance Level**	
Theta Star	0.191		
nu star	10.5		
A-D Test Statistic	0.245	**Nonparametric Statistics**	
5% A-D Critical Value	0.684	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.684	Mean	0.18
5% K-S Critical Value	0.36	SD	0.118
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0545
		95% KM (t) UCL	0.29
Assuming Gamma Distribution		95% KM (z) UCL	0.27

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.045
Maximum	0.39
Mean	0.179
Median	0.165
SD	0.13
k star	1.167
Theta star	0.154
Nu star	14.01
AppChi2	6.578
95% Gamma Approximate UCL (Use when n >= 40)	0.382
95% Adjusted Gamma UCL (Use when n < 40)	0.517

95% KM (jackknife) UCL	0.29
95% KM (bootstrap t) UCL	0.313
95% KM (BCA) UCL	0.28
95% KM (Percentile Bootstrap) UCL	0.277
95% KM (Chebyshev) UCL	0.418
97.5% KM (Chebyshev) UCL	0.521
99% KM (Chebyshev) UCL	0.723
Potential UCLs to Use	
95% KM (t) UCL	0.29
95% KM (Percentile Bootstrap) UCL	0.277

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Nickel

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		Log-transformed Statistics	
Minimum	7.3	Minimum of Log Data	1.988
Maximum	24	Maximum of Log Data	3.178
Mean	14.13	Mean of log Data	2.55
Geometric Mean	12.81	SD of log Data	0.493
Median	14		
SD	6.649		
Std. Error of Mean	2.714		
Coefficient of Variation	0.47		
Skewness	0.408		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.914	Shapiro Wilk Test Statistic	0.905

Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	19.6

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	19.08
95% Modified-t UCL (Johnson-1978)	19.68

Gamma Distribution Test

k star (bias corrected)	2.739
Theta Star	5.161
MLE of Mean	14.13
MLE of Standard Deviation	8.54
nu star	32.86
Approximate Chi Square Value (.05)	20.76
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	17.37
Anderson-Darling Test Statistic	0.355
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.219
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	22.38
95% Adjusted Gamma UCL (Use when n < 40)	26.73

Potential UCL to Use

Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	25.79
95% Chebyshev (MVUE) UCL	26.57
97.5% Chebyshev (MVUE) UCL	31.94
99% Chebyshev (MVUE) UCL	42.48

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	18.6
95% Jackknife UCL	19.6
95% Standard Bootstrap UCL	18.18
95% Bootstrap-t UCL	20.44
95% Hall's Bootstrap UCL	17.96
95% Percentile Bootstrap UCL	18.22
95% BCA Bootstrap UCL	18.33
95% Chebyshev(Mean, Sd) UCL	25.96
97.5% Chebyshev(Mean, Sd) UCL	31.08
99% Chebyshev(Mean, Sd) UCL	41.14

Use 95% Student's-t UCL 19.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Potassium

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1400	Minimum Detected	7.244
Maximum Detected	1700	Maximum Detected	7.438
Mean of Detected	1533	Mean of Detected	7.332
SD of Detected	152.8	SD of Detected	0.0984
Minimum Non-Detect	560	Minimum Non-Detect	6.328
Maximum Non-Detect	1000	Maximum Non-Detect	6.908

Note: Data have multiple DLs - Use of KM Method is recommended

Number treated as Non-Detect 3

For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	3
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	50.00%

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.964	Shapiro Wilk Test Statistic	0.973
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	947.5	Mean	6.594
SD	653.4	SD	0.834
95% DL/2 (t) UCL	1485	95% H-Stat (DL/2) UCL	3935
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1077	Mean in Log Scale	7.169
SD	508.8	SD in Log Scale	0.189
95% MLE (t) UCL	1496	Mean in Original Scale	1318
95% MLE (Tiku) UCL	1592	SD in Original Scale	254.9
		95% t UCL	1528
		95% Percentile Bootstrap UCL	1484
		95% BCA Bootstrap UCL	1484
		95% H UCL	1573

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	N/A	**Data appear Normal at 5% Significance Level**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	N/A	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	1467
5% K-S Critical Value	N/A	SD	110.6
Data not Gamma Distributed at 5% Significance Level		SE of Mean	55.28
		95% KM (t) UCL	1578
Assuming Gamma Distribution		95% KM (z) UCL	1558
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1576
Minimum	N/A	95% KM (bootstrap t) UCL	1552
Maximum	N/A	95% KM (BCA) UCL	1700
Mean	N/A	95% KM (Percentile Bootstrap) UCL	1700
Median	N/A	95% KM (Chebyshev) UCL	1708
SD	N/A	97.5% KM (Chebyshev) UCL	1812
k star	N/A	99% KM (Chebyshev) UCL	2017
Theta star	N/A		

Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	1578
95% Gamma Approximate UCL (Use when n >= 40)	N/A	95% KM (Percentile Bootstrap) UCL	1700
95% Adjusted Gamma UCL (Use when n < 40)	N/A		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Selenium

General Statistics

Number of Valid Data	6	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	5
		Percent Non-Detects	83.33%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Selenium was not processed!

Silver

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	35	Minimum Detected	3.555
Maximum Detected	62	Maximum Detected	4.127
Mean of Detected	49.33	Mean of Detected	3.871
SD of Detected	13.58	SD of Detected	0.291
Minimum Non-Detect	1.4	Minimum Non-Detect	0.336
Maximum Non-Detect	2.6	Maximum Non-Detect	0.956

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	3
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	3
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	50.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.989
5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	25.13
SD	27.88
95% DL/2 (t) UCL	48.06
Maximum Likelihood Estimate(MLE) Method	
Mean	9.327
SD	44.64
95% MLE (t) UCL	46.05
95% MLE (Tiku) UCL	54.53

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.767

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	1.872
SD	2.208
95% H-Stat (DL/2) UCL	319016
Log ROS Method	
Mean in Log Scale	3.405
SD in Log Scale	0.544
Mean in Original Scale	34.1
SD in Original Scale	18.77
95% t UCL	49.54
95% Percentile Bootstrap UCL	45.79
95% BCA Bootstrap UCL	45.81
95% H UCL	67.99

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	42.17
SD	10.62
SE of Mean	5.31
95% KM (t) UCL	52.87
95% KM (z) UCL	50.9
95% KM (jackknife) UCL	55.25
95% KM (bootstrap t) UCL	45.25
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	62
95% KM (Chebyshev) UCL	65.31
97.5% KM (Chebyshev) UCL	75.33
99% KM (Chebyshev) UCL	95.01

Potential UCLs to Use

95% KM (t) UCL	52.87
95% KM (Percentile Bootstrap) UCL	62

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Sodium

General Statistics

Number of Valid Data	6	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	3
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	95	Minimum Detected	4.554
Maximum Detected	160	Maximum Detected	5.075
Mean of Detected	121.7	Mean of Detected	4.777
SD of Detected	34.03	SD of Detected	0.269
Minimum Non-Detect	280	Minimum Non-Detect	5.635
Maximum Non-Detect	510	Maximum Non-Detect	6.234

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	6
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	0
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

However, results obtained using 4 to 9 distinct values may not be reliable.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.912	Shapiro Wilk Test Statistic	0.94
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	151.7	Mean	4.971
SD	56.27	SD	0.342
95% DL/2 (t) UCL	198	95% H-Stat (DL/2) UCL	217.3
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	4.777
		SD in Log Scale	0.17
		Mean in Original Scale	120.2
		SD in Original Scale	21.59
		95% t UCL	137.9
		95% Percentile Bootstrap UCL	135.4
		95% BCA Bootstrap UCL	135.4
		95% H-UCL	140.5

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL (Use when n >= 40)	N/A
95% Adjusted Gamma UCL (Use when n < 40)	N/A

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	121.7
SD	27.79
SE of Mean	19.65
95% KM (t) UCL	161.3
95% KM (z) UCL	154
95% KM (jackknife) UCL	165.9
95% KM (bootstrap t) UCL	241.7
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	160
95% KM (Chebyshev) UCL	207.3
97.5% KM (Chebyshev) UCL	244.4
99% KM (Chebyshev) UCL	317.2

Potential UCLs to Use	
95% KM (t) UCL	161.3
95% KM (Percentile Bootstrap) UCL	160

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

For additional insight, the user may want to consult a statistician.

Tin

General Statistics

Number of Valid Data	3	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	2
Number of Missing Values	3	Percent Non-Detects	66.67%

Warning: This data set only has 3 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Tin was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Vanadium

General Statistics

Number of Valid Observations 6

Number of Distinct Observations 6

Raw Statistics

Minimum	5.4
Maximum	14
Mean	8.65
Geometric Mean	8.266
Median	8.25
SD	2.98
Std. Error of Mean	1.216
Coefficient of Variation	0.344
Skewness	1.251

Log-transformed Statistics

Minimum of Log Data	1.686
Maximum of Log Data	2.639
Mean of log Data	2.112
SD of log Data	0.325

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.911
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.974
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	11.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	11.31
95% Modified-t UCL (Johnson-1978)	11.2

Assuming Lognormal Distribution

95% H-UCL	12.12
95% Chebyshev (MVUE) UCL	13.63
97.5% Chebyshev (MVUE) UCL	15.79
99% Chebyshev (MVUE) UCL	20.03

Gamma Distribution Test

k star (bias corrected)	5.695
Theta Star	1.519
MLE of Mean	8.65
MLE of Standard Deviation	3.625
nu star	68.35
Approximate Chi Square Value (.05)	50.32
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	44.78
Anderson-Darling Test Statistic	0.243
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.185
Kolmogorov-Smirnov 5% Critical Value	0.332

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	10.65
95% Jackknife UCL	11.1
95% Standard Bootstrap UCL	10.51
95% Bootstrap-t UCL	12.12
95% Hall's Bootstrap UCL	21.68
95% Percentile Bootstrap UCL	10.65
95% BCA Bootstrap UCL	11.08
95% Chebyshev(Mean, Sd) UCL	13.95

97.5% Chebyshev(Mean, Sd) UCL	16.25
99% Chebyshev(Mean, Sd) UCL	20.75

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	11.75
95% Adjusted Gamma UCL (Use when n < 40)	13.2

Potential UCL to Use Use 95% Student's-t UCL 11.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Zinc

General Statistics

Number of Valid Observations	6	Number of Distinct Observations	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	20	Minimum of Log Data	2.996
Maximum	57	Maximum of Log Data	4.043
Mean	34.67	Mean of log Data	3.48
Geometric Mean	32.45	SD of log Data	0.396
Median	31.5		
SD	14.01		
Std. Error of Mean	5.719		
Coefficient of Variation	0.404		
Skewness	0.807		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.931	Shapiro Wilk Test Statistic	0.967
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	46.19	95% H-UCL	53.74
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	58.99
95% Adjusted-CLT UCL (Chen-1995)	46.09	97.5% Chebyshev (MVUE) UCL	69.54

95% Modified-t UCL (Johnson-1978)	46.51
99% Chebyshev (MVUE) UCL	90.26

Gamma Distribution Test

k star (bias corrected)	3.98
Theta Star	8.71
MLE of Mean	34.67
MLE of Standard Deviation	17.38
nu star	47.76
Approximate Chi Square Value (.05)	32.9
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	28.52
Anderson-Darling Test Statistic	0.228
Anderson-Darling 5% Critical Value	0.698
Kolmogorov-Smirnov Test Statistic	0.173
Kolmogorov-Smirnov 5% Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	50.33
95% Adjusted Gamma UCL (Use when n < 40)	58.06

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	44.07
95% Jackknife UCL	46.19
95% Standard Bootstrap UCL	43.3
95% Bootstrap-t UCL	54.55
95% Hall's Bootstrap UCL	108.9
95% Percentile Bootstrap UCL	43.5
95% BCA Bootstrap UCL	44
95% Chebyshev(Mean, Sd) UCL	59.6
97.5% Chebyshev(Mean, Sd) UCL	70.38
99% Chebyshev(Mean, Sd) UCL	91.57

Potential UCL to Use

Use 95% Student's-t UCL 46.19

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Chloride

General Statistics

Number of Valid Observations	3
Number of Missing Values	3
Number of Distinct Observations	2

Warning: This data set only has 3 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Chloride was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Nitrogen, as Ammonia

General Statistics

Number of Valid Observations	6
Number of Distinct Observations	6

Raw Statistics

Minimum	54

Log-transformed Statistics

Minimum of Log Data	3.989

Maximum	290	Maximum of Log Data	5.67
Mean	172.3	Mean of log Data	4.961
Geometric Mean	142.7	SD of log Data	0.733
Median	195		
SD	97.29		
Std. Error of Mean	39.72		
Coefficient of Variation	0.565		
Skewness	-0.335		

Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!

It is suggested to collect at least 8 to 10 observations using these statistical methods!
If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Warning: There are only 6 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.902
Shapiro Wilk Critical Value	0.788

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.829
Shapiro Wilk Critical Value	0.788

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	252.4

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	231.9
95% Modified-t UCL (Johnson-1978)	251.5

Assuming Lognormal Distribution

95% H-UCL	545.1
95% Chebyshev (MVUE) UCL	407.2
97.5% Chebyshev (MVUE) UCL	506.7
99% Chebyshev (MVUE) UCL	702.1

Gamma Distribution Test

k star (bias corrected)	1.512
Theta Star	113.9
MLE of Mean	172.3
MLE of Standard Deviation	140.1
nu star	18.15
Approximate Chi Square Value (.05)	9.499
Adjusted Level of Significance	0.0122
Adjusted Chi Square Value	7.351
Anderson-Darling Test Statistic	0.528
Anderson-Darling 5% Critical Value	0.702
Kolmogorov-Smirnov Test Statistic	0.237
Kolmogorov-Smirnov 5% Critical Value	0.335

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	329.3
95% Adjusted Gamma UCL (Use when n < 40)	425.5

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	237.7
95% Jackknife UCL	252.4
95% Standard Bootstrap UCL	232.9
95% Bootstrap-t UCL	252.1
95% Hall's Bootstrap UCL	220.7
95% Percentile Bootstrap UCL	230
95% BCA Bootstrap UCL	225
95% Chebyshev(Mean, Sd) UCL	345.5
97.5% Chebyshev(Mean, Sd) UCL	420.4
99% Chebyshev(Mean, Sd) UCL	567.5

Potential UCL to Use	Use 95% Student's-t UCL 252.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

Sulfate

General Statistics

Number of Valid Observations 3	Number of Distinct Observations 3
Number of Missing Values 3	

Warning: This data set only has 3 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Sulfate was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

C11-C22 Aromatics

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 4	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable C11-C22 Aromatics was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

C19-C36 Aliphatics

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 4	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable C19-C36 Aliphatics was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

C9-C18 Aliphatics

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 4	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable C9-C18 Aliphatics was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Extractable Petroleum Hydrocarbons, Total

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 4	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Extractable Petroleum Hydrocarbons, Total was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Hydrazine

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 4	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Hydrazine was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Sediment – On-PWD

1				General UCL Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	WorkSheet.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	Bis(2-Ethylhexyl)phthalate											
10												
11						General Statistics						
12						Number of Valid Data	23			Number of Detected Data	9	
13						Number of Distinct Detected Data	9			Number of Non-Detect Data	14	
14						Number of Missing Values	7			Percent Non-Detects	60.87%	
15												
16						Raw Statistics				Log-transformed Statistics		
17						Minimum Detected	2.9			Minimum Detected	1.065	
18						Maximum Detected	14			Maximum Detected	2.639	
19						Mean of Detected	7.189			Mean of Detected	1.848	
20						SD of Detected	3.742			SD of Detected	0.536	
21						Minimum Non-Detect	2			Minimum Non-Detect	0.693	
22						Maximum Non-Detect	12			Maximum Non-Detect	2.485	
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	22	
25	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	1	
26	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	95.65%	
27												
28						Warning: There are only 9 Detected Values in this data						
29						Note: It should be noted that even though bootstrap may be performed on this data set						
30						the resulting calculations may not be reliable enough to draw conclusions						
31												
32						It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.						
33												
34												
35						UCL Statistics						
36						Normal Distribution Test with Detected Values Only				Lognormal Distribution Test with Detected Values Only		
37						Shapiro Wilk Test Statistic	0.934			Shapiro Wilk Test Statistic	0.963	
38						5% Shapiro Wilk Critical Value	0.829			5% Shapiro Wilk Critical Value	0.829	
39						Data appear Normal at 5% Significance Level				Data appear Lognormal at 5% Significance Level		
40												
41						Assuming Normal Distribution				Assuming Lognormal Distribution		
42						DL/2 Substitution Method				DL/2 Substitution Method		
43						Mean	4.202			Mean	1.161	
44						SD	3.461			SD	0.742	
45						95% DL/2 (t) UCL	5.441			95% H-Stat (DL/2) UCL	5.965	
46												
47						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
48						MLE method failed to converge properly				Mean in Log Scale	1.181	
49										SD in Log Scale	0.657	
50										Mean in Original Scale	4.133	
51										SD in Original Scale	3.389	
52										95% t UCL	5.346	

53											95% Percentile Bootstrap UCL	5.335
54											95% BCA Bootstrap UCL	5.634
55											95% H-UCL	5.445
56												
57	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
58					k star (bias corrected)	2.86	**Data appear Normal at 5% Significance Level**					
59					Theta Star	2.513						
60					nu star	51.49						
61												
62					A-D Test Statistic	0.231	**Nonparametric Statistics**					
63					5% A-D Critical Value	0.725					Kaplan-Meier (KM) Method	
64					K-S Test Statistic	0.725					Mean	4.743
65					5% K-S Critical Value	0.28					SD	3.02
66	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.683
67											95% KM (t) UCL	5.916
68	**Assuming Gamma Distribution**										95% KM (z) UCL	5.867
69					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	5.76
70					Minimum	0.000001					95% KM (bootstrap t) UCL	6.08
71					Maximum	14					95% KM (BCA) UCL	6.625
72					Mean	2.855					95% KM (Percentile Bootstrap) UCL	6.282
73					Median	0.000001					95% KM (Chebyshev) UCL	7.721
74					SD	4.214					97.5% KM (Chebyshev) UCL	9.01
75					k star	0.116					99% KM (Chebyshev) UCL	11.54
76					Theta star	24.66						
77					Nu star	5.327	**Potential UCLs to Use**					
78					AppChi2	1.306					95% KM (t) UCL	5.916
79					95% Gamma Approximate UCL (Use when n >= 40)	11.64					95% KM (Percentile Bootstrap) UCL	6.282
80					95% Adjusted Gamma UCL (Use when n < 40)	13.01						
81	**Note: DL/2 is not a recommended method.**											
82												
83	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
84	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
85	**For additional insight, the user may want to consult a statistician.**											
86												
87												
88	**Acetone**											
89												
90	**General Statistics**											
91					Number of Valid Data	8	Number of Detected Data					2
92					Number of Distinct Detected Data	2	Number of Non-Detect Data					6
93					Number of Missing Values	22	Percent Non-Detects					75.00%
94												
95	**Raw Statistics**						**Log-transformed Statistics**					
96					Minimum Detected	0.095	Minimum Detected					-2.354
97					Maximum Detected	0.34	Maximum Detected					-1.079
98					Mean of Detected	0.218	Mean of Detected					-1.716
99					SD of Detected	0.173	SD of Detected					0.902
100					Minimum Non-Detect	15	Minimum Non-Detect					2.708
101					Maximum Non-Detect	31	Maximum Non-Detect					3.434
102												
103	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					8
104	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					0

105	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
106												
107	**Warning: Data set has only 2 Distinct Detected Values.**											
108	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
109	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
110												
111	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
112												
113	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
114	**Those methods will return a 'N/A' value on your output display!**											
115												
116	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
117	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
118	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
119												
120												
121	**UCL Statistics**											
122	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
123	Shapiro Wilk Test Statistic				N/A		Shapiro Wilk Test Statistic				N/A	
124	5% Shapiro Wilk Critical Value				N/A		5% Shapiro Wilk Critical Value				N/A	
125	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
126												
127	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
128	DL/2 Substitution Method						DL/2 Substitution Method					
129	Mean				7.617		Mean				1.276	
130	SD				5.308		SD				1.894	
131	95% DL/2 (t) UCL				11.17		95% H-Stat (DL/2) UCL				1405	
132												
133	Maximum Likelihood Estimate(MLE) Method				N/A		Log ROS Method					
134	**MLE method failed to converge properly**						Mean in Log Scale				N/A	
135							SD in Log Scale				N/A	
136							Mean in Original Scale				N/A	
137							SD in Original Scale				N/A	
138							95% t UCL				N/A	
139							95% Percentile Bootstrap UCL				N/A	
140							95% BCA Bootstrap UCL				N/A	
141							95% H-UCL				N/A	
142												
143	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
144	k star (bias corrected)				N/A		**Data do not follow a Discernable Distribution (0.05)**					
145	Theta Star				N/A							
146	nu star				N/A							
147												
148	A-D Test Statistic				N/A		**Nonparametric Statistics**					
149	5% A-D Critical Value				N/A		Kaplan-Meier (KM) Method					
150	K-S Test Statistic				N/A		Mean				0.218	
151	5% K-S Critical Value				N/A		SD				0.123	
152	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean				0.123	
153							95% KM (t) UCL				0.45	
154	**Assuming Gamma Distribution**						95% KM (z) UCL				0.419	
155	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL				0.525	
156	Minimum				N/A		95% KM (bootstrap t) UCL				N/A	

157					Maximum	N/A				95% KM (BCA) UCL		0.34
158					Mean	N/A				95% KM (Percentile Bootstrap) UCL		0.34
159					Median	N/A				95% KM (Chebyshev) UCL		0.751
160					SD	N/A				97.5% KM (Chebyshev) UCL		0.983
161					k star	N/A				99% KM (Chebyshev) UCL		1.436
162					Theta star	N/A						
163					Nu star	N/A				**Potential UCLs to Use**		
164					AppChi2	N/A				95% KM (t) UCL		0.45
165				95% Gamma Approximate UCL (Use when n >= 40)		N/A				95% KM (% Bootstrap) UCL		0.34
166				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
167	**Warning: Recommended UCL exceeds the maximum observation**											
168	**Note: DL/2 is not a recommended method.**											
169												
170	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
171	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
172	**For additional insight, the user may want to consult a statistician.**											
173												
174												
175	**Benzene**											
176												
177	**General Statistics**											
178					Number of Valid Data	8				Number of Detected Data		1
179					Number of Distinct Detected Data	1				Number of Non-Detect Data		7
180					Number of Missing Values	22				Percent Non-Detects		87.50%
181												
182	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
183	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
184												
185	**The data set for variable Benzene was not processed!**											
186												
187												
188												
189	**Barium**											
190												
191	**General Statistics**											
192					Number of Valid Observations	3				Number of Distinct Observations		3
193					Number of Missing Values	28						
194												
195												
196	**Warning: This data set only has 3 observations!**											
197	**Data set is too small to compute reliable and meaningful statistics and estimates!**											
198	**The data set for variable Barium was not processed!**											
199												
200	**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**											
201	**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
202												
203												
204												
205	**Beryllium**											
206												
207	**General Statistics**											
208					Number of Valid Data	3				Number of Detected Data		1

209				Number of Distinct Detected Data	1					Number of Non-Detect Data	2
210				Number of Missing Values	28					Percent Non-Detects	66.67%
211												
212					**Warning: This data set only has 3 observations!**							
213					**Data set is too small to compute reliable and meaningful statistics and estimates!**							
214					**The data set for variable Beryllium was not processed!**							
215												
216					**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
217					**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
218												
219												
220												
221	**Cadmium**											
222												
223					**General Statistics**							
224				Number of Valid Data	9					Number of Detected Data	4
225				Number of Distinct Detected Data	4					Number of Non-Detect Data	5
226				Number of Missing Values	22					Percent Non-Detects	55.56%
227												
228				**Raw Statistics**						**Log-transformed Statistics**		
229				Minimum Detected	0.229					Minimum Detected	-1.474
230				Maximum Detected	1.2					Maximum Detected	0.182
231				Mean of Detected	0.692					Mean of Detected	-0.546
232				SD of Detected	0.429					SD of Detected	0.73
233				Minimum Non-Detect	0.2					Minimum Non-Detect	-1.609
234				Maximum Non-Detect	2					Maximum Non-Detect	0.693
235												
236	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	9
237	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	0
238	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	100.00%
239												
240					**Warning: There are only 4 Distinct Detected Values in this data**							
241					**Note: It should be noted that even though bootstrap may be performed on this data set**							
242					**the resulting calculations may not be reliable enough to draw conclusions**							
243												
244					**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**							
245												
246												
247					**UCL Statistics**							
248				**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**		
249				Shapiro Wilk Test Statistic	0.974					Shapiro Wilk Test Statistic	0.963
250				5% Shapiro Wilk Critical Value	0.748					5% Shapiro Wilk Critical Value	0.748
251				**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**		
252												
253				**Assuming Normal Distribution**						**Assuming Lognormal Distribution**		
254				DL/2 Substitution Method						DL/2 Substitution Method		
255				Mean	0.574					Mean	-0.781	
256				SD	0.369					SD	0.777	
257				95% DL/2 (t) UCL	0.803					95% H-Stat (DL/2) UCL	1.323	
258												
259				Maximum Likelihood Estimate(MLE) Method	N/A					Log ROS Method		
260				**MLE method failed to converge properly**						Mean in Log Scale	-0.995	

261											SD in Log Scale	0.684
262											Mean in Original Scale	0.46
263											SD in Original Scale	0.349
264											95% t UCL	0.676
265											95% Percentile Bootstrap UCL	0.653
266											95% BCA Bootstrap UCL	0.707
267											95% H-UCL	0.875
268												
269	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
270				k star (bias corrected)	0.905		**Data appear Normal at 5% Significance Level**					
271				Theta Star	0.765							
272				nu star	7.242							
273												
274				A-D Test Statistic	0.233		**Nonparametric Statistics**					
275				5% A-D Critical Value	0.659						Kaplan-Meier (KM) Method	
276				K-S Test Statistic	0.659						Mean	0.519
277				5% K-S Critical Value	0.397						SD	0.345
278	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.155
279											95% KM (t) UCL	0.808
280	**Assuming Gamma Distribution**										95% KM (z) UCL	0.774
281				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	0.807
282				Minimum	0.000001						95% KM (bootstrap t) UCL	0.762
283				Maximum	1.2						95% KM (BCA) UCL	1.2
284				Mean	0.435						95% KM (Percentile Bootstrap) UCL	0.943
285				Median	0.296						95% KM (Chebyshev) UCL	1.196
286				SD	0.375						97.5% KM (Chebyshev) UCL	1.489
287				k star	0.359						99% KM (Chebyshev) UCL	2.064
288				Theta star	1.213							
289				Nu star	6.456		**Potential UCLs to Use**					
290				AppChi2	1.877						95% KM (t) UCL	0.808
291				95% Gamma Approximate UCL (Use when n >= 40)	1.496						95% KM (Percentile Bootstrap) UCL	0.943
292				95% Adjusted Gamma UCL (Use when n < 40)	N/A							
293	**Note: DL/2 is not a recommended method.**											
294												
295	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
296	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
297	**For additional insight, the user may want to consult a statistician.**											
298												
299												
300	**Chromium**											
301												
302	**General Statistics**											
303				Number of Valid Data	33						Number of Detected Data	31
304				Number of Distinct Detected Data	19						Number of Non-Detect Data	2
305											Percent Non-Detects	6.06%
306												
307	**Raw Statistics**						**Log-transformed Statistics**					
308				Minimum Detected	4.5						Minimum Detected	1.504
309				Maximum Detected	69						Maximum Detected	4.234
310				Mean of Detected	25.09						Mean of Detected	3.069
311				SD of Detected	15.15						SD of Detected	0.566
312				Minimum Non-Detect	9						Minimum Non-Detect	2.197

313					Maximum Non-Detect	10					Maximum Non-Detect	2.303
314												
315	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	3
316	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	30
317	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	9.09%
318												
319	**UCL Statistics**											
320	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
321					Shapiro Wilk Test Statistic	0.827					Shapiro Wilk Test Statistic	0.957
322					5% Shapiro Wilk Critical Value	0.929					5% Shapiro Wilk Critical Value	0.929
323	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
324												
325	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
326					DL/2 Substitution Method						DL/2 Substitution Method	
327					Mean	23.86					Mean	2.977
328					SD	15.47					SD	0.66
329					95% DL/2 (t) UCL	28.42					95% H-Stat (DL/2) UCL	31.09
330												
331					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
332					Mean	23.55					Mean in Log Scale	2.999
333					SD	15.81					SD in Log Scale	0.616
334					95% MLE (t) UCL	28.21					Mean in Original Scale	23.98
335					95% MLE (Tiku) UCL	28.06					SD in Original Scale	15.33
336											95% t UCL	28.5
337											95% Percentile Bootstrap UCL	28.33
338											95% BCA Bootstrap UCL	28.91
339											95% H UCL	30.27
340												
341	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
342					k star (bias corrected)	3.106	**Data appear Lognormal at 5% Significance Level**					
343					Theta Star	8.078						
344					nu star	192.6						
345												
346					A-D Test Statistic	0.836	**Nonparametric Statistics**					
347					5% A-D Critical Value	0.752					Kaplan-Meier (KM) Method	
348					K-S Test Statistic	0.752					Mean	23.85
349					5% K-S Critical Value	0.159					SD	15.25
350	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	2.699
351											95% KM (t) UCL	28.42
352	**Assuming Gamma Distribution**										95% KM (z) UCL	28.29
353					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	28.24
354					Minimum	0.000001					95% KM (bootstrap t) UCL	29.36
355					Maximum	69					95% KM (BCA) UCL	29.17
356					Mean	23.57					95% KM (Percentile Bootstrap) UCL	28.33
357					Median	20					95% KM (Chebyshev) UCL	35.61
358					SD	15.88					97.5% KM (Chebyshev) UCL	40.7
359					k star	0.529					99% KM (Chebyshev) UCL	50.7
360					Theta star	44.52						
361					Nu star	34.95	**Potential UCLs to Use**					
362					AppChi2	22.42					95% KM (Chebyshev) UCL	35.61
363					95% Gamma Approximate UCL (Use when n >= 40)	36.74						
364					95% Adjusted Gamma UCL (Use when n < 40)	37.61						

365	Note: DL/2 is not a recommended method.											
366												
367	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
368	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
369	For additional insight, the user may want to consult a statistician.											
370												
371												
372	Lead											
373												
374	General Statistics											
375					Number of Valid Data	9			Number of Detected Data	8		
376					Number of Distinct Detected Data	8			Number of Non-Detect Data	1		
377					Number of Missing Values	22			Percent Non-Detects	11.11%		
378												
379					Raw Statistics				Log-transformed Statistics			
380					Minimum Detected	4.6			Minimum Detected	1.526		
381					Maximum Detected	110			Maximum Detected	4.7		
382					Mean of Detected	55.34			Mean of Detected	3.57		
383					SD of Detected	40.57			SD of Detected	1.207		
384					Minimum Non-Detect	9			Minimum Non-Detect	2.197		
385					Maximum Non-Detect	9			Maximum Non-Detect	2.197		
386												
387												
388	Warning: There are only 8 Detected Values in this data											
389	Note: It should be noted that even though bootstrap may be performed on this data set											
390	the resulting calculations may not be reliable enough to draw conclusions											
391												
392	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
393												
394												
395	UCL Statistics											
396					Normal Distribution Test with Detected Values Only				Lognormal Distribution Test with Detected Values Only			
397					Shapiro Wilk Test Statistic	0.932			Shapiro Wilk Test Statistic	0.855		
398					5% Shapiro Wilk Critical Value	0.818			5% Shapiro Wilk Critical Value	0.818		
399					Data appear Normal at 5% Significance Level				Data appear Lognormal at 5% Significance Level			
400												
401					Assuming Normal Distribution				Assuming Lognormal Distribution			
402					DL/2 Substitution Method				DL/2 Substitution Method			
403					Mean	49.69			Mean	3.341		
404					SD	41.56			SD	1.323		
405					95% DL/2 (t) UCL	75.45			95% H-Stat (DL/2) UCL	439.1		
406												
407					Maximum Likelihood Estimate(MLE) Method				Log ROS Method			
408					Mean	39.84			Mean in Log Scale	3.402		
409					SD	53.32			SD in Log Scale	1.237		
410					95% MLE (t) UCL	72.89			Mean in Original Scale	50.06		
411					95% MLE (Tiku) UCL	76.16			SD in Original Scale	41.12		
412									95% t UCL	75.55		
413									95% Percentile Bootstrap UCL	71.46		
414									95% BCA Bootstrap UCL	72.58		
415									95% H UCL	337.8		
416												

	A	B	C	D	E	F	G	H	I	J	K	L
417	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
418					k star (bias corrected)	0.876	**Data appear Normal at 5% Significance Level**					
419					Theta Star	63.16						
420					nu star	14.02						
421												
422					A-D Test Statistic	0.413	**Nonparametric Statistics**					
423					5% A-D Critical Value	0.732	Kaplan-Meier (KM) Method					
424					K-S Test Statistic	0.732	Mean					49.85
425					5% K-S Critical Value	0.3	SD					39
426	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					13.9
427							95% KM (t) UCL					75.7
428	**Assuming Gamma Distribution**						95% KM (z) UCL					72.71
429	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					75.5
430					Minimum	2.328	95% KM (bootstrap t) UCL					75.36
431					Maximum	110	95% KM (BCA) UCL					74.29
432					Mean	49.45	95% KM (Percentile Bootstrap) UCL					72.46
433					Median	44	95% KM (Chebyshev) UCL					110.4
434					SD	41.86	97.5% KM (Chebyshev) UCL					136.7
435					k star	0.687	99% KM (Chebyshev) UCL					188.2
436					Theta star	71.92						
437					Nu star	12.37	**Potential UCLs to Use**					
438					AppChi2	5.475	95% KM (t) UCL					75.7
439				95% Gamma Approximate UCL (Use when n >= 40)		111.8	95% KM (Percentile Bootstrap) UCL					72.46
440				95% Adjusted Gamma UCL (Use when n < 40)		134.6						
441	**Note: DL/2 is not a recommended method.**											
442												
443	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
444	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
445	**For additional insight, the user may want to consult a statistician.**											
446												
447												
448	**Mercury**											
449												
450	**General Statistics**											
451					Number of Valid Data	8	Number of Detected Data					5
452					Number of Distinct Detected Data	5	Number of Non-Detect Data					3
453					Number of Missing Values	22	Percent Non-Detects					37.50%
454												
455	**Raw Statistics**						**Log-transformed Statistics**					
456					Minimum Detected	0.23	Minimum Detected					-1.47
457					Maximum Detected	0.44	Maximum Detected					-0.821
458					Mean of Detected	0.314	Mean of Detected					-1.189
459					SD of Detected	0.0885	SD of Detected					0.273
460					Minimum Non-Detect	0.06	Minimum Non-Detect					-2.813
461					Maximum Non-Detect	0.3	Maximum Non-Detect					-1.204
462												
463	Note: Data have multiple DLs - Use of KM Method is recommended						Number treated as Non-Detect					6
464	For all methods (except KM, DL/2, and ROS Methods),						Number treated as Detected					2
465	Observations < Largest ND are treated as NDs						Single DL Non-Detect Percentage					75.00%
466												
467	**Warning: There are only 5 Detected Values in this data**											
468	**Note: It should be noted that even though bootstrap may be performed on this data set**											

	A	B	C	D	E	F	G	H	I	J	K	L
469	the resulting calculations may not be reliable enough to draw conclusions											
470												
471	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
472												
473												
474	UCL Statistics											
475	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
476					Shapiro Wilk Test Statistic	0.907				Shapiro Wilk Test Statistic		0.927
477					5% Shapiro Wilk Critical Value	0.762				5% Shapiro Wilk Critical Value		0.762
478	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
479												
480	Assuming Normal Distribution						Assuming Lognormal Distribution					
481					DL/2 Substitution Method					DL/2 Substitution Method		
482					Mean	0.231				Mean		-1.706
483					SD	0.136				SD		0.868
484					95% DL/2 (t) UCL	0.322				95% H-Stat (DL/2) UCL		0.733
485												
486					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
487	MLE method failed to converge properly									Mean in Log Scale		-1.392
488										SD in Log Scale		0.36
489										Mean in Original Scale		0.263
490										SD in Original Scale		0.0982
491										95% t UCL		0.329
492										95% Percentile Bootstrap UCL		0.319
493										95% BCA Bootstrap UCL		0.327
494										95% H-UCL		0.355
495												
496	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
497					k star (bias corrected)	6.763	Data appear Normal at 5% Significance Level					
498					Theta Star	0.0464						
499					nu star	67.63						
500												
501					A-D Test Statistic	0.329	Nonparametric Statistics					
502					5% A-D Critical Value	0.679				Kaplan-Meier (KM) Method		
503					K-S Test Statistic	0.679				Mean		0.284
504					5% K-S Critical Value	0.357				SD		0.0739
505	Data appear Gamma Distributed at 5% Significance Level									SE of Mean		0.0293
506										95% KM (t) UCL		0.34
507	Assuming Gamma Distribution									95% KM (z) UCL		0.333
508					Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL		0.336
509					Minimum	0.0199				95% KM (bootstrap t) UCL		0.404
510					Maximum	0.44				95% KM (BCA) UCL		0.37
511					Mean	0.224				95% KM (Percentile Bootstrap) UCL		0.343
512					Median	0.24				95% KM (Chebyshev) UCL		0.412
513					SD	0.15				97.5% KM (Chebyshev) UCL		0.468
514					k star	0.883				99% KM (Chebyshev) UCL		0.576
515					Theta star	0.254						
516					Nu star	14.13	Potential UCLs to Use					
517					AppChi2	6.662				95% KM (t) UCL		0.34
518					95% Gamma Approximate UCL (Use when n >= 40)	0.476				95% KM (Percentile Bootstrap) UCL		0.343
519					95% Adjusted Gamma UCL (Use when n < 40)	0.585						
520	Note: DL/2 is not a recommended method.											

	A	B	C	D	E	F	G	H	I	J	K	L
521												
522	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
523	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
524	**For additional insight, the user may want to consult a statistician.**											
525												
526												
527	**Vanadium**											
528												
529	**General Statistics**											
530	Number of Valid Observations					3	Number of Distinct Observations					3
531	Number of Missing Values					28						
532												
533												
534	**Warning: This data set only has 3 observations!**											
535	**Data set is too small to compute reliable and meaningful statistics and estimates!**											
536	**The data set for variable Vanadium was not processed!**											
537												
538	**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**											
539	**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**											
540												
541												

Sediment – Central Pond

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Sheet1.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

2,4,4-Trimethyl-1-pentene

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2,4,4-Trimethyl-1-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2,4,4-Trimethyl-2-pentene

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2,4,4-Trimethyl-2-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2-Butanone

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 2-Butanone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Acetone

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Acetone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Methyl Tertbutyl Ether

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Methyl Tertbutyl Ether was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Toluene

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Toluene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

3 & 4 Methylphenol

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2

Number of Missing Values 5

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable 3 & 4 Methylphenol was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Acetophenone

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Acetophenone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Benzaldehyde

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Benzaldehyde was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Benzo(b)fluoranthene

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Benzo(b)fluoranthene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Fluoranthene

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Fluoranthene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Phenanthrene

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Phenanthrene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Phenol

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Phenol was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Pyrene

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Pyrene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Aluminum

General Statistics

Number of Valid Observations	9	Number of Distinct Observations	8

Raw Statistics

Minimum	6500
Maximum	12000
Mean	8933
Geometric Mean	8769
Median	9400
SD	1792
Std. Error of Mean	597.4
Coefficient of Variation	0.201
Skewness	0.0225

Log-transformed Statistics

Minimum of Log Data	8.78
Maximum of Log Data	9.393
Mean of log Data	9.079
SD of log Data	0.207

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.935
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.92
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	10044

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	9921
95% Modified-t UCL (Johnson-1978)	10045

Assuming Lognormal Distribution

95% H-UCL	10303
95% Chebyshev (MVUE) UCL	11628
97.5% Chebyshev (MVUE) UCL	12792
99% Chebyshev (MVUE) UCL	15079

Gamma Distribution Test

k star (bias corrected)	18.14
Theta Star	492.5

Data Distribution

Data appear Normal at 5% Significance Level

MLE of Mean	8933
MLE of Standard Deviation	2098
nu star	326.5
Approximate Chi Square Value (.05)	285.6
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	277.5
Anderson-Darling Test Statistic	0.381
Anderson-Darling 5% Critical Value	0.721
Kolmogorov-Smirnov Test Statistic	0.185
Kolmogorov-Smirnov 5% Critical Value	0.279

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	10211
95% Adjusted Gamma UCL (Use when n < 40)	10509

Nonparametric Statistics

95% CLT UCL	9916
95% Jackknife UCL	10044
95% Standard Bootstrap UCL	9859
95% Bootstrap-t UCL	9969
95% Hall's Bootstrap UCL	10009
95% Percentile Bootstrap UCL	9889
95% BCA Bootstrap UCL	9800
95% Chebyshev(Mean, Sd) UCL	11538
97.5% Chebyshev(Mean, Sd) UCL	12664
99% Chebyshev(Mean, Sd) UCL	14878

Potential UCL to Use Use 95% Student's-t UCL 10044

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Arsenic

General Statistics

Number of Valid Observations	2
Number of Missing Values	5
Number of Distinct Observations	2

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Arsenic was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Barium

General Statistics

Number of Valid Observations	2
Number of Missing Values	5
Number of Distinct Observations	2

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Barium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Beryllium

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Beryllium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Cadmium

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Cadmium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Calcium

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Calcium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Chromium

General Statistics

Number of Valid Observations 9 | Number of Distinct Observations 9

Raw Statistics

Minimum	18
Maximum	140
Mean	38.33
Geometric Mean	30.04
Median	25
SD	38.8
Std. Error of Mean	12.93
Coefficient of Variation	1.012
Skewness	2.815

Log-transformed Statistics

Minimum of Log Data	2.89
Maximum of Log Data	4.942
Mean of log Data	3.403
SD of log Data	0.628

Warning: There are only 9 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.539
Shapiro Wilk Critical Value	0.829

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	62.38

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	72.57
95% Modified-t UCL (Johnson-1978)	64.41

Gamma Distribution Test

k star (bias corrected)	1.544
Theta Star	24.83
MLE of Mean	38.33
MLE of Standard Deviation	30.85
nu star	27.79
Approximate Chi Square Value (.05)	16.76
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	14.98
Anderson-Darling Test Statistic	1.435
Anderson-Darling 5% Critical Value	0.729
Kolmogorov-Smirnov Test Statistic	0.38
Kolmogorov-Smirnov 5% Critical Value	0.282

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	63.55
95% Adjusted Gamma UCL (Use when n < 40)	71.09

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.724
Shapiro Wilk Critical Value	0.829

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	63.67
95% Chebyshev (MVUE) UCL	68.96
97.5% Chebyshev (MVUE) UCL	83.35
99% Chebyshev (MVUE) UCL	111.6

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	59.61
95% Jackknife UCL	62.38
95% Standard Bootstrap UCL	58.37
95% Bootstrap-t UCL	226.8
95% Hall's Bootstrap UCL	211.7
95% Percentile Bootstrap UCL	63
95% BCA Bootstrap UCL	75.67
95% Chebyshev(Mean, Sd) UCL	94.71
97.5% Chebyshev(Mean, Sd) UCL	119.1
99% Chebyshev(Mean, Sd) UCL	167

Potential UCL to Use | Use 95% Chebyshev (Mean, Sd) UCL 94.71

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Chromium, Hexavalent

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Chromium, Hexavalent was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Cobalt

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Cobalt was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Copper

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 1
Number of Missing Values 5	

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable Copper was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Iron

General Statistics

Number of Valid Observations 9 | Number of Distinct Observations 7

Raw Statistics

Minimum	9200
Maximum	17000
Mean	12733
Geometric Mean	12465
Median	14000
SD	2731
Std. Error of Mean	910.3
Coefficient of Variation	0.214
Skewness	-0.0445

Log-transformed Statistics

Minimum of Log Data	9.127
Maximum of Log Data	9.741
Mean of log Data	9.431
SD of log Data	0.221

Warning: There are only 9 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.912
Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	14426

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	14216
95% Modified-t UCL (Johnson-1978)	14424

Gamma Distribution Test

k star (bias corrected)	15.84
Theta Star	803.9
MLE of Mean	12733
MLE of Standard Deviation	3199
nu star	285.1
Approximate Chi Square Value (.05)	247
Adjusted Level of Significance	0.0231
Adjusted Chi Square Value	239.5
Anderson-Darling Test Statistic	0.505
Anderson-Darling 5% Critical Value	0.721
Kolmogorov-Smirnov Test Statistic	0.26
Kolmogorov-Smirnov 5% Critical Value	0.279

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.897
Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	14854
95% Chebyshev (MVUE) UCL	16846
97.5% Chebyshev (MVUE) UCL	18624
99% Chebyshev (MVUE) UCL	22115

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	14231
95% Jackknife UCL	14426
95% Standard Bootstrap UCL	14162
95% Bootstrap-t UCL	14285
95% Hall's Bootstrap UCL	14164
95% Percentile Bootstrap UCL	14156
95% BCA Bootstrap UCL	13989
95% Chebyshev(Mean, Sd) UCL	16701
97.5% Chebyshev(Mean, Sd) UCL	18418
99% Chebyshev(Mean, Sd) UCL	21791

95% Approximate Gamma UCL (Use when n >= 40) 14698
95% Adjusted Gamma UCL (Use when n < 40) 15158

Potential UCL to Use Use 95% Student's-t UCL 14426

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

Lead

General Statistics

Number of Valid Observations 2 Number of Distinct Observations 2
Number of Missing Values 5

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Magnesium

General Statistics

Number of Valid Observations 2 Number of Distinct Observations 2
Number of Missing Values 5

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Magnesium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Manganese

General Statistics

Number of Valid Observations 2 Number of Distinct Observations 2
Number of Missing Values 5

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Manganese was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Mercury

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Mercury was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Nickel

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	1
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Nickel was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Potassium

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Potassium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Selenium

General Statistics

Number of Valid Data	2	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	1
Number of Missing Values	5	Percent Non-Detects	50.00%

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Selenium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Sodium

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Sodium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Tin

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Tin was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Vanadium

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Vanadium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Zinc

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 1
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Zinc was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Chloride

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Chloride was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Nitrogen, as Ammonia

General Statistics

Number of Valid Observations 2	Number of Distinct Observations 2
Number of Missing Values 5	

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Nitrogen, as Ammonia was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Sulfate

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2
Number of Missing Values	5		

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Sulfate was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Sediment – Detention Pond

	General UCL Statistics for Data Sets with Non-Detects	
	User Selected Options	
	From File	Sheet1_a.wst
	Full Precision	OFF
	Confidence Coefficient	95%
	Number of Bootstrap Operations	2000

2,4,4-Trimethyl-1-pentene

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable 2,4,4-Trimethyl-1-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2,4,4-Trimethyl-2-pentene

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable 2,4,4-Trimethyl-2-pentene was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

2-Butanone

General Statistics

Number of Valid Observations	2	Number of Distinct Observations	2

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable 2-Butanone was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

	A	B	C	D	E	F	G	H	I	J	K	L
53												
54	**Acetone**											
55												
56						**General Statistics**							
57					Number of Valid Observations	2			Number of Distinct Observations	2		
58												
59												
60						**Warning: This data set only has 2 observations!**							
61						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
62						**The data set for variable Acetone was not processed!**							
63												
64						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
65						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
66												
67												
68												
69	**3 & 4 Methylphenol**											
70												
71						**General Statistics**							
72					Number of Valid Observations	2			Number of Distinct Observations	2		
73												
74												
75						**Warning: This data set only has 2 observations!**							
76						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
77						**The data set for variable 3 & 4 Methylphenol was not processed!**							
78												
79						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
80						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
81												
82												
83												
84	**Acetophenone**											
85												
86						**General Statistics**							
87					Number of Valid Data	2			Number of Detected Data	1		
88					Number of Distinct Detected Data	1			Number of Non-Detect Data	1		
89									Percent Non-Detects	50.00%		
90												
91						**Warning: This data set only has 2 observations!**							
92						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
93						**The data set for variable Acetophenone was not processed!**							
94												
95						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
96						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
97												
98												
99												
100	**Benzaldehyde**											
101												
102						**General Statistics**							
103					Number of Valid Observations	2			Number of Distinct Observations	2		
104												

	A	B	C	D	E	F	G	H	I	J	K	L
105												
106	Warning: This data set only has 2 observations!											
107	Data set is too small to compute reliable and meaningful statistics and estimates!											
108	The data set for variable Benzaldehyde was not processed!											
109												
110	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
111	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
112												
113												
114												
115	Benzo(a)pyrene											
116												
117	General Statistics											
118					Number of Valid Data	2			Number of Detected Data	1		
119					Number of Distinct Detected Data	1			Number of Non-Detect Data	1		
120									Percent Non-Detects	50.00%		
121												
122	Warning: This data set only has 2 observations!											
123	Data set is too small to compute reliable and meaningful statistics and estimates!											
124	The data set for variable Benzo(a)pyrene was not processed!											
125												
126	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
127	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
128												
129												
130												
131	Bis(2-Ethylhexyl)phthalate											
132												
133	General Statistics											
134					Number of Valid Data	2			Number of Detected Data	1		
135					Number of Distinct Detected Data	1			Number of Non-Detect Data	1		
136									Percent Non-Detects	50.00%		
137												
138	Warning: This data set only has 2 observations!											
139	Data set is too small to compute reliable and meaningful statistics and estimates!											
140	The data set for variable Bis(2-Ethylhexyl)phthalate was not processed!											
141												
142	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
143	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
144												
145												
146												
147	N-Nitrosodiphenylamine											
148												
149	General Statistics											
150					Number of Valid Data	2			Number of Detected Data	1		
151					Number of Distinct Detected Data	1			Number of Non-Detect Data	1		
152									Percent Non-Detects	50.00%		
153												
154	Warning: This data set only has 2 observations!											
155	Data set is too small to compute reliable and meaningful statistics and estimates!											
156	The data set for variable N-Nitrosodiphenylamine was not processed!											

	A	B	C	D	E	F	G	H	I	J	K	L
157												
158	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
159	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
160												
161												
162												
163	**Phenol**											
164												
165	General Statistics											
166	Number of Valid Observations	2					Number of Distinct Observations	2				
167												
168												
169	Warning: This data set only has 2 observations!											
170	Data set is too small to compute reliable and meaningful statistics and estimates!											
171	The data set for variable Phenol was not processed!											
172												
173	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
174	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
175												
176												
177												
178	**Aluminum**											
179												
180	General Statistics											
181	Number of Valid Observations	2					Number of Distinct Observations	2				
182												
183												
184	Warning: This data set only has 2 observations!											
185	Data set is too small to compute reliable and meaningful statistics and estimates!											
186	The data set for variable Aluminum was not processed!											
187												
188	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
189	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
190												
191												
192												
193	**Arsenic**											
194												
195	General Statistics											
196	Number of Valid Observations	2					Number of Distinct Observations	2				
197												
198												
199	Warning: This data set only has 2 observations!											
200	Data set is too small to compute reliable and meaningful statistics and estimates!											
201	The data set for variable Arsenic was not processed!											
202												
203	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
204	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
205												
206												
207												
208	**Barium**											

	A	B	C	D	E	F	G	H	I	J	K	L
209												
210						General Statistics						
211						Number of Valid Observations	2			Number of Distinct Observations	2	
212												
213												
214						Warning: This data set only has 2 observations!						
215						Data set is too small to compute reliable and meaningful statistics and estimates!						
216						The data set for variable Barium was not processed!						
217												
218						It is suggested to collect at least 8 to 10 observations before using these statistical methods!						
219						If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.						
220												
221												
222												
223	Beryllium											
224												
225						General Statistics						
226						Number of Valid Observations	2			Number of Distinct Observations	2	
227												
228												
229						Warning: This data set only has 2 observations!						
230						Data set is too small to compute reliable and meaningful statistics and estimates!						
231						The data set for variable Beryllium was not processed!						
232												
233						It is suggested to collect at least 8 to 10 observations before using these statistical methods!						
234						If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.						
235												
236												
237												
238	Cadmium											
239												
240						General Statistics						
241						Number of Valid Observations	2			Number of Distinct Observations	2	
242												
243												
244						Warning: This data set only has 2 observations!						
245						Data set is too small to compute reliable and meaningful statistics and estimates!						
246						The data set for variable Cadmium was not processed!						
247												
248						It is suggested to collect at least 8 to 10 observations before using these statistical methods!						
249						If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.						
250												
251												
252												
253	Calcium											
254												
255						General Statistics						
256						Number of Valid Observations	2			Number of Distinct Observations	2	
257												
258												
259						Warning: This data set only has 2 observations!						
260						Data set is too small to compute reliable and meaningful statistics and estimates!						

	A	B	C	D	E	F	G	H	I	J	K	L
261	The data set for variable Calcium was not processed!											
262												
263	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
264	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
265												
266												
267												
268	Chromium											
269												
270	General Statistics											
271	Number of Valid Observations	2					Number of Distinct Observations	2				
272												
273												
274	Warning: This data set only has 2 observations!											
275	Data set is too small to compute reliable and meaningful statistics and estimates!											
276	The data set for variable Chromium was not processed!											
277												
278	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
279	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
280												
281												
282												
283	Cobalt											
284												
285	General Statistics											
286	Number of Valid Observations	2					Number of Distinct Observations	2				
287												
288												
289	Warning: This data set only has 2 observations!											
290	Data set is too small to compute reliable and meaningful statistics and estimates!											
291	The data set for variable Cobalt was not processed!											
292												
293	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
294	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
295												
296												
297												
298	Copper											
299												
300	General Statistics											
301	Number of Valid Observations	2					Number of Distinct Observations	2				
302												
303												
304	Warning: This data set only has 2 observations!											
305	Data set is too small to compute reliable and meaningful statistics and estimates!											
306	The data set for variable Copper was not processed!											
307												
308	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
309	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
310												
311												
312												

	A	B	C	D	E	F	G	H	I	J	K	L
313	**Iron**											
314												
315						**General Statistics**							
316						Number of Valid Observations	2			Number of Distinct Observations	2	
317												
318												
319						**Warning: This data set only has 2 observations!**							
320						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
321						**The data set for variable Iron was not processed!**							
322												
323						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
324						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
325												
326												
327												
328	**Lead**											
329												
330						**General Statistics**							
331						Number of Valid Observations	2			Number of Distinct Observations	2	
332												
333												
334						**Warning: This data set only has 2 observations!**							
335						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
336						**The data set for variable Lead was not processed!**							
337												
338						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
339						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
340												
341												
342												
343	**Magnesium**											
344												
345						**General Statistics**							
346						Number of Valid Observations	2			Number of Distinct Observations	2	
347												
348												
349						**Warning: This data set only has 2 observations!**							
350						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
351						**The data set for variable Magnesium was not processed!**							
352												
353						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
354						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
355												
356												
357												
358	**Manganese**											
359												
360						**General Statistics**							
361						Number of Valid Observations	2			Number of Distinct Observations	2	
362												
363												
364						**Warning: This data set only has 2 observations!**							

	A	B	C	D	E	F	G	H	I	J	K	L
365	Data set is too small to compute reliable and meaningful statistics and estimates!											
366	The data set for variable Manganese was not processed!											
367												
368	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
369	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
370												
371												
372												
373	Mercury											
374												
375	General Statistics											
376				Number of Valid Observations	2			Number of Distinct Observations	2			
377												
378												
379	Warning: This data set only has 2 observations!											
380	Data set is too small to compute reliable and meaningful statistics and estimates!											
381	The data set for variable Mercury was not processed!											
382												
383	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
384	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
385												
386												
387												
388	Nickel											
389												
390	General Statistics											
391				Number of Valid Observations	2			Number of Distinct Observations	2			
392												
393												
394	Warning: This data set only has 2 observations!											
395	Data set is too small to compute reliable and meaningful statistics and estimates!											
396	The data set for variable Nickel was not processed!											
397												
398	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
399	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
400												
401												
402												
403	Potassium											
404												
405	General Statistics											
406				Number of Valid Observations	2			Number of Distinct Observations	2			
407												
408												
409	Warning: This data set only has 2 observations!											
410	Data set is too small to compute reliable and meaningful statistics and estimates!											
411	The data set for variable Potassium was not processed!											
412												
413	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
414	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
415												
416												

	A	B	C	D	E	F	G	H	I	J	K	L
417												
418	**Sodium**											
419												
420						**General Statistics**							
421					Number of Valid Observations	2				Number of Distinct Observations	2	
422												
423												
424						**Warning: This data set only has 2 observations!**							
425						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
426						**The data set for variable Sodium was not processed!**							
427												
428						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
429						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
430												
431												
432												
433	**Tin**											
434												
435						**General Statistics**							
436					Number of Valid Observations	2				Number of Distinct Observations	2	
437												
438												
439						**Warning: This data set only has 2 observations!**							
440						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
441						**The data set for variable Tin was not processed!**							
442												
443						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
444						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
445												
446												
447												
448	**Vanadium**											
449												
450						**General Statistics**							
451					Number of Valid Observations	2				Number of Distinct Observations	2	
452												
453												
454						**Warning: This data set only has 2 observations!**							
455						**Data set is too small to compute reliable and meaningful statistics and estimates!**							
456						**The data set for variable Vanadium was not processed!**							
457												
458						**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**							
459						**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**							
460												
461												
462												
463	**Zinc**											
464												
465						**General Statistics**							
466					Number of Valid Observations	2				Number of Distinct Observations	2	
467												
468												

	A	B	C	D	E	F	G	H	I	J	K	L
469	Warning: This data set only has 2 observations!											
470	Data set is too small to compute reliable and meaningful statistics and estimates!											
471	The data set for variable Zinc was not processed!											
472												
473	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
474	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
475												
476												
477												
478	Chloride											
479												
480	General Statistics											
481	Number of Valid Observations	2					Number of Distinct Observations	2				
482												
483												
484	Warning: This data set only has 2 observations!											
485	Data set is too small to compute reliable and meaningful statistics and estimates!											
486	The data set for variable Chloride was not processed!											
487												
488	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
489	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
490												
491												
492												
493	Nitrogen, as Ammonia											
494												
495	General Statistics											
496	Number of Valid Observations	2					Number of Distinct Observations	2				
497												
498												
499	Warning: This data set only has 2 observations!											
500	Data set is too small to compute reliable and meaningful statistics and estimates!											
501	The data set for variable Nitrogen, as Ammonia was not processed!											
502												
503	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
504	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
505												
506												
507												
508	Sulfate											
509												
510	General Statistics											
511	Number of Valid Observations	2					Number of Distinct Observations	2				
512												
513												
514	Warning: This data set only has 2 observations!											
515	Data set is too small to compute reliable and meaningful statistics and estimates!											
516	The data set for variable Sulfate was not processed!											
517												
518	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
519	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
520												

	A	B	C	D	E	F	G	H	I	J	K	L
521												

Sediment – MMB Wetland

1				**General UCL Statistics for Data Sets with Non-Detects**								
2			**User Selected Options**									
3			From File	WorkSheet.wst								
4			Full Precision	OFF								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	**Bis(2-Ethylhexyl)phthalate**											
10												
11						**General Statistics**						
12						Number of Valid Data	13			Number of Detected Data	10	
13						Number of Distinct Detected Data	10			Number of Non-Detect Data	3	
14										Percent Non-Detects	23.08%	
15												
16						**Raw Statistics**				**Log-transformed Statistics**		
17						Minimum Detected	0.05			Minimum Detected	-2.996	
18						Maximum Detected	0.35			Maximum Detected	-1.05	
19						Mean of Detected	0.162			Mean of Detected	-2.004	
20						SD of Detected	0.0995			SD of Detected	0.662	
21						Minimum Non-Detect	0.2			Minimum Non-Detect	-1.609	
22						Maximum Non-Detect	0.31			Maximum Non-Detect	-1.171	
23												
24	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	12	
25	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	1	
26	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	92.31%	
27												
28						**UCL Statistics**						
29						**Normal Distribution Test with Detected Values Only**				**Lognormal Distribution Test with Detected Values Only**		
30						Shapiro Wilk Test Statistic	0.899			Shapiro Wilk Test Statistic	0.922	
31						5% Shapiro Wilk Critical Value	0.842			5% Shapiro Wilk Critical Value	0.842	
32						**Data appear Normal at 5% Significance Level**				**Data appear Lognormal at 5% Significance Level**		
33												
34						**Assuming Normal Distribution**				**Assuming Lognormal Distribution**		
35						DL/2 Substitution Method				DL/2 Substitution Method		
36						Mean	0.155			Mean	-2.016	
37						SD	0.0881			SD	0.581	
38						95% DL/2 (t) UCL	0.198			95% H-Stat (DL/2) UCL	0.228	
39												
40						Maximum Likelihood Estimate(MLE) Method	N/A			Log ROS Method		
41						**MLE method failed to converge properly**				Mean in Log Scale	-2.064	
42										SD in Log Scale	0.59	
43										Mean in Original Scale	0.149	
44										SD in Original Scale	0.0901	
45										95% t UCL	0.194	
46										95% Percentile Bootstrap UCL	0.19	
47										95% BCA Bootstrap UCL	0.196	
48										95% H-UCL	0.221	
49												
50						**Gamma Distribution Test with Detected Values Only**				**Data Distribution Test with Detected Values Only**		
51						k star (bias corrected)	2.053			**Data appear Normal at 5% Significance Level**		
52						Theta Star	0.0791					

53					nu star	41.06						
54												
55					A-D Test Statistic	0.477	**Nonparametric Statistics**					
56					5% A-D Critical Value	0.733				Kaplan-Meier (KM) Method		
57					K-S Test Statistic	0.733				Mean		0.152
58					5% K-S Critical Value	0.269				SD		0.091
59	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean		0.0282
60										95% KM (t) UCL		0.202
61	**Assuming Gamma Distribution**									95% KM (z) UCL		0.198
62				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.202
63					Minimum	0.05				95% KM (bootstrap t) UCL		0.21
64					Maximum	0.35				95% KM (BCA) UCL		0.193
65					Mean	0.155				95% KM (Percentile Bootstrap) UCL		0.195
66					Median	0.153				95% KM (Chebyshev) UCL		0.275
67					SD	0.0884				97.5% KM (Chebyshev) UCL		0.328
68					k star	2.677				99% KM (Chebyshev) UCL		0.432
69					Theta star	0.0581						
70					Nu star	69.6	**Potential UCLs to Use**					
71					AppChi2	51.39				95% KM (t) UCL		0.202
72				95% Gamma Approximate UCL (Use when n >= 40)		0.21				95% KM (Percentile Bootstrap) UCL		0.195
73				95% Adjusted Gamma UCL (Use when n < 40)		0.22						
74	**Note: DL/2 is not a recommended method.**											
75												
76	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
77	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
78	**For additional insight, the user may want to consult a statistician.**											
79												
80												
81	**Carbazole**											
82												
83	**General Statistics**											
84					Number of Valid Data	13				Number of Detected Data		2
85					Number of Distinct Detected Data	2				Number of Non-Detect Data		11
86										Percent Non-Detects		84.62%
87												
88	**Raw Statistics**						**Log-transformed Statistics**					
89					Minimum Detected	0.025				Minimum Detected		-3.689
90					Maximum Detected	0.097				Maximum Detected		-2.333
91					Mean of Detected	0.061				Mean of Detected		-3.011
92					SD of Detected	0.0509				SD of Detected		0.959
93					Minimum Non-Detect	0.045				Minimum Non-Detect		-3.101
94					Maximum Non-Detect	0.31				Maximum Non-Detect		-1.171
95												
96	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		13
97	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
98	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
99												
100	**Warning: Data set has only 2 Distinct Detected Values.**											
101	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
102	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
103												
104	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											

105												
106	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
107	**Those methods will return a 'N/A' value on your output display!**											
108												
109	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
110	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
111	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
112												
113												
114	**UCL Statistics**											
115	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
116	Shapiro Wilk Test Statistic				N/A		Shapiro Wilk Test Statistic				N/A	
117	5% Shapiro Wilk Critical Value				N/A		5% Shapiro Wilk Critical Value				N/A	
118	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
119												
120	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
121	DL/2 Substitution Method						DL/2 Substitution Method					
122	Mean				0.0928		Mean				-2.544	
123	SD				0.0431		SD				0.684	
124	95% DL/2 (t) UCL				0.114		95% H-Stat (DL/2) UCL				0.158	
125												
126	Maximum Likelihood Estimate(MLE) Method				N/A		Log ROS Method					
127	**MLE method failed to converge properly**						Mean in Log Scale				N/A	
128							SD in Log Scale				N/A	
129							Mean in Original Scale				N/A	
130							SD in Original Scale				N/A	
131							95% t UCL				N/A	
132							95% Percentile Bootstrap UCL				N/A	
133							95% BCA Bootstrap UCL				N/A	
134							95% H-UCL				N/A	
135												
136	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
137	k star (bias corrected)				N/A		**Data do not follow a Discernable Distribution (0.05)**					
138	Theta Star				N/A							
139	nu star				N/A							
140												
141	A-D Test Statistic				N/A		**Nonparametric Statistics**					
142	5% A-D Critical Value				N/A		Kaplan-Meier (KM) Method					
143	K-S Test Statistic				N/A		Mean				0.043	
144	5% K-S Critical Value				N/A		SD				0.0312	
145	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean				0.022	
146							95% KM (t) UCL				0.0823	
147	**Assuming Gamma Distribution**						95% KM (z) UCL				0.0793	
148	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL				0.0946	
149	Minimum				N/A		95% KM (bootstrap t) UCL				N/A	
150	Maximum				N/A		95% KM (BCA) UCL				0.097	
151	Mean				N/A		95% KM (Percentile Bootstrap) UCL				0.097	
152	Median				N/A		95% KM (Chebyshev) UCL				0.139	
153	SD				N/A		97.5% KM (Chebyshev) UCL				0.181	
154	k star				N/A		99% KM (Chebyshev) UCL				0.262	
155	Theta star				N/A							
156	Nu star				N/A		**Potential UCLs to Use**					

157					AppChi2	N/A					95% KM (t) UCL	0.0823
158				95% Gamma Approximate UCL (Use when n >= 40)		N/A					95% KM (% Bootstrap) UCL	0.097
159				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
160	**Note: DL/2 is not a recommended method.**											
161												
162	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
163	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
164	**For additional insight, the user may want to consult a statistician.**											
165												
166												
167	**Arsenic**											
168												
169	**General Statistics**											
170	Number of Valid Observations					13	Number of Distinct Observations					12
171												
172	**Raw Statistics**						**Log-transformed Statistics**					
173	Minimum					3.5	Minimum of Log Data					1.253
174	Maximum					52	Maximum of Log Data					3.951
175	Mean					17.18	Mean of log Data					2.547
176	Geometric Mean					12.77	SD of log Data					0.84
177	Median					15						
178	SD					13.44						
179	Std. Error of Mean					3.729						
180	Coefficient of Variation					0.783						
181	Skewness					1.459						
182												
183	**Relevant UCL Statistics**											
184	**Normal Distribution Test**						**Lognormal Distribution Test**					
185	Shapiro Wilk Test Statistic					0.863	Shapiro Wilk Test Statistic					0.942
186	Shapiro Wilk Critical Value					0.866	Shapiro Wilk Critical Value					0.866
187	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
188												
189	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
190	95% Student's-t UCL					23.82	95% H-UCL					34.02
191	**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL					36.51
192	95% Adjusted-CLT UCL (Chen-1995)					24.92	97.5% Chebyshev (MVUE) UCL					44.71
193	95% Modified-t UCL (Johnson-1978)					24.07	99% Chebyshev (MVUE) UCL					60.81
194												
195	**Gamma Distribution Test**						**Data Distribution**					
196	k star (bias corrected)					1.464	**Data appear Gamma Distributed at 5% Significance Level**					
197	Theta Star					11.74						
198	MLE of Mean					17.18						
199	MLE of Standard Deviation					14.2						
200	nu star					38.06						
201	Approximate Chi Square Value (.05)					24.93	**Nonparametric Statistics**					
202	Adjusted Level of Significance					0.0301	95% CLT UCL					23.31
203	Adjusted Chi Square Value					23.42	95% Jackknife UCL					23.82
204							95% Standard Bootstrap UCL					23.04
205	Anderson-Darling Test Statistic					0.307	95% Bootstrap-t UCL					26.8
206	Anderson-Darling 5% Critical Value					0.745	95% Hall's Bootstrap UCL					32.64
207	Kolmogorov-Smirnov Test Statistic					0.138	95% Percentile Bootstrap UCL					23.27
208	Kolmogorov-Smirnov 5% Critical Value					0.24	95% BCA Bootstrap UCL					25.09

209	Data appear Gamma Distributed at 5% Significance Level						95% Chebyshev(Mean, Sd) UCL					33.43
210							97.5% Chebyshev(Mean, Sd) UCL					40.46
211	Assuming Gamma Distribution						99% Chebyshev(Mean, Sd) UCL					54.28
212	95% Approximate Gamma UCL (Use when n >= 40)					26.22						
213	95% Adjusted Gamma UCL (Use when n < 40)					27.91						
214												
215	Potential UCL to Use						Use 95% Approximate Gamma UCL					26.22
216												
217	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
218	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
219	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
220												
221												
222	Thallium											
223												
224	General Statistics											
225	Number of Valid Data					13	Number of Detected Data					1
226	Number of Distinct Detected Data					1	Number of Non-Detect Data					12
227							Percent Non-Detects					92.31%
228												
229	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
230	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
231												
232	The data set for variable Thallium was not processed!											
233												
234												
235												
236	Chloride											
237												
238	General Statistics											
239	Number of Valid Observations					13	Number of Distinct Observations					13
240												
241	Raw Statistics						Log-transformed Statistics					
242	Minimum					34	Minimum of Log Data					3.526
243	Maximum					1000	Maximum of Log Data					6.908
244	Mean					485.2	Mean of log Data					5.75
245	Geometric Mean					314.2	SD of log Data					1.153
246	Median					480						
247	SD					350.2						
248	Std. Error of Mean					97.13						
249	Coefficient of Variation					0.722						
250	Skewness					0.0514						
251												
252	Relevant UCL Statistics											
253	Normal Distribution Test						Lognormal Distribution Test					
254	Shapiro Wilk Test Statistic					0.916	Shapiro Wilk Test Statistic					0.87
255	Shapiro Wilk Critical Value					0.866	Shapiro Wilk Critical Value					0.866
256	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
257												
258	Assuming Normal Distribution						Assuming Lognormal Distribution					
259	95% Student's-t UCL					658.3	95% H-UCL					1724
260	95% UCLs (Adjusted for Skewness)						95% Chebyshev (MVUE) UCL					1427

261	95% Adjusted-CLT UCL (Chen-1995)					646.4				97.5% Chebyshev (MVUE) UCL		1800
262	95% Modified-t UCL (Johnson-1978)					658.5				99% Chebyshev (MVUE) UCL		2532
263												
264	**Gamma Distribution Test**						**Data Distribution**					
265	k star (bias corrected)					1.045	**Data appear Normal at 5% Significance Level**					
266	Theta Star					464.2						
267	MLE of Mean					485.2						
268	MLE of Standard Deviation					474.6						
269	nu star					27.17						
270	Approximate Chi Square Value (.05)					16.28	**Nonparametric Statistics**					
271	Adjusted Level of Significance					0.0301				95% CLT UCL		644.9
272	Adjusted Chi Square Value					15.09				95% Jackknife UCL		658.3
273										95% Standard Bootstrap UCL		636.4
274	Anderson-Darling Test Statistic					0.534				95% Bootstrap-t UCL		659.4
275	Anderson-Darling 5% Critical Value					0.753				95% Hall's Bootstrap UCL		634.4
276	Kolmogorov-Smirnov Test Statistic					0.188				95% Percentile Bootstrap UCL		642.2
277	Kolmogorov-Smirnov 5% Critical Value					0.242				95% BCA Bootstrap UCL		640.5
278	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL		908.5
279										97.5% Chebyshev(Mean, Sd) UCL		1092
280	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL		1452
281	95% Approximate Gamma UCL (Use when n >= 40)					809.5						
282	95% Adjusted Gamma UCL (Use when n < 40)					873.4						
283												
284	**Potential UCL to Use**									Use 95% Student's-t UCL		658.3
285												
286	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
287	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
288	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
289												
290												
291	**Nitrogen, as Ammonia**											
292												
293	**General Statistics**											
294	Number of Valid Observations					13	Number of Distinct Observations					13
295												
296	**Raw Statistics**						**Log-transformed Statistics**					
297	Minimum					62	Minimum of Log Data					4.127
298	Maximum					1500	Maximum of Log Data					7.313
299	Mean					566.8	Mean of log Data					5.973
300	Geometric Mean					392.8	SD of log Data					1.018
301	Median					580						
302	SD					413.6						
303	Std. Error of Mean					114.7						
304	Coefficient of Variation					0.73						
305	Skewness					0.71						
306												
307	**Relevant UCL Statistics**											
308	**Normal Distribution Test**						**Lognormal Distribution Test**					
309	Shapiro Wilk Test Statistic					0.918	Shapiro Wilk Test Statistic					0.872
310	Shapiro Wilk Critical Value					0.866	Shapiro Wilk Critical Value					0.866
311	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
312												

313	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
314				95% Student's-t UCL	771.2					95% H-UCL	1539	
315	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL	1455	
316				95% Adjusted-CLT UCL (Chen-1995)	779.6					97.5% Chebyshev (MVUE) UCL	1814	
317				95% Modified-t UCL (Johnson-1978)	775					99% Chebyshev (MVUE) UCL	2519	
318												
319	**Gamma Distribution Test**						**Data Distribution**					
320				k star (bias corrected)	1.212		**Data appear Normal at 5% Significance Level**					
321				Theta Star	467.8							
322				MLE of Mean	566.8							
323				MLE of Standard Deviation	514.9							
324				nu star	31.5							
325				Approximate Chi Square Value (.05)	19.68		**Nonparametric Statistics**					
326				Adjusted Level of Significance	0.0301					95% CLT UCL	755.4	
327				Adjusted Chi Square Value	18.36					95% Jackknife UCL	771.2	
328										95% Standard Bootstrap UCL	750.1	
329				Anderson-Darling Test Statistic	0.64					95% Bootstrap-t UCL	799.2	
330				Anderson-Darling 5% Critical Value	0.75					95% Hall's Bootstrap UCL	831.9	
331				Kolmogorov-Smirnov Test Statistic	0.233					95% Percentile Bootstrap UCL	753.5	
332				Kolmogorov-Smirnov 5% Critical Value	0.241					95% BCA Bootstrap UCL	767.8	
333	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL	1067	
334										97.5% Chebyshev(Mean, Sd) UCL	1283	
335	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL	1708	
336				95% Approximate Gamma UCL (Use when n >= 40)	907.3							
337				95% Adjusted Gamma UCL (Use when n < 40)	972.7							
338												
339	**Potential UCL to Use**									Use 95% Student's-t UCL	771.2	
340												
341	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
342	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
343	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
344												
345												
346	**Sulfate**											
347												
348	**General Statistics**											
349				Number of Valid Data	13					Number of Detected Data	11	
350				Number of Distinct Detected Data	10					Number of Non-Detect Data	2	
351										Percent Non-Detects	15.38%	
352												
353	**Raw Statistics**						**Log-transformed Statistics**					
354				Minimum Detected	120					Minimum Detected	4.787	
355				Maximum Detected	1400					Maximum Detected	7.244	
356				Mean of Detected	702.7					Mean of Detected	6.326	
357				SD of Detected	422					SD of Detected	0.785	
358				Minimum Non-Detect	63					Minimum Non-Detect	4.143	
359				Maximum Non-Detect	75					Maximum Non-Detect	4.317	
360												
361	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect	2	
362	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected	11	
363	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage	15.38%	
364												

	A	B	C	D	E	F	G	H	I	J	K	L
365	**UCL Statistics**											
366	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
367					Shapiro Wilk Test Statistic	0.95					Shapiro Wilk Test Statistic	0.917
368					5% Shapiro Wilk Critical Value	0.85					5% Shapiro Wilk Critical Value	0.85
369	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
370												
371	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
372					DL/2 Substitution Method						DL/2 Substitution Method	
373					Mean	599.9					Mean	5.897
374					SD	459.7					SD	1.27
375					95% DL/2 (t) UCL	827.2					95% H-Stat (DL/2) UCL	2769
376												
377					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
378					Mean	565.7					Mean in Log Scale	6.053
379					SD	497.9					SD in Log Scale	0.978
380					95% MLE (t) UCL	811.8					Mean in Original Scale	609.2
381					95% MLE (Tiku) UCL	815.8					SD in Original Scale	447.8
382											95% t UCL	830.5
383											95% Percentile Bootstrap UCL	808.5
384											95% BCA Bootstrap UCL	815.8
385											95% H UCL	1519
386												
387	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
388					k star (bias corrected)	1.763	**Data appear Normal at 5% Significance Level**					
389					Theta Star	398.7						
390					nu star	38.78						
391												
392					A-D Test Statistic	0.33	**Nonparametric Statistics**					
393					5% A-D Critical Value	0.737					Kaplan-Meier (KM) Method	
394					K-S Test Statistic	0.737					Mean	613.1
395					5% K-S Critical Value	0.258					SD	425.6
396	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	123.8
397											95% KM (t) UCL	833.8
398	**Assuming Gamma Distribution**										95% KM (z) UCL	816.7
399					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	828
400					Minimum	0.000001					95% KM (bootstrap t) UCL	858.2
401					Maximum	1400					95% KM (BCA) UCL	823.8
402					Mean	594.6					95% KM (Percentile Bootstrap) UCL	825.4
403					Median	550					95% KM (Chebyshev) UCL	1153
404					SD	466.9					97.5% KM (Chebyshev) UCL	1386
405					k star	0.227					99% KM (Chebyshev) UCL	1845
406					Theta star	2623						
407					Nu star	5.895	**Potential UCLs to Use**					
408					AppChi2	1.586					95% KM (t) UCL	833.8
409					95% Gamma Approximate UCL (Use when n >= 40)	2209					95% KM (Percentile Bootstrap) UCL	825.4
410					95% Adjusted Gamma UCL (Use when n < 40)	2715						
411	**Note: DL/2 is not a recommended method.**											
412												
413	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
414	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
415	**For additional insight, the user may want to consult a statistician.**											
416												

	A	B	C	D	E	F	G	H	I	J	K	L
417												
418	**Acetaldehyde**											
419												
420						**General Statistics**							
421						Number of Valid Data	11				Number of Detected Data	6
422						Number of Distinct Detected Data	5				Number of Non-Detect Data	5
423						Number of Missing Values	1				Percent Non-Detects	45.45%
424												
425					**Raw Statistics**					**Log-transformed Statistics**		
426						Minimum Detected	0.22				Minimum Detected	-1.514
427						Maximum Detected	0.42				Maximum Detected	-0.868
428						Mean of Detected	0.293				Mean of Detected	-1.265
429						SD of Detected	0.0924				SD of Detected	0.299
430						Minimum Non-Detect	0.27				Minimum Non-Detect	-1.309
431						Maximum Non-Detect	1.5				Maximum Non-Detect	0.405
432												
433	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	11
434	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
435	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
436												
437						**Warning: There are only 6 Detected Values in this data**							
438						**Note: It should be noted that even though bootstrap may be performed on this data set**						
439						**the resulting calculations may not be reliable enough to draw conclusions**						
440												
441						**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**						
442												
443												
444						**UCL Statistics**							
445					**Normal Distribution Test with Detected Values Only**					**Lognormal Distribution Test with Detected Values Only**		
446						Shapiro Wilk Test Statistic	0.78				Shapiro Wilk Test Statistic	0.798
447						5% Shapiro Wilk Critical Value	0.788				5% Shapiro Wilk Critical Value	0.788
448					**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**		
449												
450					**Assuming Normal Distribution**					**Assuming Lognormal Distribution**		
451						DL/2 Substitution Method					DL/2 Substitution Method	
452						Mean	0.35				Mean	-1.185
453						SD	0.194				SD	0.545
454						95% DL/2 (t) UCL	0.456				95% H-Stat (DL/2) UCL	0.522
455												
456						Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method	
457					**MLE method failed to converge properly**						Mean in Log Scale	-1.314
458											SD in Log Scale	0.224
459											Mean in Original Scale	0.275
460											SD in Original Scale	0.0695
461											95% t UCL	0.313
462											95% Percentile Bootstrap UCL	0.311
463											95% BCA Bootstrap UCL	0.319
464											95% H-UCL	0.315
465												
466					**Gamma Distribution Test with Detected Values Only**					**Data Distribution Test with Detected Values Only**		
467						k star (bias corrected)	6.648			**Data appear Gamma Distributed at 5% Significance Level**		
468						Theta Star	0.0441					

469					nu star	79.78						
470												
471					A-D Test Statistic	0.691	**Nonparametric Statistics**					
472					5% A-D Critical Value	0.698				Kaplan-Meier (KM) Method		
473					K-S Test Statistic	0.698				Mean		0.277
474					5% K-S Critical Value	0.332				SD		0.0787
475	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean		0.0306
476										95% KM (t) UCL		0.333
477	**Assuming Gamma Distribution**									95% KM (z) UCL		0.327
478				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.332
479					Minimum	0.22				95% KM (bootstrap t) UCL		0.443
480					Maximum	0.42				95% KM (BCA) UCL		0.336
481					Mean	0.285				95% KM (Percentile Bootstrap) UCL		0.328
482					Median	0.27				95% KM (Chebyshev) UCL		0.411
483					SD	0.068				97.5% KM (Chebyshev) UCL		0.468
484					k star	15.79				99% KM (Chebyshev) UCL		0.582
485					Theta star	0.0181						
486					Nu star	347.4	**Potential UCLs to Use**					
487					AppChi2	305.2				95% KM (t) UCL		0.333
488				95% Gamma Approximate UCL (Use when n >= 40)		0.325						
489				95% Adjusted Gamma UCL (Use when n < 40)		0.332						
490	**Note: DL/2 is not a recommended method.**											
491												
492	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
493	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
494	**For additional insight, the user may want to consult a statistician.**											
495												
496												
497	**Acetone**											
498												
499	**General Statistics**											
500					Number of Valid Observations	13				Number of Distinct Observations		13
501												
502	**Raw Statistics**						**Log-transformed Statistics**					
503					Minimum	0.035				Minimum of Log Data		-3.352
504					Maximum	1.7				Maximum of Log Data		0.531
505					Mean	0.723				Mean of log Data		-0.706
506					Geometric Mean	0.494				SD of log Data		1.136
507					Median	0.73						
508					SD	0.483						
509					Std. Error of Mean	0.134						
510					Coefficient of Variation	0.668						
511					Skewness	0.384						
512												
513	**Relevant UCL Statistics**											
514	**Normal Distribution Test**						**Lognormal Distribution Test**					
515					Shapiro Wilk Test Statistic	0.972				Shapiro Wilk Test Statistic		0.844
516					Shapiro Wilk Critical Value	0.866				Shapiro Wilk Critical Value		0.866
517	**Data appear Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
518												
519	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
520					95% Student's-t UCL	0.962				95% H-UCL		2.591

521	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL		2.185
522				95% Adjusted-CLT UCL (Chen-1995)		0.959				97.5% Chebyshev (MVUE) UCL		2.752
523				95% Modified-t UCL (Johnson-1978)		0.964				99% Chebyshev (MVUE) UCL		3.866
524												
525	**Gamma Distribution Test**									**Data Distribution**		
526				k star (bias corrected)		1.169				**Data appear Normal at 5% Significance Level**		
527				Theta Star		0.618						
528				MLE of Mean		0.723						
529				MLE of Standard Deviation		0.669						
530				nu star		30.4						
531				Approximate Chi Square Value (.05)		18.81				**Nonparametric Statistics**		
532				Adjusted Level of Significance		0.0301				95% CLT UCL		0.943
533				Adjusted Chi Square Value		17.52				95% Jackknife UCL		0.962
534										95% Standard Bootstrap UCL		0.933
535				Anderson-Darling Test Statistic		0.474				95% Bootstrap-t UCL		0.988
536				Anderson-Darling 5% Critical Value		0.751				95% Hall's Bootstrap UCL		0.991
537				Kolmogorov-Smirnov Test Statistic		0.184				95% Percentile Bootstrap UCL		0.935
538				Kolmogorov-Smirnov 5% Critical Value		0.241				95% BCA Bootstrap UCL		0.956
539	**Data appear Gamma Distributed at 5% Significance Level**									95% Chebyshev(Mean, Sd) UCL		1.307
540										97.5% Chebyshev(Mean, Sd) UCL		1.559
541	**Assuming Gamma Distribution**									99% Chebyshev(Mean, Sd) UCL		2.056
542				95% Approximate Gamma UCL (Use when n >= 40)		1.169						
543				95% Adjusted Gamma UCL (Use when n < 40)		1.255						
544												
545	**Potential UCL to Use**									Use 95% Student's-t UCL		0.962
546												
547	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
548	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
549	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
550												
551												
552	**Formaldehyde**											
553												
554	**General Statistics**											
555				Number of Valid Observations		11				Number of Distinct Observations		11
556				Number of Missing Values		1						
557												
558	**Raw Statistics**									**Log-transformed Statistics**		
559				Minimum		0.31				Minimum of Log Data		-1.171
560				Maximum		4				Maximum of Log Data		1.386
561				Mean		2.159				Mean of log Data		0.54
562				Geometric Mean		1.715				SD of log Data		0.858
563				Median		2.3						
564				SD		1.112						
565				Std. Error of Mean		0.335						
566				Coefficient of Variation		0.515						
567				Skewness		-0.41						
568												
569	**Relevant UCL Statistics**											
570	**Normal Distribution Test**									**Lognormal Distribution Test**		
571				Shapiro Wilk Test Statistic		0.943				Shapiro Wilk Test Statistic		0.753
572				Shapiro Wilk Critical Value		0.85				Shapiro Wilk Critical Value		0.85

573	Data appear Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
574												
575	Assuming Normal Distribution						Assuming Lognormal Distribution					
576				95% Student's-t UCL	2.767					95% H-UCL	5.205	
577	95% UCLs (Adjusted for Skewness)									95% Chebyshev (MVUE) UCL	5.188	
578				95% Adjusted-CLT UCL (Chen-1995)	2.666					97.5% Chebyshev (MVUE) UCL	6.405	
579				95% Modified-t UCL (Johnson-1978)	2.76					99% Chebyshev (MVUE) UCL	8.796	
580												
581	Gamma Distribution Test						Data Distribution					
582				k star (bias corrected)	1.752		Data appear Normal at 5% Significance Level					
583				Theta Star	1.232							
584				MLE of Mean	2.159							
585				MLE of Standard Deviation	1.631							
586				nu star	38.54							
587				Approximate Chi Square Value (.05)	25.32		Nonparametric Statistics					
588				Adjusted Level of Significance	0.0278					95% CLT UCL	2.711	
589				Adjusted Chi Square Value	23.59					95% Jackknife UCL	2.767	
590										95% Standard Bootstrap UCL	2.688	
591				Anderson-Darling Test Statistic	0.945					95% Bootstrap-t UCL	2.698	
592				Anderson-Darling 5% Critical Value	0.737					95% Hall's Bootstrap UCL	2.707	
593				Kolmogorov-Smirnov Test Statistic	0.268					95% Percentile Bootstrap UCL	2.685	
594				Kolmogorov-Smirnov 5% Critical Value	0.258					95% BCA Bootstrap UCL	2.665	
595	Data not Gamma Distributed at 5% Significance Level									95% Chebyshev(Mean, Sd) UCL	3.62	
596										97.5% Chebyshev(Mean, Sd) UCL	4.253	
597	Assuming Gamma Distribution									99% Chebyshev(Mean, Sd) UCL	5.495	
598				95% Approximate Gamma UCL (Use when n >= 40)	3.286							
599				95% Adjusted Gamma UCL (Use when n < 40)	3.528							
600												
601	Potential UCL to Use									Use 95% Student's-t UCL	2.767	
602												
603	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
604	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
605	and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.											
606												
607	Note: For highly negative-skewed data, confidence limits											
608	(e.g., Chen, Johnson, Lognormal, and Gamma) may not be											
609	reliable. Chen's and Johnson's methods provide											
610	adjustments for positvely skewed data sets.											
611												
612												
613	3 & 4 Methylphenol											
614												
615	General Statistics											
616				Number of Valid Data	13					Number of Detected Data	2	
617				Number of Distinct Detected Data	2					Number of Non-Detect Data	11	
618										Percent Non-Detects	84.62%	
619												
620	Raw Statistics						Log-transformed Statistics					
621				Minimum Detected	0.2					Minimum Detected	-1.609	
622				Maximum Detected	0.32					Maximum Detected	-1.139	
623				Mean of Detected	0.26					Mean of Detected	-1.374	
624				SD of Detected	0.0849					SD of Detected	0.332	

625					Minimum Non-Detect	0.045					Minimum Non-Detect	-3.101
626					Maximum Non-Detect	0.31					Maximum Non-Detect	-1.171
627												
628	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	12
629	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	1
630	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	92.31%
631												
632	**Warning: Data set has only 2 Distinct Detected Values.**											
633	**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**											
634	**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**											
635												
636	**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**											
637												
638	**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**											
639	**Those methods will return a 'N/A' value on your output display!**											
640												
641	**It is necessary to have 4 or more Distinct Values for bootstrap methods.**											
642	**However, results obtained using 4 to 9 distinct values may not be reliable.**											
643	**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**											
644												
645												
646	**UCL Statistics**											
647	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
648	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk Test Statistic					N/A
649	5% Shapiro Wilk Critical Value					N/A	5% Shapiro Wilk Critical Value					N/A
650	**Data not Normal at 5% Significance Level**						**Data not Lognormal at 5% Significance Level**					
651												
652	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
653	DL/2 Substitution Method						DL/2 Substitution Method					
654	Mean					0.122	Mean					-2.291
655	SD					0.0757	SD					0.693
656	95% DL/2 (t) UCL					0.16	95% H-Stat (DL/2) UCL					0.206
657												
658	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
659	**MLE method failed to converge properly**						Mean in Log Scale					N/A
660							SD in Log Scale					N/A
661							Mean in Original Scale					N/A
662							SD in Original Scale					N/A
663							95% t UCL					N/A
664							95% Percentile Bootstrap UCL					N/A
665							95% BCA Bootstrap UCL					N/A
666							95% H-UCL					N/A
667												
668	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
669	k star (bias corrected)					N/A	**Data do not follow a Discernable Distribution (0.05)**					
670	Theta Star					N/A						
671	nu star					N/A						
672												
673	A-D Test Statistic					N/A	**Nonparametric Statistics**					
674	5% A-D Critical Value					N/A	Kaplan-Meier (KM) Method					
675	K-S Test Statistic					N/A	Mean					0.209
676	5% K-S Critical Value					N/A	SD					0.032

677	Data not Gamma Distributed at 5% Significance Level										SE of Mean	0.0125
678											95% KM (t) UCL	0.232
679	Assuming Gamma Distribution										95% KM (z) UCL	0.23
680	Gamma ROS Statistics using Extrapolated Data										95% KM (jackknife) UCL	0.291
681	Minimum	N/A									95% KM (bootstrap t) UCL	N/A
682	Maximum	N/A									95% KM (BCA) UCL	0.32
683	Mean	N/A									95% KM (Percentile Bootstrap) UCL	0.32
684	Median	N/A									95% KM (Chebyshev) UCL	0.264
685	SD	N/A									97.5% KM (Chebyshev) UCL	0.288
686	k star	N/A									99% KM (Chebyshev) UCL	0.334
687	Theta star	N/A										
688	Nu star	N/A									Potential UCLs to Use	
689	AppChi2	N/A									95% KM (t) UCL	0.232
690	95% Gamma Approximate UCL (Use when n >= 40)	N/A									95% KM (% Bootstrap) UCL	0.32
691	95% Adjusted Gamma UCL (Use when n < 40)	N/A										
692	Note: DL/2 is not a recommended method.											
693												
694	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
695	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
696	For additional insight, the user may want to consult a statistician.											
697												
698												
699	4-Nitrophenol											
700												
701	General Statistics											
702	Number of Valid Data	13									Number of Detected Data	1
703	Number of Distinct Detected Data	1									Number of Non-Detect Data	12
704											Percent Non-Detects	92.31%
705												
706	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
707	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
708												
709	The data set for variable 4-Nitrophenol was not processed!											
710												
711												
712												
713	Benzaldehyde											
714												
715	General Statistics											
716	Number of Valid Data	13									Number of Detected Data	4
717	Number of Distinct Detected Data	4									Number of Non-Detect Data	9
718											Percent Non-Detects	69.23%
719												
720	Raw Statistics										Log-transformed Statistics	
721	Minimum Detected	0.056									Minimum Detected	-2.882
722	Maximum Detected	0.3									Maximum Detected	-1.204
723	Mean of Detected	0.168									Mean of Detected	-1.953
724	SD of Detected	0.103									SD of Detected	0.708
725	Minimum Non-Detect	0.045									Minimum Non-Detect	-3.101
726	Maximum Non-Detect	0.31									Maximum Non-Detect	-1.171
727												
728	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	13

	A	B	C	D	E	F	G	H	I	J	K	L
729	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
730	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
731												
732	**Warning: There are only 4 Distinct Detected Values in this data**											
733	**Note: It should be noted that even though bootstrap may be performed on this data set**											
734	**the resulting calculations may not be reliable enough to draw conclusions**											
735												
736	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
737												
738												
739	**UCL Statistics**											
740	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
741	Shapiro Wilk Test Statistic					0.987	Shapiro Wilk Test Statistic					0.978
742	5% Shapiro Wilk Critical Value					0.748	5% Shapiro Wilk Critical Value					0.748
743	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
744												
745	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
746	DL/2 Substitution Method						DL/2 Substitution Method					
747	Mean					0.117	Mean					-2.347
748	SD					0.0723	SD					0.726
749	95% DL/2 (t) UCL					0.153	95% H-Stat (DL/2) UCL					0.206
750												
751	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
752	**MLE method failed to converge properly**						Mean in Log Scale					-2.603
753							SD in Log Scale					0.64
754							Mean in Original Scale					0.092
755							SD in Original Scale					0.0751
756							95% t UCL					0.129
757							95% Percentile Bootstrap UCL					0.127
758							95% BCA Bootstrap UCL					0.14
759							95% H-UCL					0.139
760												
761	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
762	k star (bias corrected)					0.949	**Data appear Normal at 5% Significance Level**					
763	Theta Star					0.177						
764	nu star					7.592						
765												
766	A-D Test Statistic					0.2	**Nonparametric Statistics**					
767	5% A-D Critical Value					0.659	Kaplan-Meier (KM) Method					
768	K-S Test Statistic					0.659	Mean					0.11
769	5% K-S Critical Value					0.397	SD					0.0749
770	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.0297
771							95% KM (t) UCL					0.163
772	**Assuming Gamma Distribution**						95% KM (z) UCL					0.159
773	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.167
774	Minimum					0.000001	95% KM (bootstrap t) UCL					0.149
775	Maximum					0.3	95% KM (BCA) UCL					0.3
776	Mean					0.071	95% KM (Percentile Bootstrap) UCL					0.204
777	Median					0.0316	95% KM (Chebyshev) UCL					0.24
778	SD					0.0892	97.5% KM (Chebyshev) UCL					0.295
779	k star					0.216	99% KM (Chebyshev) UCL					0.405
780	Theta star					0.329						

781					Nu star	5.611	**Potential UCLs to Use**					
782					AppChi2	1.444					95% KM (t) UCL	0.163
783				95% Gamma Approximate UCL (Use when n >= 40)		0.276					95% KM (Percentile Bootstrap) UCL	0.204
784				95% Adjusted Gamma UCL (Use when n < 40)		N/A						
785	**Note: DL/2 is not a recommended method.**											
786												
787	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
788	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
789	**For additional insight, the user may want to consult a statistician.**											
790												
791												
792	**Benzoic Acid**											
793												
794	**General Statistics**											
795					Number of Valid Observations	13					Number of Distinct Observations	13
796												
797	**Raw Statistics**						**Log-transformed Statistics**					
798					Minimum	0.21					Minimum of Log Data	-1.561
799					Maximum	1.4					Maximum of Log Data	0.336
800					Mean	0.586					Mean of log Data	-0.704
801					Geometric Mean	0.495					SD of log Data	0.607
802					Median	0.52						
803					SD	0.359						
804					Std. Error of Mean	0.0995						
805					Coefficient of Variation	0.612						
806					Skewness	0.979						
807												
808	**Relevant UCL Statistics**											
809	**Normal Distribution Test**						**Lognormal Distribution Test**					
810					Shapiro Wilk Test Statistic	0.883					Shapiro Wilk Test Statistic	0.926
811					Shapiro Wilk Critical Value	0.866					Shapiro Wilk Critical Value	0.866
812	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
813												
814	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
815					95% Student's-t UCL	0.763					95% H-UCL	0.882
816	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	1.031
817					95% Adjusted-CLT UCL (Chen-1995)	0.779					97.5% Chebyshev (MVUE) UCL	1.223
818					95% Modified-t UCL (Johnson-1978)	0.768					99% Chebyshev (MVUE) UCL	1.602
819												
820	**Gamma Distribution Test**						**Data Distribution**					
821					k star (bias corrected)	2.44	**Data appear Normal at 5% Significance Level**					
822					Theta Star	0.24						
823					MLE of Mean	0.586						
824					MLE of Standard Deviation	0.375						
825					nu star	63.43						
826					Approximate Chi Square Value (.05)	46.11	**Nonparametric Statistics**					
827					Adjusted Level of Significance	0.0301					95% CLT UCL	0.75
828					Adjusted Chi Square Value	44.01					95% Jackknife UCL	0.763
829											95% Standard Bootstrap UCL	0.741
830					Anderson-Darling Test Statistic	0.506					95% Bootstrap-t UCL	0.791
831					Anderson-Darling 5% Critical Value	0.739					95% Hall's Bootstrap UCL	0.792
832					Kolmogorov-Smirnov Test Statistic	0.214					95% Percentile Bootstrap UCL	0.755

833				Kolmogorov-Smirnov 5% Critical Value	0.238					95% BCA Bootstrap UCL	0.779	
834				**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	1.02	
835										97.5% Chebyshev(Mean, Sd) UCL	1.207	
836				**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	1.576	
837				95% Approximate Gamma UCL (Use when n >= 40)	0.806							
838				95% Adjusted Gamma UCL (Use when n < 40)	0.845							
839												
840				**Potential UCL to Use**						Use 95% Student's-t UCL	0.763	
841												
842	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
843	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
844	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
845												
846												
847	**Benzyl alcohol**											
848												
849	**General Statistics**											
850				Number of Valid Data	13					Number of Detected Data	1	
851				Number of Distinct Detected Data	1					Number of Non-Detect Data	12	
852										Percent Non-Detects	92.31%	
853												
854	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
855	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
856												
857	**The data set for variable Benzyl alcohol was not processed!**											
858												
859												
860												
861	**Caprolactam**											
862												
863	**General Statistics**											
864				Number of Valid Data	8					Number of Detected Data	1	
865				Number of Distinct Detected Data	1					Number of Non-Detect Data	7	
866				Number of Missing Values	5					Percent Non-Detects	87.50%	
867												
868	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
869	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
870												
871	**The data set for variable Caprolactam was not processed!**											
872												
873												
874												
875	**Barium**											
876												
877	**General Statistics**											
878				Number of Valid Observations	13					Number of Distinct Observations	12	
879												
880	**Raw Statistics**									**Log-transformed Statistics**		
881				Minimum	22					Minimum of Log Data	3.091	
882				Maximum	190					Maximum of Log Data	5.247	
883				Mean	102.5					Mean of log Data	4.412	
884				Geometric Mean	82.47					SD of log Data	0.76	

Median	120	
SD	58.08	
Std. Error of Mean	16.11	
Coefficient of Variation	0.566	
Skewness	-0.178	

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.915	Shapiro Wilk Test Statistic	0.863
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	131.2	95% H-UCL	188.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	210.7
95% Adjusted-CLT UCL (Chen-1995)	128.2	97.5% Chebyshev (MVUE) UCL	255.5
95% Modified-t UCL (Johnson-1978)	131.1	99% Chebyshev (MVUE) UCL	343.5

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.935	**Data appear Normal at 5% Significance Level**	
Theta Star	52.98		
MLE of Mean	102.5		
MLE of Standard Deviation	73.71		
nu star	50.32		
Approximate Chi Square Value (.05)	35.03	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0301	95% CLT UCL	129
Adjusted Chi Square Value	33.22	95% Jackknife UCL	131.2
		95% Standard Bootstrap UCL	128.2
Anderson-Darling Test Statistic	0.691	95% Bootstrap-t UCL	130.9
Anderson-Darling 5% Critical Value	0.741	95% Hall's Bootstrap UCL	127.3
Kolmogorov-Smirnov Test Statistic	0.217	95% Percentile Bootstrap UCL	127
Kolmogorov-Smirnov 5% Critical Value	0.239	95% BCA Bootstrap UCL	126
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	172.8
		97.5% Chebyshev(Mean, Sd) UCL	203.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	262.8
95% Approximate Gamma UCL (Use when n >= 40)	147.3		
95% Adjusted Gamma UCL (Use when n < 40)	155.3		
Potential UCL to Use		Use 95% Student's-t UCL	131.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits
(e.g., Chen, Johnson, Lognormal, and Gamma) may not be
reliable. Chen's and Johnson's methods provide
adjustments for positvely skewed data sets.

Beryllium

	A	B	C	D	E	F	G	H	I	J	K	L
937	**General Statistics**											
938					Number of Valid Data	13				Number of Detected Data		12
939					Number of Distinct Detected Data	11				Number of Non-Detect Data		1
940										Percent Non-Detects		7.69%
941												
942	**Raw Statistics**						**Log-transformed Statistics**					
943					Minimum Detected	0.17				Minimum Detected		-1.772
944					Maximum Detected	2.6				Maximum Detected		0.956
945					Mean of Detected	1.048				Mean of Detected		-0.345
946					SD of Detected	0.886				SD of Detected		0.982
947					Minimum Non-Detect	0.44				Minimum Non-Detect		-0.821
948					Maximum Non-Detect	0.44				Maximum Non-Detect		-0.821
949												
950												
951	**UCL Statistics**											
952	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
953					Shapiro Wilk Test Statistic	0.86				Shapiro Wilk Test Statistic		0.927
954					5% Shapiro Wilk Critical Value	0.859				5% Shapiro Wilk Critical Value		0.859
955	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
956												
957	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
958					DL/2 Substitution Method					DL/2 Substitution Method		
959					Mean	0.985				Mean		-0.435
960					SD	0.879				SD		0.995
961					95% DL/2 (t) UCL	1.419				95% H-Stat (DL/2) UCL		2.398
962												
963					Maximum Likelihood Estimate(MLE) Method					Log ROS Method		
964					Mean	0.757				Mean in Log Scale		-0.425
965					SD	1.135				SD in Log Scale		0.983
966					95% MLE (t) UCL	1.318				Mean in Original Scale		0.987
967					95% MLE (Tiku) UCL	1.383				SD in Original Scale		0.876
968										95% t UCL		1.42
969										95% Percentile Bootstrap UCL		1.379
970										95% BCA Bootstrap UCL		1.422
971										95% H UCL		2.36
972												
973	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
974					k star (bias corrected)	1.119	**Data appear Normal at 5% Significance Level**					
975					Theta Star	0.937						
976					nu star	26.86						
977												
978					A-D Test Statistic	0.349	**Nonparametric Statistics**					
979					5% A-D Critical Value	0.747				Kaplan-Meier (KM) Method		
980					K-S Test Statistic	0.747				Mean		0.986
981					5% K-S Critical Value	0.25				SD		0.843
982	**Data appear Gamma Distributed at 5% Significance Level**									SE of Mean		0.244
983										95% KM (t) UCL		1.421
984	**Assuming Gamma Distribution**									95% KM (z) UCL		1.388
985					Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL		1.42
986					Minimum	0.0946				95% KM (bootstrap t) UCL		1.508
987					Maximum	2.6				95% KM (BCA) UCL		1.404
988					Mean	0.975				95% KM (Percentile Bootstrap) UCL		1.391

989					Median	0.72				95% KM (Chebyshev) UCL		2.051
990					SD	0.888				97.5% KM (Chebyshev) UCL		2.512
991					k star	0.969				99% KM (Chebyshev) UCL		3.417
992					Theta star	1.007						
993					Nu star	25.18				**Potential UCLs to Use**		
994					AppChi2	14.75				95% KM (t) UCL		1.421
995				95% Gamma Approximate UCL (Use when n >= 40)		1.664				95% KM (Percentile Bootstrap) UCL		1.391
996				95% Adjusted Gamma UCL (Use when n < 40)		1.802						
997	**Note: DL/2 is not a recommended method.**											
998												
999	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1000	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1001	**For additional insight, the user may want to consult a statistician.**											
1002												
1003												
1004	**Cadmium**											
1005												
1006	**General Statistics**											
1007	Number of Valid Observations					13				Number of Distinct Observations		12
1008												
1009	**Raw Statistics**									**Log-transformed Statistics**		
1010	Minimum					0.082				Minimum of Log Data		-2.501
1011	Maximum					4.8				Maximum of Log Data		1.569
1012	Mean					2.056				Mean of log Data		0.122
1013	Geometric Mean					1.13				SD of log Data		1.39
1014	Median					1.9						
1015	SD					1.738						
1016	Std. Error of Mean					0.482						
1017	Coefficient of Variation					0.846						
1018	Skewness					0.52						
1019												
1020	**Relevant UCL Statistics**											
1021	**Normal Distribution Test**									**Lognormal Distribution Test**		
1022	Shapiro Wilk Test Statistic					0.886				Shapiro Wilk Test Statistic		0.881
1023	Shapiro Wilk Critical Value					0.866				Shapiro Wilk Critical Value		0.866
1024	**Data appear Normal at 5% Significance Level**									**Data appear Lognormal at 5% Significance Level**		
1025												
1026	**Assuming Normal Distribution**									**Assuming Lognormal Distribution**		
1027	95% Student's-t UCL					2.915				95% H-UCL		12.41
1028	**95% UCLs (Adjusted for Skewness)**									95% Chebyshev (MVUE) UCL		7.501
1029	95% Adjusted-CLT UCL (Chen-1995)					2.923				97.5% Chebyshev (MVUE) UCL		9.613
1030	95% Modified-t UCL (Johnson-1978)					2.926				99% Chebyshev (MVUE) UCL		13.76
1031												
1032	**Gamma Distribution Test**									**Data Distribution**		
1033	k star (bias corrected)					0.796				**Data appear Normal at 5% Significance Level**		
1034	Theta Star					2.582						
1035	MLE of Mean					2.056						
1036	MLE of Standard Deviation					2.304						
1037	nu star					20.7						
1038	Approximate Chi Square Value (.05)					11.37				**Nonparametric Statistics**		
1039	Adjusted Level of Significance					0.0301				95% CLT UCL		2.849
1040	Adjusted Chi Square Value					10.4				95% Jackknife UCL		2.915

1041											95% Standard Bootstrap UCL	2.83
1042					Anderson-Darling Test Statistic	0.401					95% Bootstrap-t UCL	3.067
1043					Anderson-Darling 5% Critical Value	0.759					95% Hall's Bootstrap UCL	2.861
1044					Kolmogorov-Smirnov Test Statistic	0.144					95% Percentile Bootstrap UCL	2.815
1045					Kolmogorov-Smirnov 5% Critical Value	0.243					95% BCA Bootstrap UCL	2.893
1046					**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	4.157
1047											97.5% Chebyshev(Mean, Sd) UCL	5.066
1048					**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	6.852
1049					95% Approximate Gamma UCL (Use when n >= 40)	3.743						
1050					95% Adjusted Gamma UCL (Use when n < 40)	4.093						
1051												
1052					**Potential UCL to Use**						Use 95% Student's-t UCL	2.915
1053												
1054	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1055	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1056	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1057												
1058												
1059	**Copper**											
1060												
1061					**General Statistics**							
1062					Number of Valid Observations	13					Number of Distinct Observations	13
1063												
1064					**Raw Statistics**						**Log-transformed Statistics**	
1065					Minimum	7.4					Minimum of Log Data	2.001
1066					Maximum	90					Maximum of Log Data	4.5
1067					Mean	38.98					Mean of log Data	3.33
1068					Geometric Mean	27.93					SD of log Data	0.919
1069					Median	34						
1070					SD	29.04						
1071					Std. Error of Mean	8.055						
1072					Coefficient of Variation	0.745						
1073					Skewness	0.55						
1074												
1075					**Relevant UCL Statistics**							
1076					**Normal Distribution Test**						**Lognormal Distribution Test**	
1077					Shapiro Wilk Test Statistic	0.905					Shapiro Wilk Test Statistic	0.905
1078					Shapiro Wilk Critical Value	0.866					Shapiro Wilk Critical Value	0.866
1079					**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**	
1080												
1081					**Assuming Normal Distribution**						**Assuming Lognormal Distribution**	
1082					95% Student's-t UCL	53.34					95% H-UCL	87.41
1083					**95% UCLs (Adjusted for Skewness)**						95% Chebyshev (MVUE) UCL	89.33
1084					95% Adjusted-CLT UCL (Chen-1995)	53.55					97.5% Chebyshev (MVUE) UCL	110.3
1085					95% Modified-t UCL (Johnson-1978)	53.55					99% Chebyshev (MVUE) UCL	151.5
1086												
1087					**Gamma Distribution Test**						**Data Distribution**	
1088					k star (bias corrected)	1.318					**Data appear Normal at 5% Significance Level**	
1089					Theta Star	29.59						
1090					MLE of Mean	38.98						
1091					MLE of Standard Deviation	33.96						
1092					nu star	34.26						

1093	Approximate Chi Square Value (.05)				21.87	**Nonparametric Statistics**					
1094	Adjusted Level of Significance				0.0301	95% CLT UCL					52.23
1095	Adjusted Chi Square Value				20.47	95% Jackknife UCL					53.34
1096						95% Standard Bootstrap UCL					51.59
1097	Anderson-Darling Test Statistic				0.382	95% Bootstrap-t UCL					55.24
1098	Anderson-Darling 5% Critical Value				0.748	95% Hall's Bootstrap UCL					53.21
1099	Kolmogorov-Smirnov Test Statistic				0.137	95% Percentile Bootstrap UCL					52
1100	Kolmogorov-Smirnov 5% Critical Value				0.24	95% BCA Bootstrap UCL					54.24
1101	**Data appear Gamma Distributed at 5% Significance Level**					95% Chebyshev(Mean, Sd) UCL					74.1
1102						97.5% Chebyshev(Mean, Sd) UCL					89.29
1103	**Assuming Gamma Distribution**					99% Chebyshev(Mean, Sd) UCL					119.1
1104	95% Approximate Gamma UCL (Use when n >= 40)				61.06						
1105	95% Adjusted Gamma UCL (Use when n < 40)				65.25						
1106											
1107	**Potential UCL to Use**					Use 95% Student's-t UCL					53.34
1108											
1109	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**										
1110	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**										
1111	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**										
1112											
1113											
1114	**Iron**										
1115											
1116	**General Statistics**										
1117	Number of Valid Observations				13	Number of Distinct Observations					13
1118											
1119	**Raw Statistics**					**Log-transformed Statistics**					
1120	Minimum				6400	Minimum of Log Data					8.764
1121	Maximum				95000	Maximum of Log Data					11.46
1122	Mean				25508	Mean of log Data					9.864
1123	Geometric Mean				19227	SD of log Data					0.75
1124	Median				18000						
1125	SD				23513						
1126	Std. Error of Mean				6521						
1127	Coefficient of Variation				0.922						
1128	Skewness				2.41						
1129											
1130	**Relevant UCL Statistics**										
1131	**Normal Distribution Test**					**Lognormal Distribution Test**					
1132	Shapiro Wilk Test Statistic				0.723	Shapiro Wilk Test Statistic					0.966
1133	Shapiro Wilk Critical Value				0.866	Shapiro Wilk Critical Value					0.866
1134	**Data not Normal at 5% Significance Level**					**Data appear Lognormal at 5% Significance Level**					
1135											
1136	**Assuming Normal Distribution**					**Assuming Lognormal Distribution**					
1137	95% Student's-t UCL				37131	95% H-UCL					43229
1138	**95% UCLs (Adjusted for Skewness)**					95% Chebyshev (MVUE) UCL					48468
1139	95% Adjusted-CLT UCL (Chen-1995)				40892	97.5% Chebyshev (MVUE) UCL					58704
1140	95% Modified-t UCL (Johnson-1978)				37857	99% Chebyshev (MVUE) UCL					78812
1141											
1142	**Gamma Distribution Test**					**Data Distribution**					
1143	k star (bias corrected)				1.527	**Data appear Gamma Distributed at 5% Significance Level**					
1144	Theta Star				16702						

1145					MLE of Mean	25508						
1146					MLE of Standard Deviation	20641						
1147					nu star	39.71						
1148					Approximate Chi Square Value (.05)	26.27	**Nonparametric Statistics**					
1149					Adjusted Level of Significance	0.0301					95% CLT UCL	36234
1150					Adjusted Chi Square Value	24.72					95% Jackknife UCL	37131
1151											95% Standard Bootstrap UCL	35739
1152					Anderson-Darling Test Statistic	0.418					95% Bootstrap-t UCL	47407
1153					Anderson-Darling 5% Critical Value	0.744					95% Hall's Bootstrap UCL	77745
1154					Kolmogorov-Smirnov Test Statistic	0.174					95% Percentile Bootstrap UCL	37323
1155					Kolmogorov-Smirnov 5% Critical Value	0.24					95% BCA Bootstrap UCL	41185
1156					**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL	53934
1157											97.5% Chebyshev(Mean, Sd) UCL	66234
1158					**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL	90395
1159					95% Approximate Gamma UCL (Use when n >= 40)	38554						
1160					95% Adjusted Gamma UCL (Use when n < 40)	40970						
1161												
1162					**Potential UCL to Use**						Use 95% Approximate Gamma UCL	38554
1163												
1164	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1165	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1166	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1167												
1168												
1169	**Lead**											
1170												
1171	**General Statistics**											
1172					Number of Valid Observations	13					Number of Distinct Observations	12
1173												
1174	**Raw Statistics**						**Log-transformed Statistics**					
1175					Minimum	7.2					Minimum of Log Data	1.974
1176					Maximum	415					Maximum of Log Data	6.028
1177					Mean	138.3					Mean of log Data	4.3
1178					Geometric Mean	73.7					SD of log Data	1.358
1179					Median	120						
1180					SD	132.2						
1181					Std. Error of Mean	36.65						
1182					Coefficient of Variation	0.956						
1183					Skewness	0.962						
1184												
1185	**Relevant UCL Statistics**											
1186	**Normal Distribution Test**						**Lognormal Distribution Test**					
1187					Shapiro Wilk Test Statistic	0.877					Shapiro Wilk Test Statistic	0.916
1188					Shapiro Wilk Critical Value	0.866					Shapiro Wilk Critical Value	0.866
1189	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1190												
1191	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1192					95% Student's-t UCL	203.6					95% H-UCL	732.9
1193	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	464.6
1194					95% Adjusted-CLT UCL (Chen-1995)	209					97.5% Chebyshev (MVUE) UCL	594.3
1195					95% Modified-t UCL (Johnson-1978)	205.2					99% Chebyshev (MVUE) UCL	849
1196												

	A	B	C	D	E	F	G	H	I	J	K	L
1197	**Gamma Distribution Test**						**Data Distribution**					
1198					k star (bias corrected)	0.764	**Data appear Normal at 5% Significance Level**					
1199					Theta Star	181.1						
1200					MLE of Mean	138.3						
1201					MLE of Standard Deviation	158.2						
1202					nu star	19.85						
1203					Approximate Chi Square Value (.05)	10.74	**Nonparametric Statistics**					
1204					Adjusted Level of Significance	0.0301					95% CLT UCL	198.6
1205					Adjusted Chi Square Value	9.799					95% Jackknife UCL	203.6
1206											95% Standard Bootstrap UCL	198.4
1207					Anderson-Darling Test Statistic	0.298					95% Bootstrap-t UCL	218.9
1208					Anderson-Darling 5% Critical Value	0.761					95% Hall's Bootstrap UCL	214.5
1209					Kolmogorov-Smirnov Test Statistic	0.144					95% Percentile Bootstrap UCL	200.4
1210					Kolmogorov-Smirnov 5% Critical Value	0.244					95% BCA Bootstrap UCL	208.4
1211	**Data appear Gamma Distributed at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	298
1212											97.5% Chebyshev(Mean, Sd) UCL	367.2
1213	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	503
1214					95% Approximate Gamma UCL (Use when n >= 40)	255.5						
1215					95% Adjusted Gamma UCL (Use when n < 40)	280.1						
1216												
1217	**Potential UCL to Use**										Use 95% Student's-t UCL	203.6
1218												
1219	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1220	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1221	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1222												
1223												
1224	**Manganese**											
1225												
1226	**General Statistics**											
1227					Number of Valid Observations	13					Number of Distinct Observations	12
1228												
1229	**Raw Statistics**						**Log-transformed Statistics**					
1230					Minimum	110					Minimum of Log Data	4.7
1231					Maximum	2100					Maximum of Log Data	7.65
1232					Mean	788.5					Mean of log Data	6.298
1233					Geometric Mean	543.5					SD of log Data	0.991
1234					Median	610						
1235					SD	640.5						
1236					Std. Error of Mean	177.6						
1237					Coefficient of Variation	0.812						
1238					Skewness	1.087						
1239												
1240	**Relevant UCL Statistics**											
1241	**Normal Distribution Test**						**Lognormal Distribution Test**					
1242					Shapiro Wilk Test Statistic	0.853					Shapiro Wilk Test Statistic	0.88
1243					Shapiro Wilk Critical Value	0.866					Shapiro Wilk Critical Value	0.866
1244	**Data not Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1245												
1246	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1247					95% Student's-t UCL	1105					95% H-UCL	1998
1248	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	1933

1249				95% Adjusted-CLT UCL (Chen-1995)		1138				97.5% Chebyshev (MVUE) UCL		2404
1250				95% Modified-t UCL (Johnson-1978)		1114				99% Chebyshev (MVUE) UCL		3330
1251												
1252				**Gamma Distribution Test**						**Data Distribution**		
1253				k star (bias corrected)		1.197				**Data appear Gamma Distributed at 5% Significance Level**		
1254				Theta Star		659						
1255				MLE of Mean		788.5						
1256				MLE of Standard Deviation		720.8						
1257				nu star		31.11						
1258				Approximate Chi Square Value (.05)		19.37				**Nonparametric Statistics**		
1259				Adjusted Level of Significance		0.0301				95% CLT UCL		1081
1260				Adjusted Chi Square Value		18.06				95% Jackknife UCL		1105
1261										95% Standard Bootstrap UCL		1068
1262				Anderson-Darling Test Statistic		0.525				95% Bootstrap-t UCL		1281
1263				Anderson-Darling 5% Critical Value		0.75				95% Hall's Bootstrap UCL		1239
1264				Kolmogorov-Smirnov Test Statistic		0.193				95% Percentile Bootstrap UCL		1063
1265				Kolmogorov-Smirnov 5% Critical Value		0.241				95% BCA Bootstrap UCL		1128
1266				**Data appear Gamma Distributed at 5% Significance Level**						95% Chebyshev(Mean, Sd) UCL		1563
1267										97.5% Chebyshev(Mean, Sd) UCL		1898
1268				**Assuming Gamma Distribution**						99% Chebyshev(Mean, Sd) UCL		2556
1269				95% Approximate Gamma UCL (Use when n >= 40)		1267						
1270				95% Adjusted Gamma UCL (Use when n < 40)		1358						
1271												
1272				**Potential UCL to Use**						Use 95% Approximate Gamma UCL		1267
1273												
1274	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1275	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1276	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1277												
1278												
1279	**Mercury**											
1280												
1281						**General Statistics**							
1282						Number of Valid Data	13			Number of Detected Data		7
1283						Number of Distinct Detected Data	6			Number of Non-Detect Data		6
1284										Percent Non-Detects		46.15%
1285												
1286						**Raw Statistics**				**Log-transformed Statistics**		
1287						Minimum Detected	0.22			Minimum Detected		-1.514
1288						Maximum Detected	0.51			Maximum Detected		-0.673
1289						Mean of Detected	0.38			Mean of Detected		-1.006
1290						SD of Detected	0.106			SD of Detected		0.31
1291						Minimum Non-Detect	0.095			Minimum Non-Detect		-2.354
1292						Maximum Non-Detect	0.47			Maximum Non-Detect		-0.755
1293												
1294	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		12
1295	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		1
1296	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		92.31%
1297												
1298	**Warning: There are only 7 Detected Values in this data**											
1299	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1300	**the resulting calculations may not be reliable enough to draw conclusions**											

	A	B	C	D	E	F	G	H	I	J	K	L
1301												
1302	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1303												
1304												
1305	**UCL Statistics**											
1306	**Normal Distribution Test with Detected Values Only**						**Lognormal Distribution Test with Detected Values Only**					
1307	Shapiro Wilk Test Statistic					0.922	Shapiro Wilk Test Statistic					0.884
1308	5% Shapiro Wilk Critical Value					0.803	5% Shapiro Wilk Critical Value					0.803
1309	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1310												
1311	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1312	DL/2 Substitution Method						DL/2 Substitution Method					
1313	Mean					0.257	Mean					-1.66
1314	SD					0.168	SD					0.903
1315	95% DL/2 (t) UCL					0.34	95% H-Stat (DL/2) UCL					0.576
1316												
1317	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
1318	**MLE method failed to converge properly**						Mean in Log Scale					-1.252
1319							SD in Log Scale					0.368
1320							Mean in Original Scale					0.305
1321							SD in Original Scale					0.115
1322							95% t UCL					0.362
1323							95% Percentile Bootstrap UCL					0.358
1324							95% BCA Bootstrap UCL					0.359
1325							95% H-UCL					0.377
1326												
1327	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1328	k star (bias corrected)					7.661	**Data appear Normal at 5% Significance Level**					
1329	Theta Star					0.0496						
1330	nu star					107.3						
1331												
1332	A-D Test Statistic					0.449	**Nonparametric Statistics**					
1333	5% A-D Critical Value					0.708	Kaplan-Meier (KM) Method					
1334	K-S Test Statistic					0.708	Mean					0.316
1335	5% K-S Critical Value					0.312	SD					0.107
1336	**Data appear Gamma Distributed at 5% Significance Level**						SE of Mean					0.0338
1337							95% KM (t) UCL					0.376
1338	**Assuming Gamma Distribution**						95% KM (z) UCL					0.371
1339	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					0.372
1340	Minimum					0.000001	95% KM (bootstrap t) UCL					0.373
1341	Maximum					0.51	95% KM (BCA) UCL					0.423
1342	Mean					0.241	95% KM (Percentile Bootstrap) UCL					0.411
1343	Median					0.24	95% KM (Chebyshev) UCL					0.463
1344	SD					0.186	97.5% KM (Chebyshev) UCL					0.527
1345	k star					0.248	99% KM (Chebyshev) UCL					0.652
1346	Theta star					0.973						
1347	Nu star					6.447	**Potential UCLs to Use**					
1348	AppChi2					1.872	95% KM (t) UCL					0.376
1349	95% Gamma Approximate UCL (Use when n >= 40)					0.831	95% KM (Percentile Bootstrap) UCL					0.411
1350	95% Adjusted Gamma UCL (Use when n < 40)					1.008						
1351	**Note: DL/2 is not a recommended method.**											
1352												

	A	B	C	D	E	F	G	H	I	J	K	L
1353	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1354	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
1355	For additional insight, the user may want to consult a statistician.											
1356												
1357												
1358	Nickel											
1359												
1360	General Statistics											
1361	Number of Valid Observations					13	Number of Distinct Observations					13
1362												
1363	Raw Statistics						Log-transformed Statistics					
1364	Minimum					5.4	Minimum of Log Data					1.686
1365	Maximum					44	Maximum of Log Data					3.784
1366	Mean					18.58	Mean of log Data					2.703
1367	Geometric Mean					14.93	SD of log Data					0.693
1368	Median					15						
1369	SD					12.9						
1370	Std. Error of Mean					3.579						
1371	Coefficient of Variation					0.695						
1372	Skewness					1.052						
1373												
1374	Relevant UCL Statistics											
1375	Normal Distribution Test						Lognormal Distribution Test					
1376	Shapiro Wilk Test Statistic					0.867	Shapiro Wilk Test Statistic					0.956
1377	Shapiro Wilk Critical Value					0.866	Shapiro Wilk Critical Value					0.866
1378	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
1379												
1380	Assuming Normal Distribution						Assuming Lognormal Distribution					
1381	95% Student's-t UCL					24.96	95% H-UCL					30.42
1382	95% UCLs (Adjusted for Skewness)						95% Chebyshev (MVUE) UCL					34.82
1383	95% Adjusted-CLT UCL (Chen-1995)					25.58	97.5% Chebyshev (MVUE) UCL					41.85
1384	95% Modified-t UCL (Johnson-1978)					25.13	99% Chebyshev (MVUE) UCL					55.67
1385												
1386	Gamma Distribution Test						Data Distribution					
1387	k star (bias corrected)					1.929	Data appear Normal at 5% Significance Level					
1388	Theta Star					9.63						
1389	MLE of Mean					18.58						
1390	MLE of Standard Deviation					13.37						
1391	nu star					50.16						
1392	Approximate Chi Square Value (.05)					34.9	Nonparametric Statistics					
1393	Adjusted Level of Significance					0.0301	95% CLT UCL					24.46
1394	Adjusted Chi Square Value					33.09	95% Jackknife UCL					24.96
1395							95% Standard Bootstrap UCL					24.15
1396	Anderson-Darling Test Statistic					0.298	95% Bootstrap-t UCL					27.35
1397	Anderson-Darling 5% Critical Value					0.741	95% Hall's Bootstrap UCL					27.64
1398	Kolmogorov-Smirnov Test Statistic					0.122	95% Percentile Bootstrap UCL					24.42
1399	Kolmogorov-Smirnov 5% Critical Value					0.239	95% BCA Bootstrap UCL					25.64
1400	Data appear Gamma Distributed at 5% Significance Level						95% Chebyshev(Mean, Sd) UCL					34.18
1401							97.5% Chebyshev(Mean, Sd) UCL					40.93
1402	Assuming Gamma Distribution						99% Chebyshev(Mean, Sd) UCL					54.18
1403	95% Approximate Gamma UCL (Use when n >= 40)					26.7						
1404	95% Adjusted Gamma UCL (Use when n < 40)					28.16						

1405												
1406	**Potential UCL to Use**										Use 95% Student's-t UCL	24.96
1407												
1408	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1409	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1410	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1411												
1412												
1413	**Tin**											
1414												
1415	**General Statistics**											
1416						Number of Valid Data	13				Number of Detected Data	8
1417						Number of Distinct Detected Data	8				Number of Non-Detect Data	5
1418											Percent Non-Detects	38.46%
1419												
1420	**Raw Statistics**							**Log-transformed Statistics**				
1421						Minimum Detected	7.1				Minimum Detected	1.96
1422						Maximum Detected	16				Maximum Detected	2.773
1423						Mean of Detected	9.338				Mean of Detected	2.196
1424						SD of Detected	3.027				SD of Detected	0.28
1425						Minimum Non-Detect	7.5				Minimum Non-Detect	2.015
1426						Maximum Non-Detect	34				Maximum Non-Detect	3.526
1427												
1428	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	13
1429	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
1430	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
1431												
1432	**Warning: There are only 8 Detected Values in this data**											
1433	**Note: It should be noted that even though bootstrap may be performed on this data set**											
1434	**the resulting calculations may not be reliable enough to draw conclusions**											
1435												
1436	**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**											
1437												
1438												
1439	**UCL Statistics**											
1440	**Normal Distribution Test with Detected Values Only**							**Lognormal Distribution Test with Detected Values Only**				
1441						Shapiro Wilk Test Statistic	0.754				Shapiro Wilk Test Statistic	0.812
1442						5% Shapiro Wilk Critical Value	0.818				5% Shapiro Wilk Critical Value	0.818
1443	**Data not Normal at 5% Significance Level**							**Data not Lognormal at 5% Significance Level**				
1444												
1445	**Assuming Normal Distribution**							**Assuming Lognormal Distribution**				
1446						DL/2 Substitution Method					DL/2 Substitution Method	
1447						Mean	8.588				Mean	2.059
1448						SD	4.022				SD	0.438
1449						95% DL/2 (t) UCL	10.58				95% H-Stat (DL/2) UCL	11.17
1450												
1451						Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method	
1452	**MLE method failed to converge properly**										Mean in Log Scale	2.138
1453											SD in Log Scale	0.234
1454											Mean in Original Scale	8.725
1455											SD in Original Scale	2.482
1456											95% t UCL	9.951

1457											95% Percentile Bootstrap UCL	10.01
1458											95% BCA Bootstrap UCL	10.43
1459											95% H-UCL	9.874
1460												
1461	**Gamma Distribution Test with Detected Values Only**						**Data Distribution Test with Detected Values Only**					
1462					k star (bias corrected)	8.48	**Data do not follow a Discernable Distribution (0.05)**					
1463					Theta Star	1.101						
1464					nu star	135.7						
1465												
1466					A-D Test Statistic	0.788	**Nonparametric Statistics**					
1467					5% A-D Critical Value	0.715	Kaplan-Meier (KM) Method					
1468					K-S Test Statistic	0.715	Mean	8.781				
1469					5% K-S Critical Value	0.294	SD	2.491				
1470	**Data not Gamma Distributed at 5% Significance Level**						SE of Mean	0.784				
1471							95% KM (t) UCL	10.18				
1472	**Assuming Gamma Distribution**						95% KM (z) UCL	10.07				
1473					Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	10.16				
1474					Minimum	6.376	95% KM (bootstrap t) UCL	11.68				
1475					Maximum	16	95% KM (BCA) UCL	10.14				
1476					Mean	8.936	95% KM (Percentile Bootstrap) UCL	10.17				
1477					Median	8.234	95% KM (Chebyshev) UCL	12.2				
1478					SD	2.46	97.5% KM (Chebyshev) UCL	13.68				
1479					k star	13.89	99% KM (Chebyshev) UCL	16.58				
1480					Theta star	0.644						
1481					Nu star	361	**Potential UCLs to Use**					
1482					AppChi2	318	95% KM (BCA) UCL	10.14				
1483					95% Gamma Approximate UCL (Use when n >= 40)	10.14						
1484					95% Adjusted Gamma UCL (Use when n < 40)	10.33						
1485	**Note: DL/2 is not a recommended method.**											
1486												
1487	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1488	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
1489	**For additional insight, the user may want to consult a statistician.**											
1490												
1491												
1492	**Vanadium**											
1493												
1494	**General Statistics**											
1495					Number of Valid Observations	13	Number of Distinct Observations	12				
1496												
1497	**Raw Statistics**						**Log-transformed Statistics**					
1498					Minimum	8.9	Minimum of Log Data	2.186				
1499					Maximum	58	Maximum of Log Data	4.06				
1500					Mean	32.07	Mean of log Data	3.29				
1501					Geometric Mean	26.85	SD of log Data	0.653				
1502					Median	29						
1503					SD	17.97						
1504					Std. Error of Mean	4.983						
1505					Coefficient of Variation	0.56						
1506					Skewness	0.104						
1507												
1508	**Relevant UCL Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
1509	**Normal Distribution Test**						**Lognormal Distribution Test**					
1510					Shapiro Wilk Test Statistic	0.886					Shapiro Wilk Test Statistic	0.898
1511					Shapiro Wilk Critical Value	0.866					Shapiro Wilk Critical Value	0.866
1512	**Data appear Normal at 5% Significance Level**						**Data appear Lognormal at 5% Significance Level**					
1513												
1514	**Assuming Normal Distribution**						**Assuming Lognormal Distribution**					
1515					95% Student's-t UCL	40.95					95% H-UCL	51.34
1516	**95% UCLs (Adjusted for Skewness)**										95% Chebyshev (MVUE) UCL	59.43
1517					95% Adjusted-CLT UCL (Chen-1995)	40.42					97.5% Chebyshev (MVUE) UCL	71.03
1518					95% Modified-t UCL (Johnson-1978)	40.97					99% Chebyshev (MVUE) UCL	93.83
1519												
1520	**Gamma Distribution Test**						**Data Distribution**					
1521					k star (bias corrected)	2.336	**Data appear Normal at 5% Significance Level**					
1522					Theta Star	13.73						
1523					MLE of Mean	32.07						
1524					MLE of Standard Deviation	20.98						
1525					nu star	60.73						
1526					Approximate Chi Square Value (.05)	43.81	**Nonparametric Statistics**					
1527					Adjusted Level of Significance	0.0301					95% CLT UCL	40.27
1528					Adjusted Chi Square Value	41.76					95% Jackknife UCL	40.95
1529											95% Standard Bootstrap UCL	39.84
1530					Anderson-Darling Test Statistic	0.618					95% Bootstrap-t UCL	40.65
1531					Anderson-Darling 5% Critical Value	0.739					95% Hall's Bootstrap UCL	39.39
1532					Kolmogorov-Smirnov Test Statistic	0.239					95% Percentile Bootstrap UCL	39.77
1533					Kolmogorov-Smirnov 5% Critical Value	0.238					95% BCA Bootstrap UCL	39.77
1534	**Data follow Appr. Gamma Distribution at 5% Significance Level**										95% Chebyshev(Mean, Sd) UCL	53.79
1535											97.5% Chebyshev(Mean, Sd) UCL	63.19
1536	**Assuming Gamma Distribution**										99% Chebyshev(Mean, Sd) UCL	81.65
1537					95% Approximate Gamma UCL (Use when n >= 40)	44.46						
1538					95% Adjusted Gamma UCL (Use when n < 40)	46.63						
1539												
1540	**Potential UCL to Use**										Use 95% Student's-t UCL	40.95
1541												
1542	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
1543	**These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)**											
1544	**and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.**											
1545												
1546												
1547	**Zinc**											
1548												
1549	**General Statistics**											
1550					Number of Valid Observations	13					Number of Distinct Observations	12
1551												
1552	**Raw Statistics**						**Log-transformed Statistics**					
1553					Minimum	22					Minimum of Log Data	3.091
1554					Maximum	500					Maximum of Log Data	6.215
1555					Mean	206.7					Mean of log Data	4.92
1556					Geometric Mean	137					SD of log Data	1.055
1557					Median	190						
1558					SD	163.6						
1559					Std. Error of Mean	45.37						
1560					Coefficient of Variation	0.791						

Skewness	0.566	
Relevant UCL Statistics		
Normal Distribution Test		**Lognormal Distribution Test**
Shapiro Wilk Test Statistic	0.908	Shapiro Wilk Test Statistic 0.918
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value 0.866
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**
Assuming Normal Distribution		**Assuming Lognormal Distribution**
95% Student's-t UCL	287.5	95% H-UCL 586.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL 536.2
95% Adjusted-CLT UCL (Chen-1995)	288.9	97.5% Chebyshev (MVUE) UCL 670.8
95% Modified-t UCL (Johnson-1978)	288.7	99% Chebyshev (MVUE) UCL 935.2
Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	1.095	**Data appear Normal at 5% Significance Level**
Theta Star	188.7	
MLE of Mean	206.7	
MLE of Standard Deviation	197.5	
nu star	28.48	
Approximate Chi Square Value (.05)	17.3	**Nonparametric Statistics**
Adjusted Level of Significance	0.0301	95% CLT UCL 281.3
Adjusted Chi Square Value	16.07	95% Jackknife UCL 287.5
		95% Standard Bootstrap UCL 276.2
Anderson-Darling Test Statistic	0.333	95% Bootstrap-t UCL 294.7
Anderson-Darling 5% Critical Value	0.752	95% Hall's Bootstrap UCL 285.7
Kolmogorov-Smirnov Test Statistic	0.129	95% Percentile Bootstrap UCL 282.5
Kolmogorov-Smirnov 5% Critical Value	0.242	95% BCA Bootstrap UCL 283.5
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 404.4
		97.5% Chebyshev(Mean, Sd) UCL 490
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 658.1
95% Approximate Gamma UCL (Use when n >= 40)	340.2	
95% Adjusted Gamma UCL (Use when n < 40)	366.3	
Potential UCL to Use		Use 95% Student's-t UCL 287.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Aluminum

General Statistics		
Number of Valid Observations	13	Number of Distinct Observations 12
Raw Statistics		**Log-transformed Statistics**
Minimum	5400	Minimum of Log Data 8.594
Maximum	28000	Maximum of Log Data 10.24
Mean	12969	Mean of log Data 9.32
Geometric Mean	11164	SD of log Data 0.562
Median	8500	
SD	7616	

Std. Error of Mean	2112	
Coefficient of Variation	0.587	
Skewness	0.947	
Relevant UCL Statistics		
Normal Distribution Test		**Lognormal Distribution Test**
Shapiro Wilk Test Statistic	0.859	Shapiro Wilk Test Statistic 0.917
Shapiro Wilk Critical Value	0.866	Shapiro Wilk Critical Value 0.866
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**
Assuming Normal Distribution		**Assuming Lognormal Distribution**
95% Student's-t UCL	16734	95% H-UCL 18652
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL 21952
95% Adjusted-CLT UCL (Chen-1995)	17037	97.5% Chebyshev (MVUE) UCL 25869
95% Modified-t UCL (Johnson-1978)	16826	99% Chebyshev (MVUE) UCL 33563
Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	2.738	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	4736	
MLE of Mean	12969	
MLE of Standard Deviation	7838	
nu star	71.19	
Approximate Chi Square Value (.05)	52.77	**Nonparametric Statistics**
Adjusted Level of Significance	0.0301	95% CLT UCL 16444
Adjusted Chi Square Value	50.51	95% Jackknife UCL 16734
		95% Standard Bootstrap UCL 16237
Anderson-Darling Test Statistic	0.569	95% Bootstrap-t UCL 17583
Anderson-Darling 5% Critical Value	0.738	95% Hall's Bootstrap UCL 17040
Kolmogorov-Smirnov Test Statistic	0.248	95% Percentile Bootstrap UCL 16446
Kolmogorov-Smirnov 5% Critical Value	0.238	95% BCA Bootstrap UCL 16623
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 22177
		97.5% Chebyshev(Mean, Sd) UCL 26161
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 33987
95% Approximate Gamma UCL (Use when n >= 40)	17498	
95% Adjusted Gamma UCL (Use when n < 40)	18279	
Potential UCL to Use		Use 95% Approximate Gamma UCL 17498

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)

and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

ATTACHMENT 3

ENDANGERED, THREATENED OR STATE LISTED SPECIES REVIEW

(Provided on CD ROM)

Attachment 3 – Supporting Information for Baseline Ecological Risk Assessment – Endangered, Threatened or State Listed Species Review

List of Sections

Section 1 USFWS Information Planning and Conservation System

Section 2 MassDEP Natural Heritage and Endangered Species Program Interactive Priority and Estimated Habitats Online Viewer

USFWS Information Planning and Conservation System

U.S. Fish and Wildlife Service

Natural Resources of Concern

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

NEW ENGLAND ECOLOGICAL SERVICES FIELD OFFICE
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 03301
(603) 223-2541
http://www.fws.gov/newengland

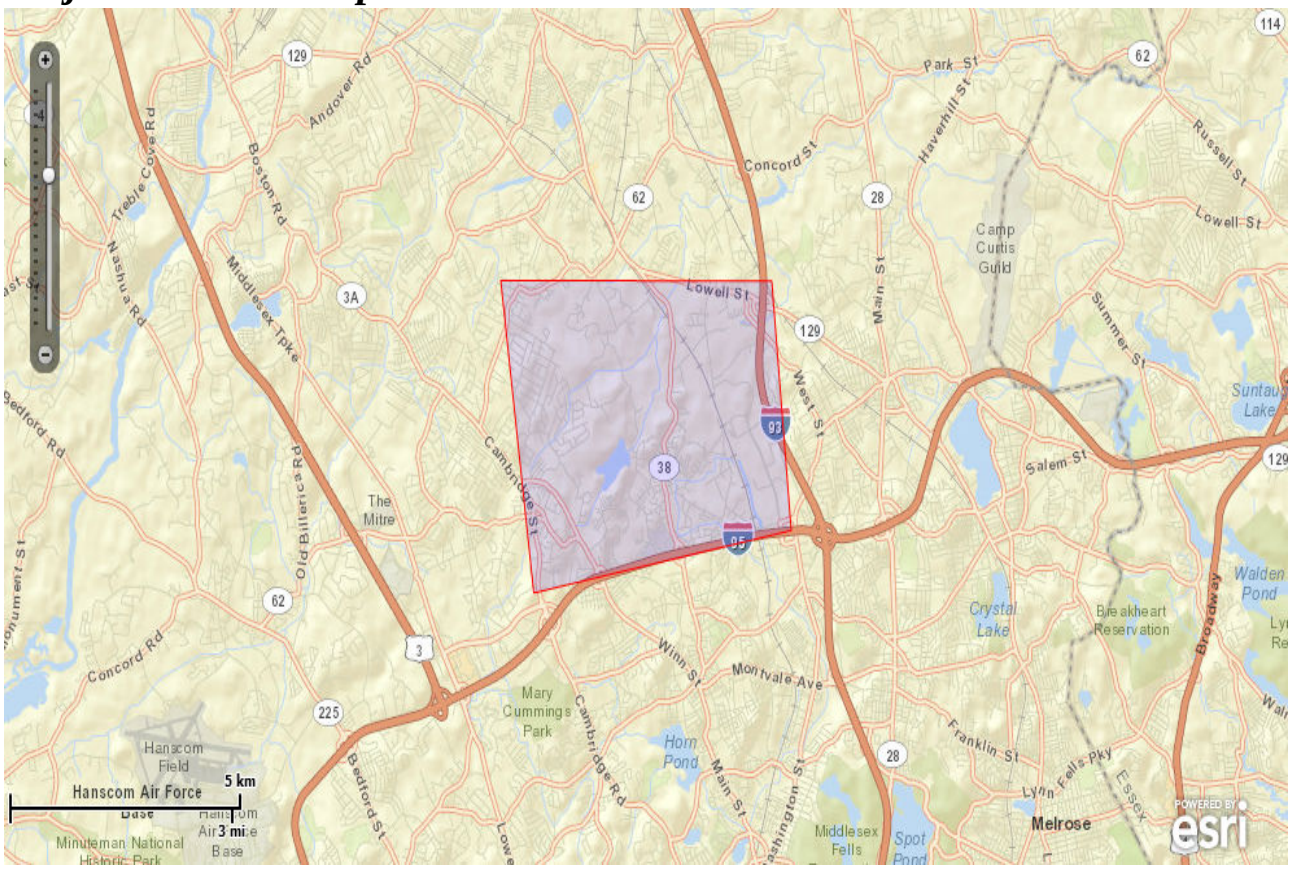
Project Name:

Olin

U.S. Fish and Wildlife Service

Natural Resources of Concern

Project Location Map:



Project Counties:

Middlesex, MA

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-71.2042922 42.5408452, -71.1325377 42.5407188, -71.1273965 42.5028899, -71.1955374 42.4933975, -71.2042922 42.5408452)))

Project Type:

Superfund Site Remediation

U.S. Fish and Wildlife Service

Natural Resources of Concern

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

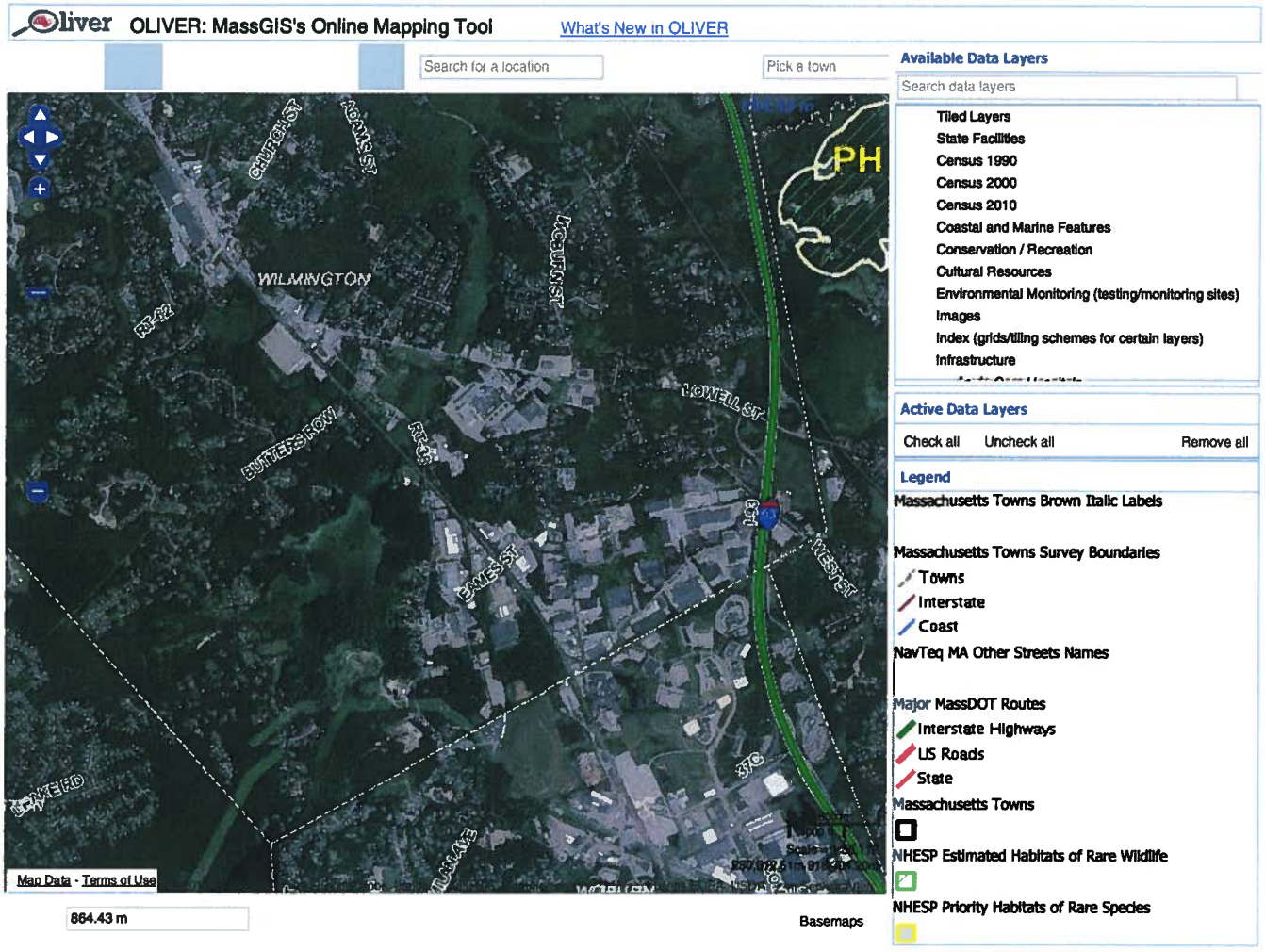
FWS Migratory Birds (USFWS Migratory Bird Program).

Most species of birds, including eagles and other raptors, are protected under the Migratory Bird Treaty Act (16 U.S.C. 703). Bald eagles and golden eagles receive additional protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668). The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

MassDEP Natural Heritage and Endangered Species Program Interactive Priority and Estimated Habitats Online Viewer


OLIVER: MassGIS's Online Mapping Tool
What's New in OLIVER
Search for a location
Pick a town
Available Data Layers
Search data layers
Tiled Layers
State Facilities
Census 1990
Census 2000
Census 2010
Coastal and Marine Features
Conservation / Recreation
Cultural Resources
Environmental Monitoring (testing/monitoring sites)
Images
Index (grids/tiling schemes for certain layers)
Infrastructure
Active Data Layers
Check all
Uncheck all
Remove all
Legend
Massachusetts Towns Brown Italic Labels
Massachusetts Towns Survey Boundaries
Towns
Interstate
Coast
NavTeq MA Other Streets Names
Major MassDOT Routes
Interstate Highways
US Roads
State
Massachusetts Towns
NHESP Estimated Habitats of Rare Wildlife
NHESP Priority Habitats of Rare Species
WILMINGTON
CHURCH ST
ADAMS ST
MCBURN ST
LOWELL ST
BUTTERS ROW
EAMES ST
WEST ST
PH
Map Data - Terms of Use
864.43 m
Basemaps

ATTACHMENT 4

ECOSAR SCREENING BENCHMARK CALCULATIONS

(Provided on CD ROM)

Attachment 4 – Supporting Information for Baseline Ecological Risk Assessment – Screening Benchmark Calculations

List of Sections

Section 1 ECOSAR Database Outputs

Section 2 ECOSAR Soil Screening Benchmark Calculations

Section 3 ECOSAR Surface Water Screening Benchmark Calculations

ECOSAR Database Outputs

ECOSAR Version 1.11 Results Page

SMILES : O=C
CHEM : Formaldehyde
CAS Num: 000050-00-0
ChemID1:
MOL FOR: C1 H2 O1
MOL WT : 30.03
Log Kow: 0.350 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 0.35 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -92.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 5.498E+004 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 4E+005 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 0.350 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 4E+005 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000050-00-0	Fish	96-hr	LC50	24.1	Aldehydes (Mono)	DUL

ECOSAR v1.1 Class-specific Estimations

Aldehydes (Mono)

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)	
Aldehydes (Mono)	: Fish	96-hr	LC50	12.544	
Aldehydes (Mono)	: Daphnid	48-hr	LC50	46.086	
Aldehydes (Mono)	: Green Algae	96-hr	EC50	48.403	
Aldehydes (Mono)	: Fish		ChV	3.636	
Aldehydes (Mono)	: Daphnid		ChV	4.923	!
Aldehydes (Mono)	: Green Algae		ChV	12.182	
Aldehydes (Mono)	: Fish (SW)	96-hr	LC50	17.899	
Aldehydes (Mono)	: Fish (SW)		ChV	1.652	!
Neutral Organic SAR	: Fish	96-hr	LC50	748.117	
(Baseline Toxicity)	: Daphnid	48-hr	LC50	364.758	
	: Green Algae	96-hr	EC50	144.722	
	: Fish		ChV	61.098	
	: Daphnid		ChV	23.279	

: Green Algae ChV 26.995

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

NOTE: ! = exclamation designates: The toxicity value was estimated through application of acute-to-chronic ratios per methods outlined in the ECOSAR Methodology Document provided in the ECOSAR Help Menu.

Class Specific LogKow Cut-Offs

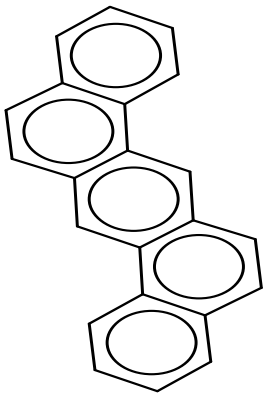
If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Aldehydes (Mono):

Maximum LogKow: 5.0 (LC50)
Maximum LogKow: 6.4 (EC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(c(c(c(c1)ccc2)c2)cc(c3c(c(c4)ccc5)c5)c4)(c1)c3
CHEM : Dibenz(a,h)anthracene
CAS Num: 000053-70-3
ChemID1:
MOL FOR: C22 H14
MOL WT : 278.36
Log Kow: 6.697 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 6.54 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 269.50 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.0005442 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.00103 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.697 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.00103 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	0.014 *
Neutral Organics	Daphnid	48-hr	LC50	0.012 *
Neutral Organics	Green Algae	96-hr	EC50	0.054 *
Neutral Organics	Fish		ChV	0.002 *
Neutral Organics	Daphnid		ChV	0.004 *
Neutral Organics	Green Algae		ChV	0.037 *
Neutral Organics	Fish (SW)	96-hr	LC50	0.018 *
Neutral Organics	Mysid	96-hr	LC50	0.000552
Neutral Organics	Fish (SW)		ChV	0.034 *
Neutral Organics	Mysid (SW)		ChV	1.19e-005
Neutral Organics	Earthworm	14-day	LC50	157.660 *

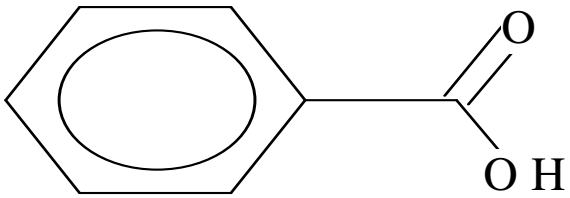
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O=C(O)c(cccc1)c1
CHEM   : Benzoic acid
CAS Num: 000065-85-0
ChemID1:
MOL FOR: C7 H6 O2
MOL WT : 122.12
Log Kow: 1.874 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 1.87 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 122.40 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 4009 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 3400 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 1.874 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 3400 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

****
| Not Related to an Existing ECOSAR Class Definition |
| |
| Estimates provided below use the Neutral Organics QSAR equations which |
| represent baseline toxicity potential (minimum toxicity) assuming a simple |
| non-polar narcosis model. Without empirical data on structurally similar |
| chemicals, it is uncertain if this substance will present significantly |
| higher toxicity above baseline estimates. |
****

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
--> Acid moeity found: Predicted values multiplied by 10				
Neutral Organics-acid	: Fish	96-hr	LC50	1300.781
Neutral Organics-acid	: Daphnid	48-hr	LC50	730.075
Neutral Organics-acid	: Green Algae	96-hr	EC50	518.374
Neutral Organics-acid	: Fish		ChV	125.419
Neutral Organics-acid	: Daphnid		ChV	68.937
Neutral Organics-acid	: Green Algae		ChV	132.290

Neutral Organics-acid	: Fish (SW)	96-hr	LC50	1636.355
Neutral Organics-acid	: Mysid	96-hr	LC50	1324.125
Neutral Organics-acid	: Fish (SW)		ChV	164.501
Neutral Organics-acid	: Mysid (SW)		ChV	118.794
Neutral Organics-acid	: Earthworm	14-day	LC50	2187.900

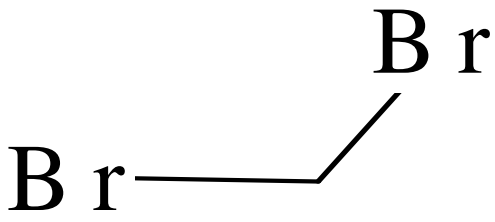
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : BrCBr
CHEM : Methane, dibromo-
CAS Num: 000074-95-3
ChemID1:
MOL FOR: C1 H2 Br2
MOL WT : 173.84
Log Kow: 1.520 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 1.70 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -52.50 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 5692 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 1.19E+004 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 1.520 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 1.19E+004 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	385.722
Neutral Organics	Daphnid	48-hr	LC50	209.511
Neutral Organics	Green Algae	96-hr	EC50	129.909
Neutral Organics	Fish		ChV	35.781
Neutral Organics	Daphnid		ChV	18.059
Neutral Organics	Green Algae		ChV	30.820
Neutral Organics	Fish (SW)	96-hr	LC50	484.201
Neutral Organics	Mysid	96-hr	LC50	498.297
Neutral Organics	Fish (SW)		ChV	39.192
Neutral Organics	Mysid (SW)		ChV	49.663
Neutral Organics	Earthworm	14-day	LC50	338.973

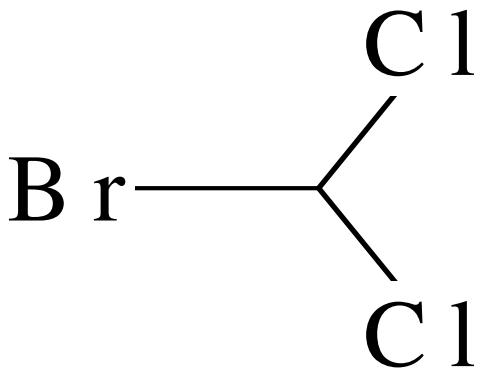
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : BrC(CL)CL
CHEM : Methane, bromodichloro-
CAS Num: 000075-27-4
ChemID1:
MOL FOR: C1 H1 Br1 CL2
MOL WT : 163.83
Log Kow: 1.610 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 2.00 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -57.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 2971 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 3030 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 1.610 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 3030 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	301.163
Neutral Organics	Daphnid	48-hr	LC50	164.961
Neutral Organics	Green Algae	96-hr	EC50	105.902
Neutral Organics	Fish		ChV	28.215
Neutral Organics	Daphnid		ChV	14.555
Neutral Organics	Green Algae		ChV	25.599
Neutral Organics	Fish (SW)	96-hr	LC50	378.258
Neutral Organics	Mysid	96-hr	LC50	365.998
Neutral Organics	Fish (SW)		ChV	32.366
Neutral Organics	Mysid (SW)		ChV	35.507
Neutral Organics	Earthworm	14-day	LC50	312.595

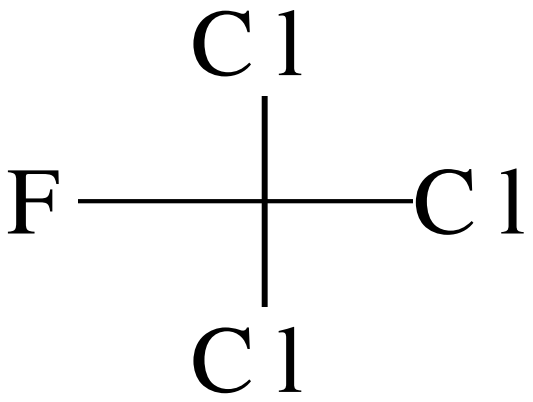
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : FC(CL)(CL)CL
CHEM : Methane, trichlorofluoro-
CAS Num: 000075-69-4
ChemID1:
MOL FOR: C1 CL3 F1
MOL WT : 137.37
Log Kow: 2.129 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 2.53 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -111.10 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 934.9 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 1100 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 2.129 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 1100 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	86.459
Neutral Organics	Daphnid	48-hr	LC50	49.679
Neutral Organics	Green Algae	96-hr	EC50	38.872
Neutral Organics	Fish		ChV	8.570
Neutral Organics	Daphnid		ChV	5.008
Neutral Organics	Green Algae		ChV	10.453
Neutral Organics	Fish (SW)	96-hr	LC50	108.930
Neutral Organics	Mysid	96-hr	LC50	74.191
Neutral Organics	Fish (SW)		ChV	12.791
Neutral Organics	Mysid (SW)		ChV	6.173
Neutral Organics	Earthworm	14-day	LC50	231.596

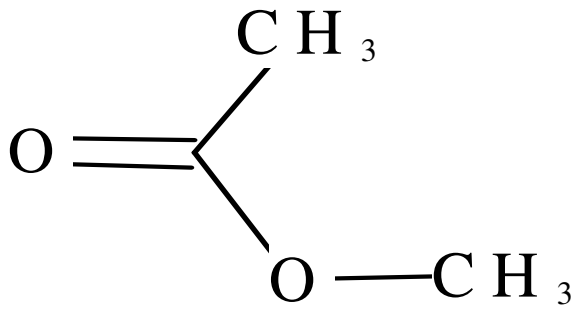
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O=C(OC)C
CHEM : Acetic acid, methyl ester
CAS Num: 000079-20-9
ChemID1:
MOL FOR: C3 H6 O2
MOL WT : 74.08
Log Kow: 0.373 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 0.18 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -98.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 1.436E+005 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 2.43E+005 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 0.373 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 2.43E+005 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000079-20-9	Fish		ChV	72.1	Esters	DUL
000079-20-9	Fish	96-hr	LC50	320	Esters	DUL
000079-20-9	Fish	96-hr	LC50	399	Esters	DUL

ECOSAR v1.1 Class-specific Estimations

Esters

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Esters	: Fish	96-hr	LC50	88.290
Esters	: Daphnid	48-hr	LC50	218.455
Esters	: Green Algae	96-hr	EC50	120.308
Esters	: Fish		ChV	9.345
Esters	: Daphnid		ChV	238.485
Esters	: Green Algae		ChV	18.184
Esters	: Fish (SW)	96-hr	LC50	148.384
Esters	: Mysid	96-hr	LC50	325.344
Esters	: Fish (SW)		ChV	15.869
Esters	: Mysid (SW)		ChV	6.59e+005 *
Esters	: Earthworm	14-day	LC50	3231.574

Neutral Organic SAR	: Fish	96-hr	LC50	1759.626
(Baseline Toxicity)	: Daphnid	48-hr	LC50	859.769
	: Green Algae	96-hr	EC50	344.145
	: Fish		ChV	144.068
	: Daphnid		ChV	55.198
	: Green Algae		ChV	64.500

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

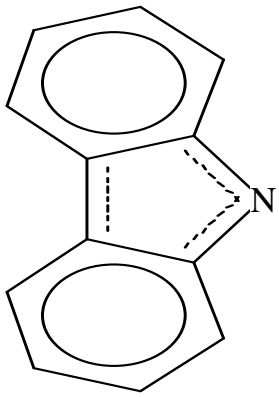
If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Esters:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : n(c(c(c1cccc2)ccc3)c3)c12
CHEM : 9H-Carbazole
CAS Num: 000086-74-8
ChemID1:
MOL FOR: C12 H9 N1
MOL WT : 167.21
Log Kow: 3.231 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.72 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 246.20 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.6095 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 1.8 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.231 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 1.8 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	10.777 *
Neutral Organics	Daphnid	48-hr	LC50	6.856 *
Neutral Organics	Green Algae	96-hr	EC50	8.170 *
Neutral Organics	Fish		ChV	1.204
Neutral Organics	Daphnid		ChV	0.917
Neutral Organics	Green Algae		ChV	2.756 *
Neutral Organics	Fish (SW)	96-hr	LC50	13.667 *
Neutral Organics	Mysid	96-hr	LC50	4.412 *
Neutral Organics	Fish (SW)		ChV	3.146 *
Neutral Organics	Mysid (SW)		ChV	0.265
Neutral Organics	Earthworm	14-day	LC50	216.687 *

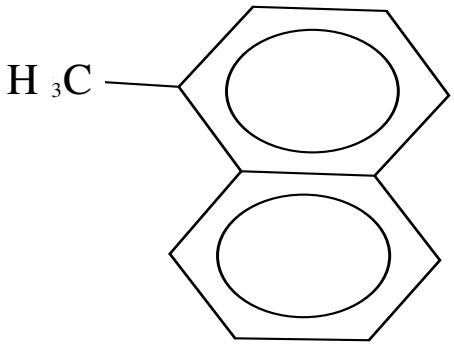
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(c(c(cc1)C)ccc2)(c2)c1
CHEM : Naphthalene, 1-methyl-
CAS Num: 000090-12-0
ChemID1:
MOL FOR: C11 H10
MOL WT : 142.20
Log Kow: 3.716 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.87 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -30.40 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 48.33 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 25 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.716 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 25 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	3.358
Neutral Organics	Daphnid	48-hr	LC50	2.234
Neutral Organics	Green Algae	96-hr	EC50	3.205
Neutral Organics	Fish		ChV	0.396
Neutral Organics	Daphnid		ChV	0.339
Neutral Organics	Green Algae		ChV	1.194
Neutral Organics	Fish (SW)	96-hr	LC50	4.271
Neutral Organics	Mysid	96-hr	LC50	0.992
Neutral Organics	Fish (SW)		ChV	1.322
Neutral Organics	Mysid (SW)		ChV	0.052
Neutral Organics	Earthworm	14-day	LC50	164.106 *

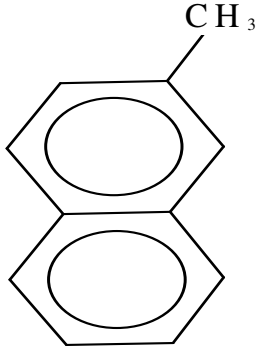
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(c(ccc1C)ccc2)(c2)c1
CHEM : Naphthalene, 2-methyl-
CAS Num: 000091-57-6
ChemID1:
MOL FOR: C11 H10
MOL WT : 142.20
Log Kow: 3.716 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.86 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 34.40 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 40.49 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 24.6 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.716 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 24.6 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	3.358
Neutral Organics	Daphnid	48-hr	LC50	2.234
Neutral Organics	Green Algae	96-hr	EC50	3.205
Neutral Organics	Fish		ChV	0.396
Neutral Organics	Daphnid		ChV	0.339
Neutral Organics	Green Algae		ChV	1.194
Neutral Organics	Fish (SW)	96-hr	LC50	4.271
Neutral Organics	Mysid	96-hr	LC50	0.992
Neutral Organics	Fish (SW)		ChV	1.322
Neutral Organics	Mysid (SW)		ChV	0.052
Neutral Organics	Earthworm	14-day	LC50	164.106 *

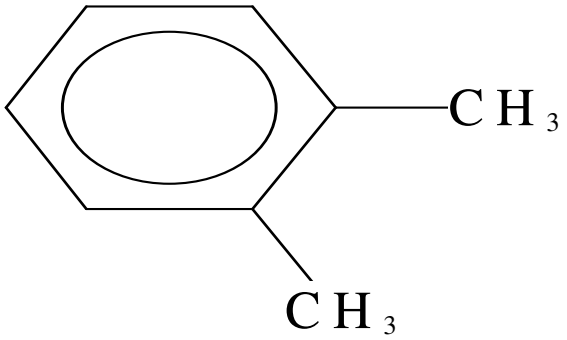
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(c(ccc1)C)(c1)C
CHEM : Benzene, 1,2-dimethyl-
CAS Num: 000095-47-6
ChemID1:
MOL FOR: C8 H10
MOL WT : 106.17
Log Kow: 3.088 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.16 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -25.20 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 224.9 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 106 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.088 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 106 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000095-47-6	Green Algae	96-hr	ChV	1.4	Neutral organics	Herman, 1990
000095-47-6	Green Algae	96-hr	EC50	4.2	Neutral organics	Herman, 1990
000095-47-6	Green Algae	96-hr	EC50	4.7	Neutral organics	Galassi, 1988
000095-47-6	Fish	96-hr	LC50	16.4	Neutral organics	DUL
000095-47-6	Fish	96-hr	LC50	16.4	Neutral organics	DUL
001330-20-7	Fish	96-hr	LC50	13.4	Neutral organics	DUL
001330-20-7	Fish	96-hr	LC50	15.7	Neutral organics	CAS-Bailey et a
001330-20-7	Fish	96-hr	LC50	24.5	Neutral organics	CAS-Bailey et a

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ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	9.201
Neutral Organics	: Daphnid	48-hr	LC50	5.776
Neutral Organics	: Green Algae	96-hr	EC50	6.517
Neutral Organics	: Fish		ChV	1.012
Neutral Organics	: Daphnid		ChV	0.745
Neutral Organics	: Green Algae		ChV	2.134
Neutral Organics	: Fish (SW)	96-hr	LC50	11.659
Neutral Organics	: Mysid	96-hr	LC50	4.147

Neutral Organics	: Fish (SW)		ChV	2.459
Neutral Organics	: Mysid (SW)		ChV	0.260
Neutral Organics	: Earthworm	14-day	LC50	142.368 *

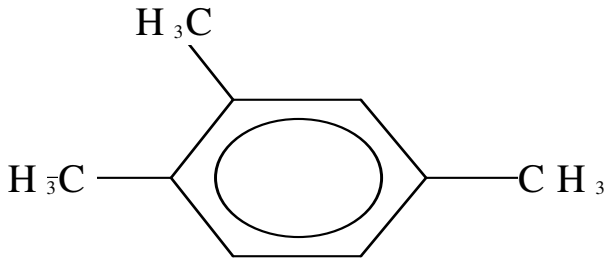
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(ccc(c1C)C)(c1)C
CHEM : Benzene, 1,2,4-trimethyl-
CAS Num: 000095-63-6
ChemID1:
MOL FOR: C9 H12
MOL WT : 120.20
Log Kow: 3.635 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.63 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -43.80 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 81.41 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 57 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.635 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 57 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000095-63-6	Fish	96-hr	LC50	7.7	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	3.359
Neutral Organics	: Daphnid	48-hr	LC50	2.218
Neutral Organics	: Green Algae	96-hr	EC50	3.084
Neutral Organics	: Fish		ChV	0.392
Neutral Organics	: Daphnid		ChV	0.329
Neutral Organics	: Green Algae		ChV	1.130
Neutral Organics	: Fish (SW)	96-hr	LC50	4.270
Neutral Organics	: Mysid	96-hr	LC50	1.048
Neutral Organics	: Fish (SW)		ChV	1.258
Neutral Organics	: Mysid (SW)		ChV	0.056
Neutral Organics	: Earthworm	14-day	LC50	141.433 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES)

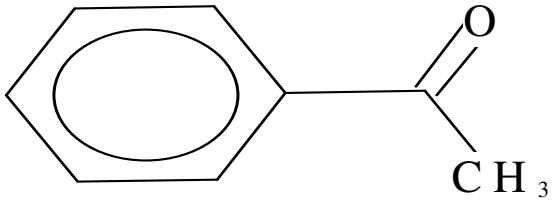
are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O=C(c(cccc1)c1)C
CHEM : Ethanone, 1-phenyl-
CAS Num: 000098-86-2
ChemID1:
MOL FOR: C8 H8 O1
MOL WT : 120.15
Log Kow: 1.674 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 1.58 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 20.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 7562 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 6130 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 1.674 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 6130 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000098-86-2	Fish	96-hr	LC50	162	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	193.853
Neutral Organics	: Daphnid	48-hr	LC50	106.803
Neutral Organics	: Green Algae	96-hr	EC50	70.237
Neutral Organics	: Fish		ChV	18.287
Neutral Organics	: Daphnid		ChV	9.578
Neutral Organics	: Green Algae		ChV	17.200
Neutral Organics	: Fish (SW)	96-hr	LC50	243.570
Neutral Organics	: Mysid	96-hr	LC50	225.813
Neutral Organics	: Fish (SW)		ChV	21.660
Neutral Organics	: Mysid (SW)		ChV	21.501
Neutral Organics	: Earthworm	14-day	LC50	225.829

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES)

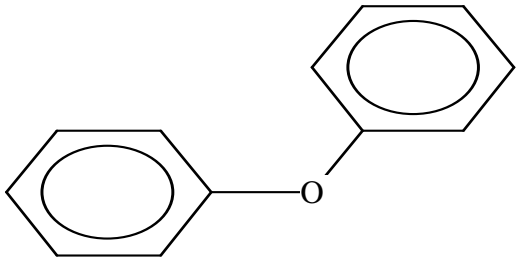
are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O(c(cccc1)c1)c(cccc2)c2
CHEM : Benzene, 1,1'-oxybis-
CAS Num: 000101-84-8
ChemID1:
MOL FOR: C12 H10 O1
MOL WT : 170.21
Log Kow: 4.049 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 4.21 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 26.80 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 21.45 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 18 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.049 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 18 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000101-84-8	Fish (SW)	96-hr	LC50	2.3	Neutral organics	Zaroogian et al
000101-84-8	Fish	96-hr	LC50	4	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	2.019
Neutral Organics	: Daphnid	48-hr	LC50	1.385
Neutral Organics	: Green Algae	96-hr	EC50	2.256
Neutral Organics	: Fish		ChV	0.247
Neutral Organics	: Daphnid		ChV	0.229
Neutral Organics	: Green Algae		ChV	0.900
Neutral Organics	: Fish (SW)	96-hr	LC50	2.573
Neutral Organics	: Mysid	96-hr	LC50	0.477
Neutral Organics	: Fish (SW)		ChV	0.976
Neutral Organics	: Mysid (SW)		ChV	0.022
Neutral Organics	: Earthworm	14-day	LC50	181.418 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the

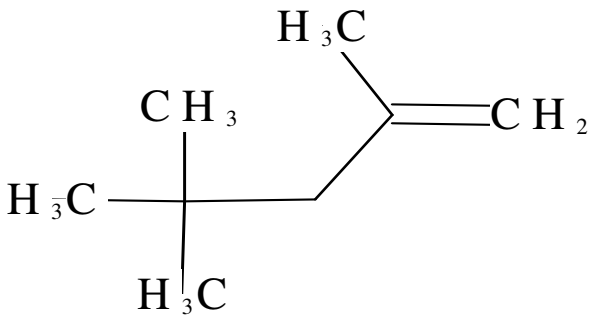
water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : C(=C)(CC(C)(C)C)C
CHEM : 1-Pentene, 2,4,4-trimethyl-
CAS Num: 000107-39-1
ChemID1:
MOL FOR: C8 H16
MOL WT : 112.22
Log Kow: 4.079 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 4.55 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -93.50 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 3.817 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.079 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 3.817 (mg/L, EPISuite WSKowwin v1.43 Estimate)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	1.252
Neutral Organics	Daphnid	48-hr	LC50	0.861
Neutral Organics	Green Algae	96-hr	EC50	1.419
Neutral Organics	Fish		ChV	0.153
Neutral Organics	Daphnid		ChV	0.143
Neutral Organics	Green Algae		ChV	0.570
Neutral Organics	Fish (SW)	96-hr	LC50	1.596
Neutral Organics	Mysid	96-hr	LC50	0.290
Neutral Organics	Fish (SW)		ChV	0.616
Neutral Organics	Mysid (SW)		ChV	0.014
Neutral Organics	Earthworm	14-day	LC50	118.762 *

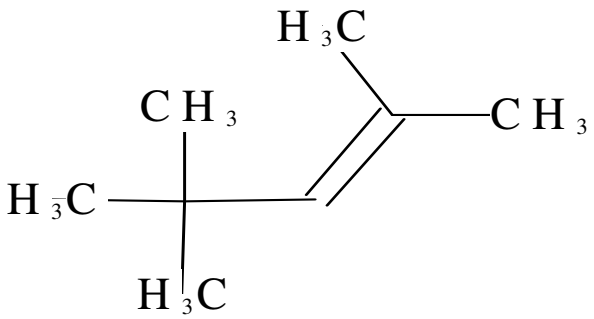
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : C(=CC(C)(C)C)(C)C
CHEM : 2-Pentene, 2,4,4-trimethyl-
CAS Num: 000107-40-4
ChemID1:
MOL FOR: C8 H16
MOL WT : 112.22
Log Kow: 4.000 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -106.30 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 12.86 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.000 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 12.86 (mg/L, EPISuite WSKowwin v1.43 Estimate)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	1.473
Neutral Organics	Daphnid	48-hr	LC50	1.006
Neutral Organics	Green Algae	96-hr	EC50	1.608
Neutral Organics	Fish		ChV	0.179
Neutral Organics	Daphnid		ChV	0.164
Neutral Organics	Green Algae		ChV	0.635
Neutral Organics	Fish (SW)	96-hr	LC50	1.877
Neutral Organics	Mysid	96-hr	LC50	0.360
Neutral Organics	Fish (SW)		ChV	0.691
Neutral Organics	Mysid (SW)		ChV	0.017
Neutral Organics	Earthworm	14-day	LC50	121.012 *

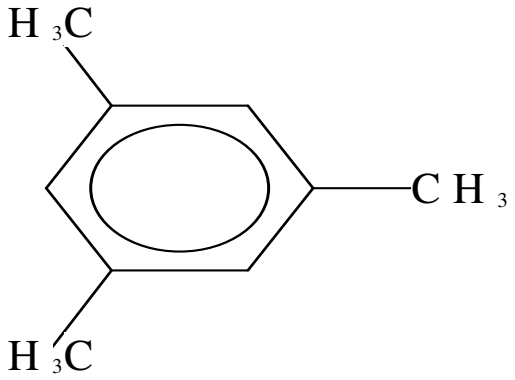
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(cc(cc1C)C)(c1)C
CHEM : Benzene, 1,3,5-trimethyl-
CAS Num: 000108-67-8
ChemID1:
MOL FOR: C9 H12
MOL WT : 120.20
Log Kow: 3.635 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.42 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -44.70 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 129.5 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 75 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.635 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 75 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	3.359
Neutral Organics	Daphnid	48-hr	LC50	2.218
Neutral Organics	Green Algae	96-hr	EC50	3.084
Neutral Organics	Fish		ChV	0.392
Neutral Organics	Daphnid		ChV	0.329
Neutral Organics	Green Algae		ChV	1.130
Neutral Organics	Fish (SW)	96-hr	LC50	4.270
Neutral Organics	Mysid	96-hr	LC50	1.048
Neutral Organics	Fish (SW)		ChV	1.258
Neutral Organics	Mysid (SW)		ChV	0.056
Neutral Organics	Earthworm	14-day	LC50	141.433 *

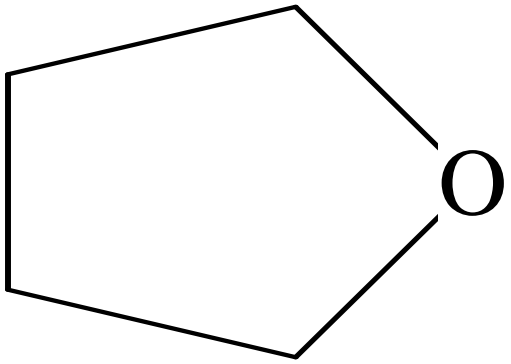
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O(CCC1)C1
CHEM : Furan, tetrahydro-
CAS Num: 000109-99-9
ChemID1:
MOL FOR: C4 H8 O1
MOL WT : 72.11
Log Kow: 0.937 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 0.46 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -108.44 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 7.638E+004 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 1E+006 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 0.937 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 1E+006 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000109-99-9	Fish		ChV	513	Neutral organics	DUL
000109-99-9	Fish	96-hr	LC50	2160	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	533.878
Neutral Organics	: Daphnid	48-hr	LC50	274.794
Neutral Organics	: Green Algae	96-hr	EC50	136.405
Neutral Organics	: Fish		ChV	46.479
Neutral Organics	: Daphnid		ChV	20.392
Neutral Organics	: Green Algae		ChV	28.707
Neutral Organics	: Fish (SW)	96-hr	LC50	667.848
Neutral Organics	: Mysid	96-hr	LC50	1019.932
Neutral Organics	: Fish (SW)		ChV	37.872
Neutral Organics	: Mysid (SW)		ChV	120.811
Neutral Organics	: Earthworm	14-day	LC50	161.598

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the

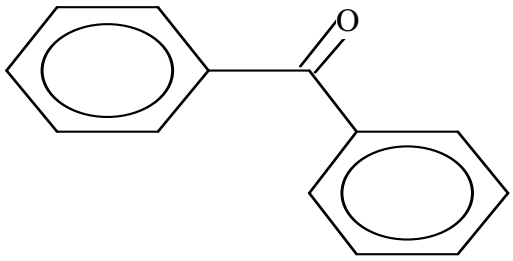
water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O=C(c(cccc1)c1)c(cccc2)c2
CHEM : Methanone, diphenyl-
CAS Num: 000119-61-9
ChemID1:
MOL FOR: C13 H10 O1
MOL WT : 182.22
Log Kow: 3.147 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.18 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 48.50 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 129.5 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 137 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.147 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 137 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000119-61-9	Fish		ChV	1.3	Neutral organics	DUL
000119-61-9	Fish	96-hr	LC50	14.2	Neutral organics	DUL
000119-61-9	Fish	96-hr	LC50	15.3	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	13.964
Neutral Organics	: Daphnid	48-hr	LC50	8.814
Neutral Organics	: Green Algae	96-hr	EC50	10.174
Neutral Organics	: Fish		ChV	1.547
Neutral Organics	: Daphnid		ChV	1.154
Neutral Organics	: Green Algae		ChV	3.373
Neutral Organics	: Fish (SW)	96-hr	LC50	17.700
Neutral Organics	: Mysid	96-hr	LC50	6.048
Neutral Organics	: Fish (SW)		ChV	3.871
Neutral Organics	: Mysid (SW)		ChV	0.372
Neutral Organics	: Earthworm	14-day	LC50	240.908 *

Note: * = asterisk designates: Chemical may not be soluble enough to

measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)

ECOSAR Version 1.11 Results Page

SMILES : N(c(cccc1)c1)c(cccc2)c2
CHEM : Benzenamine, N-phenyl-
CAS Num: 000122-39-4
ChemID1:
MOL FOR: C12 H11 N1
MOL WT : 169.23
Log Kow: 3.291 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.50 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 52.90 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 59.35 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 53 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.291 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 53 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000122-39-4	Daphnid	48-hr	LC50	1.2	Neutral organics	Datasheet
000122-39-4	Fish	96-hr	LC50	2.2	Neutral organics	Datasheet
000122-39-4	Fish	96-hr	LC50	3.7	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	9.624
Neutral Organics	: Daphnid	48-hr	LC50	6.157
Neutral Organics	: Green Algae	96-hr	EC50	7.508
Neutral Organics	: Fish		ChV	1.083
Neutral Organics	: Daphnid		ChV	0.837
Neutral Organics	: Green Algae		ChV	2.564
Neutral Organics	: Fish (SW)	96-hr	LC50	12.210
Neutral Organics	: Mysid	96-hr	LC50	3.784
Neutral Organics	: Fish (SW)		ChV	2.916
Neutral Organics	: Mysid (SW)		ChV	0.223
Neutral Organics	: Earthworm	14-day	LC50	216.154 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

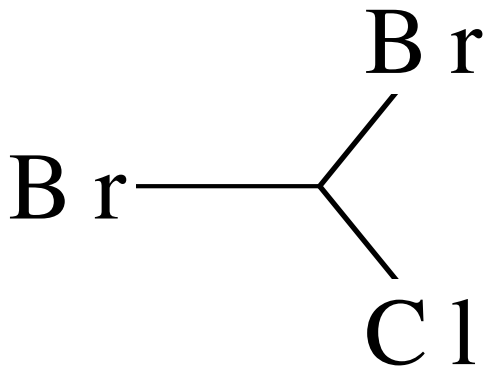
Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)

Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : BrC(Br)CL
CHEM : Methane, dibromochloro-
CAS Num: 000124-48-1
ChemID1:
MOL FOR: C1 H1 Br2 CL1
MOL WT : 208.28
Log Kow: 1.700 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 2.16 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -20.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 1923 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 2700 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 1.700 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 2700 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	318.184
Neutral Organics	Daphnid	48-hr	LC50	175.731
Neutral Organics	Green Algae	96-hr	EC50	116.737
Neutral Organics	Fish		ChV	30.101
Neutral Organics	Daphnid		ChV	15.866
Neutral Organics	Green Algae		ChV	28.742
Neutral Organics	Fish (SW)	96-hr	LC50	399.851
Neutral Organics	Mysid	96-hr	LC50	364.131
Neutral Organics	Fish (SW)		ChV	36.136
Neutral Organics	Mysid (SW)		ChV	34.401
Neutral Organics	Earthworm	14-day	LC50	389.007

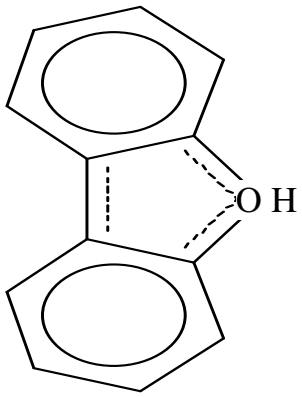
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : o(c(c(c1cccc2)ccc3)c3)c12
CHEM : Dibenzofuran
CAS Num: 000132-64-9
ChemID1:
MOL FOR: C12 H8 O1
MOL WT : 168.20
Log Kow: 3.715 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 4.12 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 86.50 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 7.408 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 3.1 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.715 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 3.1 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000132-64-9	Fish	96-hr	LC50	1.7	Neutral organics	DUL
000132-64-9	Fish (SW)	96-hr	LC50	1.7	Neutral organics	Zaroogian et al
000132-64-9	Fish	96-hr	LC50	1.8	Neutral organics	DUL

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	3.985 *
Neutral Organics	: Daphnid	48-hr	LC50	2.651
Neutral Organics	: Green Algae	96-hr	EC50	3.800 *
Neutral Organics	: Fish		ChV	0.470
Neutral Organics	: Daphnid		ChV	0.402
Neutral Organics	: Green Algae		ChV	1.416
Neutral Organics	: Fish (SW)	96-hr	LC50	5.069 *
Neutral Organics	: Mysid	96-hr	LC50	1.179
Neutral Organics	: Fish (SW)		ChV	1.568
Neutral Organics	: Mysid (SW)		ChV	0.061
Neutral Organics	: Earthworm	14-day	LC50	194.179 *

Note: * = asterisk designates: Chemical may not be soluble enough to

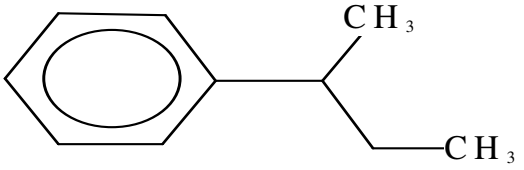
measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(cccc1)(c1)C(CC)C
CHEM : Benzene, (1-methylpropyl)-
CAS Num: 000135-98-8
ChemID1:
MOL FOR: C10 H14
MOL WT : 134.22
Log Kow: 3.940 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 4.57 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -82.70 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 10.28 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 17.6 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.940 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 17.6 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	1.995
Neutral Organics	: Daphnid	48-hr	LC50	1.355
Neutral Organics	: Green Algae	96-hr	EC50	2.117
Neutral Organics	: Fish		ChV	0.241
Neutral Organics	: Daphnid		ChV	0.218
Neutral Organics	: Green Algae		ChV	0.826
Neutral Organics	: Fish (SW)	96-hr	LC50	2.541
Neutral Organics	: Mysid	96-hr	LC50	0.507
Neutral Organics	: Fish (SW)		ChV	0.902
Neutral Organics	: Mysid (SW)		ChV	0.025
Neutral Organics	: Earthworm	14-day	LC50	146.838 *

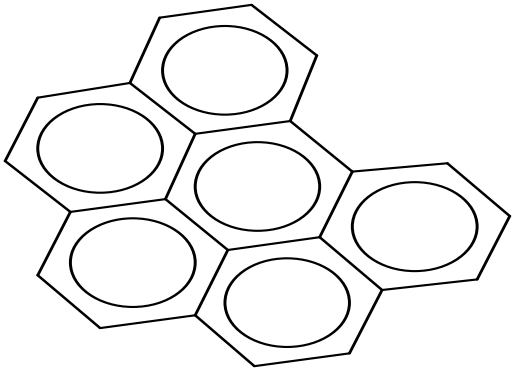
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c16cccc2ccc3ccc4ccc5cccc6c5c4c3c12
CHEM : Benzo(ghi)perylene
CAS Num: 000191-24-2
ChemID1:
MOL FOR: C22 H12
MOL WT : 276.34
Log Kow: 6.697 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 6.63 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 278.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.0003753 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.00026 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.697 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.00026 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	0.014 *
Neutral Organics	Daphnid	48-hr	LC50	0.012 *
Neutral Organics	Green Algae	96-hr	EC50	0.054 *
Neutral Organics	Fish		ChV	0.002 *
Neutral Organics	Daphnid		ChV	0.004 *
Neutral Organics	Green Algae		ChV	0.037 *
Neutral Organics	Fish (SW)	96-hr	LC50	0.018 *
Neutral Organics	Mysid	96-hr	LC50	0.000548 *
Neutral Organics	Fish (SW)		ChV	0.034 *
Neutral Organics	Mysid (SW)		ChV	1.18e-005
Neutral Organics	Earthworm	14-day	LC50	156.518 *

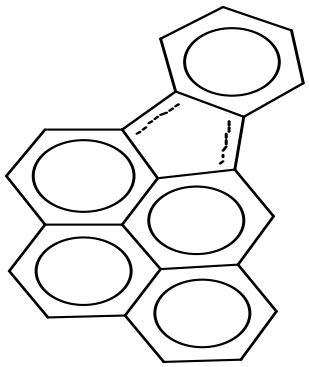
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c(c(c(c(ccc1)c2)c1cc3)c3cc4)(c2c(c5ccc6)c6)c45
CHEM : Indeno 1,2,3-cd pyrene
CAS Num: 000193-39-5
ChemID1:
MOL FOR: C22 H12
MOL WT : 276.34
Log Kow: 6.697 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 163.60 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.003652 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.00019 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.697 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.00019 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	0.014 *
Neutral Organics	Daphnid	48-hr	LC50	0.012 *
Neutral Organics	Green Algae	96-hr	EC50	0.054 *
Neutral Organics	Fish		ChV	0.002 *
Neutral Organics	Daphnid		ChV	0.004 *
Neutral Organics	Green Algae		ChV	0.037 *
Neutral Organics	Fish (SW)	96-hr	LC50	0.018 *
Neutral Organics	Mysid	96-hr	LC50	0.000548 *
Neutral Organics	Fish (SW)		ChV	0.034 *
Neutral Organics	Mysid (SW)		ChV	1.18e-005
Neutral Organics	Earthworm	14-day	LC50	156.518 *

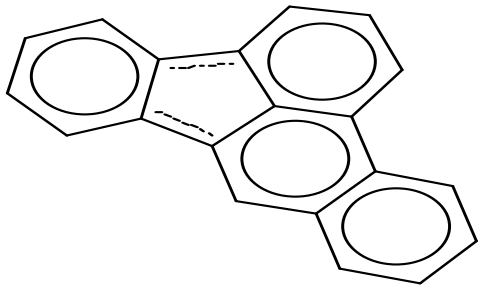
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c12ccccc1cc3c4ccccc4c5c3c2ccc5
CHEM : Benzo(b)fluoranthene
CAS Num: 000205-99-2
ChemID1:
MOL FOR: C20 H12
MOL WT : 252.32
Log Kow: 6.109 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 5.78 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 168.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.02743 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.0015 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.109 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.0015 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	0.042 *
Neutral Organics	Daphnid	48-hr	LC50	0.035 *
Neutral Organics	Green Algae	96-hr	EC50	0.125 *
Neutral Organics	Fish		ChV	0.006 *
Neutral Organics	Daphnid		ChV	0.010 *
Neutral Organics	Green Algae		ChV	0.076 *
Neutral Organics	Fish (SW)	96-hr	LC50	0.055 *
Neutral Organics	Mysid	96-hr	LC50	0.003 *
Neutral Organics	Fish (SW)		ChV	0.073 *
Neutral Organics	Mysid (SW)		ChV	6.41e-005
Neutral Organics	Earthworm	14-day	LC50	164.454 *

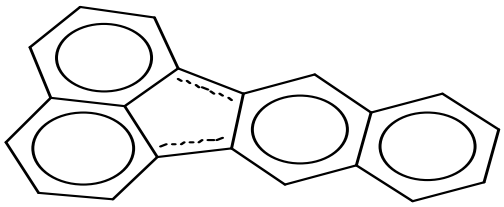
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c2ccc1cc3c(cc1c2)c4cccc5cccc3c45
CHEM : Benzo(k)fluoranthene
CAS Num: 000207-08-9
ChemID1:
MOL FOR: C20 H12
MOL WT : 252.32
Log Kow: 6.109 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 6.11 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 217.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.004685 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.0008 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.109 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.0008 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	0.042 *
Neutral Organics	Daphnid	48-hr	LC50	0.035 *
Neutral Organics	Green Algae	96-hr	EC50	0.125 *
Neutral Organics	Fish		ChV	0.006 *
Neutral Organics	Daphnid		ChV	0.010 *
Neutral Organics	Green Algae		ChV	0.076 *
Neutral Organics	Fish (SW)	96-hr	LC50	0.055 *
Neutral Organics	Mysid	96-hr	LC50	0.003 *
Neutral Organics	Fish (SW)		ChV	0.073 *
Neutral Organics	Mysid (SW)		ChV	6.41e-005
Neutral Organics	Earthworm	14-day	LC50	164.454 *

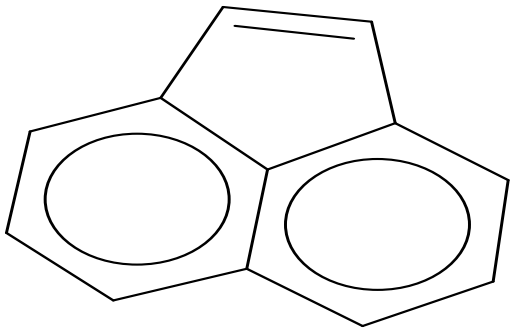
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c1ccc2cccc3c2c1C=C3
CHEM : Acenaphthylene
CAS Num: 000208-96-8
ChemID1:
MOL FOR: C12 H8
MOL WT : 152.20
Log Kow: 3.936 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.94 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 92.50 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 9.865 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 16.1 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.936 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 16.1 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	2.281
Neutral Organics	Daphnid	48-hr	LC50	1.549
Neutral Organics	Green Algae	96-hr	EC50	2.416
Neutral Organics	Fish		ChV	0.275
Neutral Organics	Daphnid		ChV	0.248
Neutral Organics	Green Algae		ChV	0.942
Neutral Organics	Fish (SW)	96-hr	LC50	2.905
Neutral Organics	Mysid	96-hr	LC50	0.582
Neutral Organics	Fish (SW)		ChV	1.029
Neutral Organics	Mysid (SW)		ChV	0.028
Neutral Organics	Earthworm	14-day	LC50	166.657 *

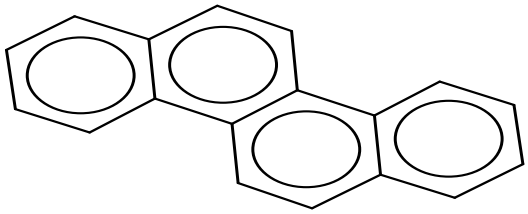
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : c1ccc2ccc3c4ccccc4ccc3c2c1
CHEM : Chrysene
CAS Num: 000218-01-9
ChemID1:
MOL FOR: C18 H12
MOL WT : 228.30
Log Kow: 5.521 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 5.81 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 68.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.2299 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.002 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 5.521 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.002 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000218-01-9	Fish	96-hr	LC50	0.06	Neutral organics	CAS - ETFS

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	0.129 *
Neutral Organics	: Daphnid	48-hr	LC50	0.101 *
Neutral Organics	: Green Algae	96-hr	EC50	0.290 *
Neutral Organics	: Fish		ChV	0.019 *
Neutral Organics	: Daphnid		ChV	0.024 *
Neutral Organics	: Green Algae		ChV	0.157 *
Neutral Organics	: Fish (SW)	96-hr	LC50	0.166 *
Neutral Organics	: Mysid	96-hr	LC50	0.011 *
Neutral Organics	: Fish (SW)		ChV	0.155 *
Neutral Organics	: Mysid (SW)		ChV	0.000346
Neutral Organics	: Earthworm	14-day	LC50	171.226 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES)

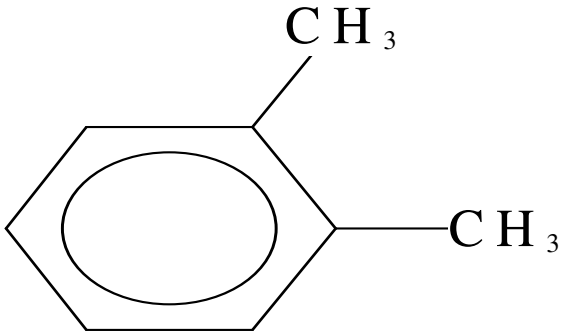
are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : Cc1ccccc1C
CHEM : Benzene, dimethyl-
CAS Num: 001330-20-7
ChemID1:
MOL FOR: C8 H10
MOL WT : 106.17
Log Kow: 3.088 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 3.16 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: -25.20 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 224.9 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 106 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 3.088 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 106 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000095-47-6	Green Algae	96-hr	ChV	1.4	Neutral organics	Herman, 1990
000095-47-6	Green Algae	96-hr	EC50	4.2	Neutral organics	Herman, 1990
000095-47-6	Green Algae	96-hr	EC50	4.7	Neutral organics	Galassi, 1988
000095-47-6	Fish	96-hr	LC50	16.4	Neutral organics	DUL
000095-47-6	Fish	96-hr	LC50	16.4	Neutral organics	DUL
001330-20-7	Fish	96-hr	LC50	13.4	Neutral organics	DUL
001330-20-7	Fish	96-hr	LC50	15.7	Neutral organics	CAS-Bailey et a
001330-20-7	Fish	96-hr	LC50	24.5	Neutral organics	CAS-Bailey et a

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ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	9.201
Neutral Organics	: Daphnid	48-hr	LC50	5.776
Neutral Organics	: Green Algae	96-hr	EC50	6.517
Neutral Organics	: Fish		ChV	1.012
Neutral Organics	: Daphnid		ChV	0.745
Neutral Organics	: Green Algae		ChV	2.134
Neutral Organics	: Fish (SW)	96-hr	LC50	11.659
Neutral Organics	: Mysid	96-hr	LC50	4.147

Neutral Organics	: Fish (SW)		ChV	2.459
Neutral Organics	: Mysid (SW)		ChV	0.260
Neutral Organics	: Earthworm	14-day	LC50	142.368 *

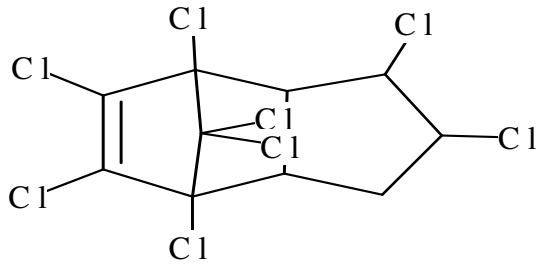
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : CLC1CC2C(C1CL)C3(CL)C(=C(CL)C2(CL)C3(CL)CL)CL
CHEM : cis-Chlordane (alpha-)
CAS Num: 005103-71-9
ChemID1:
MOL FOR: C10 H6 CL8
MOL WT : 409.78
Log Kow: 6.260 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 106.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.01837 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.056 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.260 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.056 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000057-74-9	Fish (SW)		ChV	0.00063	Vinyl/allyl halides	ETFS
000057-74-9	Fish		ChV	0.0016	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.003	Vinyl/allyl halides	ETFS
000057-74-9	Mysid	96-hr	LC50	0.005	Vinyl/allyl halides	WQC
000057-74-9	Fish (SW)	96-hr	LC50	0.01	Vinyl/allyl halides	ETFS
000057-74-9	Daphnid		ChV	0.01	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.025	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.037	Vinyl/allyl halides	ETFS
000057-74-9	Daphnid	48-hr	LC50	0.05	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.059	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.082	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.19	Vinyl/allyl halides	ETFS

ECOSAR v1.1 Class-specific Estimations

Vinyl/Allyl Halides

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Vinyl/Allyl Halides	: Fish	96-hr	LC50	0.011
Vinyl/Allyl Halides	: Daphnid	48-hr	LC50	0.012
Vinyl/Allyl Halides	: Green Algae	96-hr	EC50	0.056 *
Vinyl/Allyl Halides	: Fish		ChV	0.000255

Vinyl/Allyl Halides	: Daphnid		ChV	0.016
Vinyl/Allyl Halides	: Green Algae		ChV	0.084 *!
Vinyl/Allyl Halides	: Fish (SW)	96-hr	LC50	0.003
Vinyl/Allyl Halides	: Mysid (SW)	96-hr	LC50	0.002
Vinyl/Allyl Halides	: Earthworm	14-day	LC50	262.958 *

Neutral Organic SAR	: Fish	96-hr	LC50	0.050
(Baseline Toxicity)	: Daphnid	48-hr	LC50	0.042
	: Green Algae	96-hr	EC50	0.160 *
	: Fish		ChV	0.008
	: Daphnid		ChV	0.012
	: Green Algae		ChV	0.101 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

NOTE: ! = exclamation designates: The toxicity value was estimated through application of acute-to-chronic ratios per methods outlined in the ECOSAR Methodology Document provided in the ECOSAR Help Menu.

Class Specific LogKow Cut-Offs

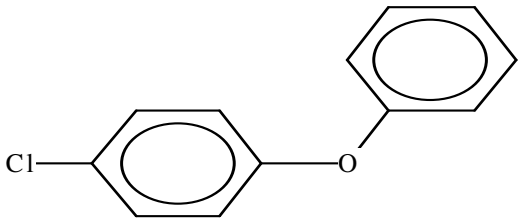
If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Vinyl/Allyl Halides:

Maximum LogKow: 6.0 (Fish 96-hr LC50; Daphnid LC50; Mysid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 5.0 (Fish (SW) 96-hr LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O(c(ccc(c1)CL)c1)c(cccc2)c2
CHEM : Benzene, 1-chloro-4-phenoxy-
CAS Num: 007005-72-3
ChemID1:
MOL FOR: C12 H9 CL1 O1
MOL WT : 204.66
Log Kow: 4.694 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 4.70 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 4.012 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 3.3 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.694 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 3.3 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
007005-72-3	Fish	96-hr	LC50	0.73	Neutral organics	Chui, 1990

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	0.640
Neutral Organics	: Daphnid	48-hr	LC50	0.466
Neutral Organics	: Green Algae	96-hr	EC50	0.971
Neutral Organics	: Fish		ChV	0.084
Neutral Organics	: Daphnid		ChV	0.091
Neutral Organics	: Green Algae		ChV	0.443
Neutral Organics	: Fish (SW)	96-hr	LC50	0.819
Neutral Organics	: Mysid	96-hr	LC50	0.098
Neutral Organics	: Fish (SW)		ChV	0.461
Neutral Organics	: Mysid (SW)		ChV	0.004
Neutral Organics	: Earthworm	14-day	LC50	187.017 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES)

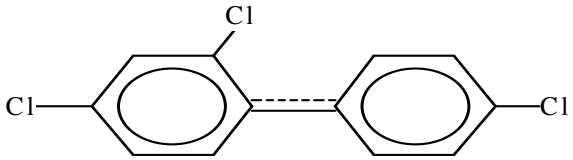
are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : CLc1ccc(cc1)c2ccc(CL)cc2CL
CHEM : Aroclor 1016
CAS Num: 012674-11-2
ChemID1:
MOL FOR: C12 H7 CL3
MOL WT : 257.55
Log Kow: 5.690 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 5.62 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 0.3407 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.42 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 5.690 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.42 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	Fish	96-hr	LC50	0.103
Neutral Organics	Daphnid	48-hr	LC50	0.082
Neutral Organics	Green Algae	96-hr	EC50	0.250
Neutral Organics	Fish		ChV	0.015
Neutral Organics	Daphnid		ChV	0.021
Neutral Organics	Green Algae		ChV	0.140
Neutral Organics	Fish (SW)	96-hr	LC50	0.132
Neutral Organics	Mysid	96-hr	LC50	0.008
Neutral Organics	Fish (SW)		ChV	0.136
Neutral Organics	Mysid (SW)		ChV	0.000233
Neutral Organics	Earthworm	14-day	LC50	185.504 *

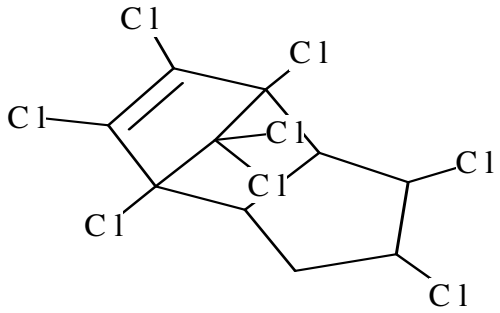
Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : CLC(C(CL)C1)C(C1C2(CL)C=3CL)C(CL)(C3CL)C2(CL)CL
CHEM : Chlordane
CAS Num: 012789-03-6
ChemID1:
MOL FOR: C10 H6 CL8
MOL WT : 409.78
Log Kow: 6.260 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: 6.22 (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 106.00 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 0.02006 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 0.056 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 6.260 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.056 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

CAS No	Organism	Duration	End Pt	Measured mg/L (ppm)	Ecosar Class	Reference
000057-74-9	Fish (SW)		ChV	0.00063	Vinyl/allyl halides	ETFS
000057-74-9	Fish		ChV	0.0016	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.003	Vinyl/allyl halides	ETFS
000057-74-9	Mysid	96-hr	LC50	0.005	Vinyl/allyl halides	WQC
000057-74-9	Fish (SW)	96-hr	LC50	0.01	Vinyl/allyl halides	ETFS
000057-74-9	Daphnid		ChV	0.01	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.025	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.037	Vinyl/allyl halides	ETFS
000057-74-9	Daphnid	48-hr	LC50	0.05	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.059	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.082	Vinyl/allyl halides	ETFS
000057-74-9	Fish	96-hr	LC50	0.19	Vinyl/allyl halides	ETFS

ECOSAR v1.1 Class-specific Estimations

Vinyl/Allyl Halides

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Vinyl/Allyl Halides	: Fish	96-hr	LC50	0.011
Vinyl/Allyl Halides	: Daphnid	48-hr	LC50	0.012
Vinyl/Allyl Halides	: Green Algae	96-hr	EC50	0.056 *
Vinyl/Allyl Halides	: Fish		ChV	0.000255

Vinyl/Allyl Halides	: Daphnid		ChV	0.016
Vinyl/Allyl Halides	: Green Algae		ChV	0.084 *!
Vinyl/Allyl Halides	: Fish (SW)	96-hr	LC50	0.003
Vinyl/Allyl Halides	: Mysid (SW)	96-hr	LC50	0.002
Vinyl/Allyl Halides	: Earthworm	14-day	LC50	262.958 *

Neutral Organic SAR	: Fish	96-hr	LC50	0.050
(Baseline Toxicity)	: Daphnid	48-hr	LC50	0.042
	: Green Algae	96-hr	EC50	0.160 *
	: Fish		ChV	0.008
	: Daphnid		ChV	0.012
	: Green Algae		ChV	0.101 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

NOTE: ! = exclamation designates: The toxicity value was estimated through application of acute-to-chronic ratios per methods outlined in the ECOSAR Methodology Document provided in the ECOSAR Help Menu.

Class Specific LogKow Cut-Offs

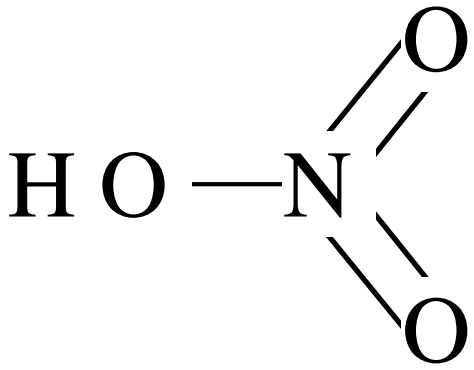
If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Vinyl/Allyl Halides:

Maximum LogKow: 6.0 (Fish 96-hr LC50; Daphnid LC50; Mysid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 5.0 (Fish (SW) 96-hr LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : O(N(=O)=O)
CHEM : NITRATE
CAS Num: 014797-55-8
ChemID1:
MOL FOR: N1 O3
MOL WT : 62.00
Log Kow: 0.209 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 9.09E+004 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 0.209 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 9.09E+004 (mg/L, EPISuite WSKowwin v1.43 Estimate)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Inorganic Compound

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organic SAR	: Fish	96-hr	LC50	2067.870
(Baseline Toxicity)	: Daphnid	48-hr	LC50	995.185
	: Green Algae	96-hr	EC50	374.159
	: Fish		ChV	166.306
	: Daphnid		ChV	61.253
	: Green Algae		ChV	67.798

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs

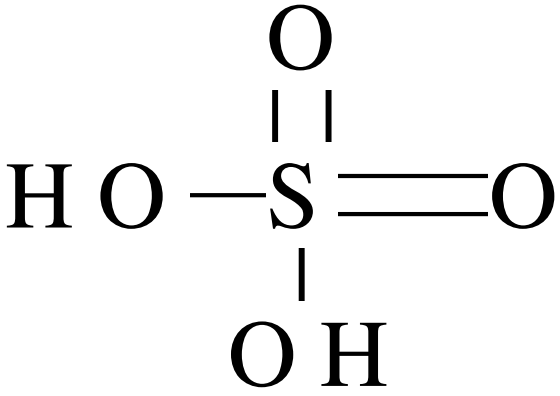
presented below, then no effects at saturation are expected for those endpoints.

Inorganic Compound:

Maximum LogKow: 5.0 (LC50)
Maximum LogKow: 6.4 (EC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : OS(=O)(=O)O
CHEM : SULFATE
CAS Num: 014808-79-8
ChemID1:
MOL FOR: H2 O4 S1
MOL WT : 98.07
Log Kow: -2.200 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: 10.31 (deg C, PhysProp DB exp value for Wat Sol est)
Wat Sol: 1E+006 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: 1E+006 (mg/L, PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: -2.200 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 1E+006 (mg/L, PhysProp DB exp value)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Inorganic Compound

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organic SAR	: Fish	96-hr	LC50	4.77e+005
(Baseline Toxicity)	: Daphnid	48-hr	LC50	1.84e+005
	: Green Algae	96-hr	EC50	27531.549
	: Fish		ChV	29497.303
	: Daphnid		ChV	6088.096
	: Green Algae		ChV	3039.855

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs

presented below, then no effects at saturation are expected for those endpoints.

Inorganic Compound:

Maximum LogKow: 5.0 (LC50)
Maximum LogKow: 6.4 (EC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)

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ECOSAR Version 1.11 Results Page

SMILES : CL
CHEM : CHLORIDE ION
CAS Num: 016887-00-6
ChemID1:
MOL FOR: CL1
MOL WT : 35.45
Log Kow: 0.539 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 4.237E+004 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 0.539 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 4.237E+004 (mg/L, EPISuite WSKowwin v1.43 Estimate)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Inorganic Compound

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organic SAR	: Fish	96-hr	LC50	597.307
(Baseline Toxicity)	: Daphnid	48-hr	LC50	296.360
	: Green Algae	96-hr	EC50	126.392
	: Fish		ChV	49.797
	: Daphnid		ChV	19.856
	: Green Algae		ChV	24.511

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs

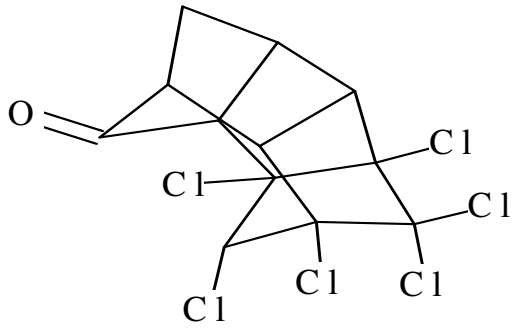
presented below, then no effects at saturation are expected for those endpoints.

Inorganic Compound:

Maximum LogKow: 5.0 (LC50)
Maximum LogKow: 6.4 (EC50)
Maximum LogKow: 8.0 (ChV)

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)



ECOSAR Version 1.11 Results Page

SMILES : CLC15C(C3(C4C5C2CC4C(=O)C2C1(C3CL)CL)CL)(CL)CL
CHEM : ENDRIN KETONE
CAS Num: 053494-70-5
ChemID1:
MOL FOR: C12 H8 CL6 O1
MOL WT : 380.91
Log Kow: 4.986 (EPISuite Kowwin v1.68 Estimate)
Log Kow: (User Entered)
Log Kow: (PhysProp DB exp value - for comparison only)
Melt Pt: (User Entered for Wat Sol estimate)
Melt Pt: (deg C, PhysProp DB exp value for Wat Sol estimate)
Wat Sol: 0.2215 (mg/L, EPISuite WSKowwin v1.43 Estimate)
Wat Sol: (User Entered)
Wat Sol: (PhysProp DB exp value)

Values used to Generate ECOSAR Profile

Log Kow: 4.986 (EPISuite Kowwin v1.68 Estimate)
Wat Sol: 0.2215 (mg/L, EPISuite WSKowwin v1.43 Estimate)

Available Measured Data from ECOSAR Training Set

No Data Available

ECOSAR v1.1 Class-specific Estimations

Neutral Organics

ECOSAR Class	Organism	Duration	End Pt	Predicted mg/L (ppm)
Neutral Organics	: Fish	96-hr	LC50	0.651 *
Neutral Organics	: Daphnid	48-hr	LC50	0.487 *
Neutral Organics	: Green Algae	96-hr	EC50	1.134 *
Neutral Organics	: Fish		ChV	0.088
Neutral Organics	: Daphnid		ChV	0.102
Neutral Organics	: Green Algae		ChV	0.549 *
Neutral Organics	: Fish (SW)	96-hr	LC50	0.834 *
Neutral Organics	: Mysid	96-hr	LC50	0.082
Neutral Organics	: Fish (SW)		ChV	0.561 *
Neutral Organics	: Mysid (SW)		ChV	0.003
Neutral Organics	: Earthworm	14-day	LC50	324.592 *

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect. If the effect level exceeds the water solubility by 10X, typically no effects at saturation (NES) are reported.

Class Specific LogKow Cut-Offs

If the log Kow of the chemical is greater than the endpoint specific cut-offs presented below, then no effects at saturation are expected for those endpoints.

Neutral Organics:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)

ECOSAR Soil Screening Benchmark Calculations

Attachment 4: Section 2
ECOSAR Soil Screening Benchmark Calculations
Screening Level Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Persistent [a]	LogKow [b]	Bioaccumulating [c]	Screening Factor	ECOSAR Estimate mg/kg	Estimate Type	Test Organism	Durration	Calculated Screening Benchmark mg/kg [d] [e]	Calculated Effects Benchmark mg/kg [d] [f]
1,2,4-Trimethylbenzene	Yes	3.63	Yes	0.01	141.433	LC50	Earthworm	14 Days	1.4	14.1
1,3,5-Trimethylbenzene	Yes	3.42	Yes	0.01	141.433	LC50	Earthworm	14 Days	1.4	14.1
1-Methylnaphthalene	No	3.87	Yes	0.1	164.106	LC50	Earthworm	14 Days	16.4	164
2,4,4-Trimethyl-1-pentene	Yes	4.55	Yes	0.01	118.762	LC50	Earthworm	14 Days	1.2	11.9
2,4,4-Trimethyl-2-Pentene	Yes	4	Yes	0.01	121.012	LC50	Earthworm	14 Days	1.2	12.1
Alpha-Chlordane	Yes	6.1	Yes	0.01	262.958	LC50	Earthworm	14 Days	2.6	26
Aroclor-1016	Yes	5.69	Yes	0.01	185.504	LC50	Earthworm	14 Days	1.9	18.6
Benzoic Acid	No	1.87	No	0.1	2187.9	LC50	Earthworm	14 Days	219	2188
Carbazole	No	3.72	Yes	0.1	216.687	LC50	Earthworm	14 Days	22	217
Chlordane (technical)	Yes	6.1	Yes	0.01	262.958	LC50	Earthworm	14 Days	2.6	26
Chloride	No	0.54	No	0.1	87.365	LC50	Earthworm	14 Days	8.7	87
Dibenzofuran	Yes	4.12	Yes	0.01	194.179	LC50	Earthworm	14 Days	1.9	19.4
Endrin ketone	Yes	4.99	Yes	0.01	324.592	LC50	Earthworm	14 Days	3.2	32
Sulfate	No	-2.2	No	0.1	464.85	LC50	Earthworm	14 Days	46	465

Prepared by: SFR 6/28/2013
Checked by: RRD 7/18/2013

Notes:

[a] Persistent chemicals are those that are either listed by chemical or chemical class as Persistent Organic Pollutants under the Stockholm Convention or have half lives longer than 2-months in surface water and soil as calculated by the USEPA's PBT (Persistent, Bio-accumulating, and Toxic) Profiler (http://www.pbtprofiler.net/entry.asp). Calculations of persistence exclude net advection and sediment burial.

[b] Log Kow values are presented in the Master Chemical List.

[c] Assumed that organic compounds with $LogK_{ow} < 3.0$ do not significantly accumulate in biological tissue.

[d] Terrestrial screening and effects values are calculated from LC50s for 14 day earthworm exposures as estimated by the ECOSAR database - ECOSAR, 2012. v.1.11.

[e] Terrestrial screening benchmarks are calculated by applying a multiple of 0.10 to LC50 values for non-persistent chemicals; applying a multiple of 0.05 to LC50 values for persistent non-bioaccumulating chemicals; and a multiple of 0.01 to LC50 values for persistent bioaccumulating chemicals. Methodology is derived from the Texas Surface Water Quality Standards TSWQS (30 TAC §307.6(c).(7), as ammended TNRCC, 2000b).

[f] Terrestrial effects benchmarks are calculated by applying a multiple of 10 to calculated screening benchmarks.

LC50 - Median Lethal Concentration
mg/kg - milligrams per kilogram

ECOSAR Surface Water Screening Benchmark Calculations

Attachment 4
ECOSAR Surface Water Screening Benchmark Calculations
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Persistent [a]	LogKow [b]	Bioaccumulating [c]	Screening Factor	ECOSAR Estimate mg/L	Type	Organism	Durration	Calculated Screening Benchmark mg/L [d] [e]	Calculated Effects Benchmark mg/L [d] [f]
2,4,4-Trimethyl-1-pentene	Yes	4.55	Yes	0.01	0.153	CHV	Fish	30 Day	0.015	0.15
2,4,4-Trimethyl-2-Pentene	Yes	4	Yes	0.01	0.179	CHV	Fish	30 Day	0.018	0.18
2-Methylnaphthalene	No	3.86	Yes	0.1	0.396	CHV	Fish	30 Day	0.40	4.0
4-Chlorophenyl phenyl ether	Yes	4.7	Yes	0.01	0.084	CHV	Fish	30 Day	0.0084	0.084
Acenaphthylene	Yes	3.94	Yes	0.01	0.275	CHV	Fish	30 Day	0.028	0.28
Acetic acid, methyl ester	No	0.18	No	0.1	11.392	CHV	Fish	32/33 Day	11.4	114
Acetophenone	No	1.58	No	0.1	18.287	CHV	Fish	30 Day	18.3	183
Alpha-Chlordane	Yes	6.1	Yes	0.01	0.00177	CHV	Fish	30/60 Day	0.00018	0.0018
Benzo(b)fluoranthene	Yes	5.78	Yes	0.01	0.006	CHV	Fish	30 Day	0.00060	0.0060
Benzo(ghi)perylene	Yes	6.63	Yes	0.01	0.002	CHV	Fish	30 Day	0.00020	0.0020
Benzo(k)fluoranthene	Yes	6.11	Yes	0.01	0.006	CHV	Fish	30 Day	0.00060	0.0060
Bromodichloromethane	Yes	2	No	0.05	28.215	CHV	Fish	30 Day	14.1	141
Carbazole	No	3.72	Yes	0.1	1.204	CHV	Fish	30 Day	1.2	12.0
Chlordane (technical)	Yes	6.1	Yes	0.01	0.00177	CHV	Fish	30/60 Day	0.00018	0.0018
Chlorodibromomethane	Yes	2.16	No	0.05	30.101	CHV	Fish	30 Day	15.1	151
Chrysene	Yes	5.81	Yes	0.01	0.019	CHV	Fish	30 Day	0.0019	0.019
Dibenz(a,h)anthracene	Yes	6.75	Yes	0.01	0.002	CHV	Fish	30 Day	0.00020	0.0020
Dibromomethane	No	1.7	No	0.1	0.148	CHV	Fish	30 Day	0.15	1.5
Diphenyl ether	No	4.2	Yes	0.1	0.247	CHV	Fish	30 Day	0.25	2.5
Diphenylamine	Yes	3.5	Yes	0.01	1.083	CHV	Fish	30 Day	0.11	1.1
Diphenylmethanone	No	3.2	Yes	0.1	1.547	CHV	Fish	30 Day	1.5	15.5
Endrin ketone	Yes	4.99	Yes	0.01	0.088	CHV	Fish	30 Day	0.0088	0.088
Formaldehyde	No	0.35	No	0.1	3.871	CHV	Fish	30 Day	3.9	39
Indeno(1,2,3-cd)pyrene	Yes	6.7	Yes	0.01	0.002	CHV	Fish	30 Day	0.00020	0.0020
Nitrate as N	No	0.21	No	0.1	166.306	CHV	Fish	30 Day	166	1663
sec-Butylbenzene	No	4.57	Yes	0.1	0.241	CHV	Fish	30 Day	0.24	2.4
Sulfate	No	-2.2	No	0.1	29479.303	CHV	Fish	30 Day	29479	294793
Tetrahydrofuran	No	0.46	No	0.1	46.479	CHV	Fish	30 Day	46	465
Trichlorofluoromethane	Yes	2.53	No	0.05	8.57	CHV	Fish	30 Day	4.3	43
Xylene, o	No	3.12	Yes	0.1	1.012	CHV	Fish	30 Day	1.0	10.1

Prepared by: SFR 6/28/2013
Checked by: RRD 7/18/2013

Notes:

[a] Persistent chemicals are those that are either listed by chemical or chemical class as Persistent Organic Pollutants under the Stockholm Convention or have half lives longer than 2-months in surface water and soil as calculated by the USEPA's PBT (Persistent, Bio-accumulating, and Toxic) Profiler (http://www.pbtprofiler.net/entry.asp). Calculations of persistence exclude net advection and sediment burial.

[b] Log Kow values are presented in the Master Chemical List.

[c] Assumed that organic compounds with $LogK_{ow} < 3.0$ do not significantly accumulate in biological tissue.

[d] Aquatic screening and effects values are calculated from CHVs for 30, 32/33, or 30/60 day fish exposures as estimated by the ECOSAR database - ECOSAR, 2012. v.1.11.

[e] Aquatic screening benchmarks are calculated by converting CHVs for 30, 32/33, or 30/60 day fish exposures to LC50s by multiplying by 10 and by applying a multiple of 0.10 to LC50 values for non-persistent chemicals; applying a multiple of 0.05 to LC50 values for persistent non-bioaccumulating chemicals; and a multiple of 0.01 to LC50 values for persistent bioaccumulating chemicals. Methodology is derived from the Texas Surface Water Quality Standards TSWQS (30 TAC §307.6(c).(7), as ammended TNRCC, 2000b).

[f] Aquatic effects benchmarks are calculated by applying a multiple of 10 to calculated screening benchmarks.

LC50 - Median Lethal Concentration
CHV - Chronic Toxicity Value = LC50 * 0.10
mg/: - mill

ATTACHMENT 5

FOOD CHAIN MODELS

(Provided on CD ROM)

1.0 Introduction

This Attachment presents the technical approach that was used in the BERA to model risks to terrestrial and semi-aquatic wildlife species. The food chain models incorporate various input parameters which utilize site-specific data as well as data derived from literature sources. The wildlife receptor species evaluated, the food chain model equations and assumptions, and the various inputs used in the food chain models are described in the following sections.

2.0 Selection of Wildlife Receptor Species

The wildlife receptor species selected are representative of the various taxonomic groups and trophic levels of vertebrates that may potentially occur in the various terrestrial and semi-aquatic habitats evaluated. Wildlife receptors were selected from species which were either known to be, or anticipated to be, common inhabitants of the exposure areas and for which natural history information was available to model exposures. Selected receptors for the terrestrial and semi-aquatic habitats are listed below.

Terrestrial Wildlife Receptors

- American robin (*Turdus migratorius*) (omnivorous bird);
- Red-tailed hawk (*Buteo jamaicensis*) (carnivorous bird);
- Short-tailed shrew (*Blarina brevicauda*) (omnivorous mammal); and
- Red fox (*Vulpes vulpes*) (carnivorous mammal).

Semi-Aquatic Wildlife Receptors

- Marsh Wren (*Cistothorus palustris*) (invertivorous bird);
- Green heron (*Butorides virescens*) (omnivorous / piscivorous bird),
- Raccoon (*Procyon lotor*) omnivorous mammal, and
- Muskrat (*Ondatra zibethicus*) (omnivorous mammal).

Risks to these receptors were evaluated for the terrestrial and semi-aquatic exposure areas. Tables that present the modeling results and risk estimates for these receptors by exposure area are presented in this attachment.

3.0 Food Chain Model Overview

Food chain models were developed to estimate the potential doses of each COPEC identified in a given exposure area to each receptor evaluated via ingestion of food, water, and soil or sediment. In the food chain models, a receptor's total estimated dose (DOSEtotal) of a given COPEC was calculated by summing the surface water ingestion dose (DOSEwater), incidental soil or sediment ingestion dose (DOSEsoil/sed), and dietary ingestion dose (DOSEdiet) according to the following equation:

$$DOSE_{total} = DOSE_{water} + DOSE_{soil/sed} + DOSE_{diet} \qquad \text{(Equation 1)}$$

The total dose (in milligrams/kilogram body weight-day) represents the daily dose to a receptor from a specific COPEC.

Modeled COPEC daily doses were compared to toxicity reference values (TRVs) to

calculate a hazard quotient (HQ):

$$HQ = \frac{DOSE_{total}}{TRV} \qquad (Equation\ 2)$$

An HQ less than 1 indicates that the receptor's estimated exposure to the COPEC is less than the minimum threshold dose associated with toxicity and exposure is unlikely to present a significant risk of harm. It is therefore assumed that there is no risk to the receptor where the estimated HQ is less than 1. An HQ greater than 1 suggests that a COPEC may be present at a concentration at which exposure for the receptor may be above the minimum threshold dose associated with toxicity. Exposure to a COPEC with an HQ greater than 1 may affect the growth, development, reproductive success or survival of the receptor.

TRVs for individual COPECs were obtained from the scientific literature. TRVs are based on both No-Observed-Adverse-Effect-Level (NOAEL) and Lowest-Observed-Adverse-Effect -Level (LOAEL). Selection of TRVs is discussed in section 3.3.

3.1 Calculation of Estimated Daily Intakes (EDIs)

Equations used to calculate doses for terrestrial and semi-aquatic receptors are presented in Attachment Tables 5-1 and 5-2, respectively. Detailed information used in the dose equations for each of the receptor species evaluated regarding diet, home-range, ingestion rates, and other biological exposure parameters was obtained primarily from the Wildlife Exposure Factors Handbook (USEPA, 1993) and supplemented with other literature sources. This information is documented in Attachment Tables 5-3 through 5-9.

The site foraging frequency (SFF) is the fraction of a receptors home range that the exposure area occupies. A SFF of 1 means that a receptor's home range can be contained within the given exposure area. Therefore it is assumed that when there is an SFF of 1 the receptor spends its all of its time in the exposure area. An SFF of less than 1 means the exposure area is a fraction of the receptor's home range, and, therefore, the receptor only spends that fraction of its time in the exposure area.

3.2 Exposure Point Concentrations (EPCs)

The dose equations utilize chemical concentration data for the various media that the receptors are assumed to contact. The concentration data are either directly measured or estimated using measured concentrations and biota accumulation factors (BAFs) derived from the literature.

The reasonable maximum exposure (RME) or central tendency exposure (CTE) concentrations of COPECs detected in a given medium from a given exposure area are used in the dose equations. The RME is assumed to be the lesser value of the 95% upper confidence limit (UCL) on the arithmetic mean concentration (95% UCL value) and the maximum detected concentration. The CTE was assumed to be the lesser value of the average concentration or maximum detected concentration. The average was calculated using both detected concentrations and ½ the sample quantitation limit for samples where the COPEC was not detected. The maximum detected concentration may

be less than the average for a COPEC with low frequency of detection and high sample quantitation limits.

For plant forage and prey items, contaminant tissue concentrations were usually calculated using chemical- and taxa-specific BAFs derived from the literature as shown in the following equation:

Prey Tissue Concentration = Soil/Sediment Concentration x BAF (*Equation 3)*

Where:

Prey Tissue Concentration = wet weight mg/kg
Soil/Sediment Concentration = dry weight mg/kg; and
BAF = mg/kg wet weight tissue/ mg/kg dry weight soil/sediment

Literature-based BAFs for COPECs identified at the Property are summarized in Attachment Table 5-10.

Organic compounds with octanol-water partition coefficients (LogKow) < 3.0 do not significantly accumulate in biological tissue (USPEA, 2000). All organic compounds where Log Kow<3.0 have BAF values set at zero. This method is consistent with the USEPA (2000) guidance "Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs". This guidance states that:

> "Chemicals with a Log Kow greater than 3.5 are considered to be bioaccumulative, that is, they are likely to partition into organic material, including lipids of organisms and predicted and measured BAFs are correlated within the range of Log Kow 3.5 to 6.5."

The USEPA (2000) guidance sets a lower bound of 3.0 to provide a small measure of conservatism. Chemicals with a Log Kow less than 3.0 are not bioaccumulative, even if USEPA included them in the Eco-SSL.

When BAF data were not available from the literature, BAFs were calculated using structure-activity relationships (SARs) or were obtained from extrapolations, as described below.

- BAFs for uptake of inorganics from soil to plants were derived from information provided in Sample et al., 1998 and Baes et al., 1984. Preference was given to recommended regression estimates followed by median values derived for the full Oak Ridge National Laboratory (ORNL) dataset. Available Baes et al. (1984) Bv values (soil-to-plant vegetation concentration factors) were used for those analytes lacking ORNL data. Br values (soil to plant root concentration factors) are also available from Baes et. al. (1984), however dietary information for the ecological receptors evaluated is generally not specific enough to justify the use of Br values over Bv values. The selection criteria are provided in the footnotes to Attachment Table 5-10.

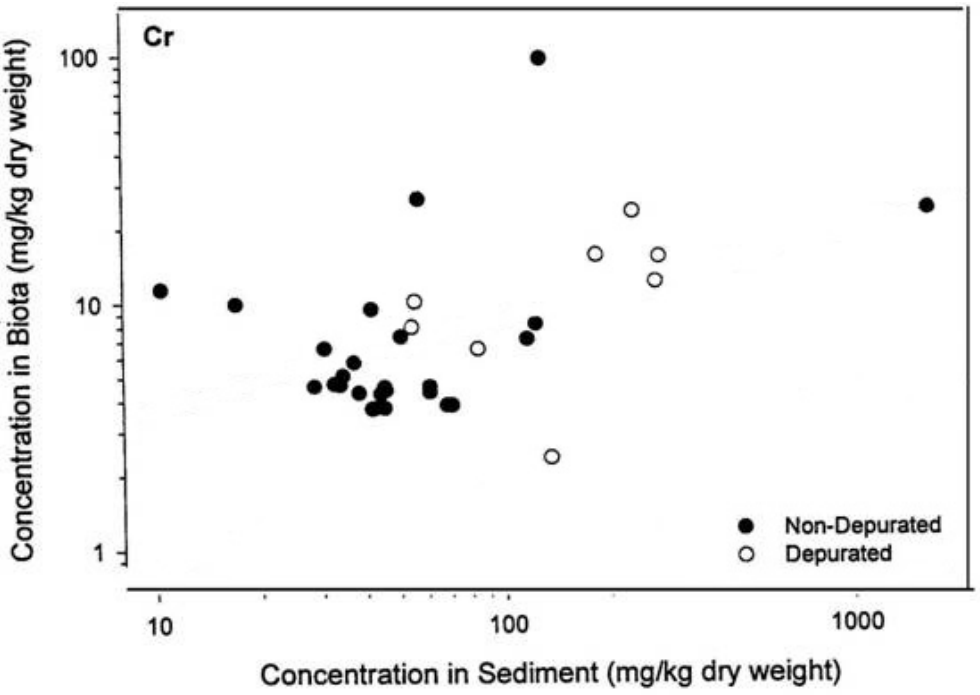
- BAFs for uptake of inorganics from soil to invertebrates were derived from information summarized in Sample *et al.,* 1998. Preference was given to recommended regression estimates in Sample *et al.,* 1998. The selection criteria are provided in the

footnotes to Attachment Table 5-10.

- Small mammal BAFs for inorganics were derived from ingestion-to-beef biotransfer factors (BTFs) presented in Baes *et al.* (1984) or from Sample *et al.,* 1998.

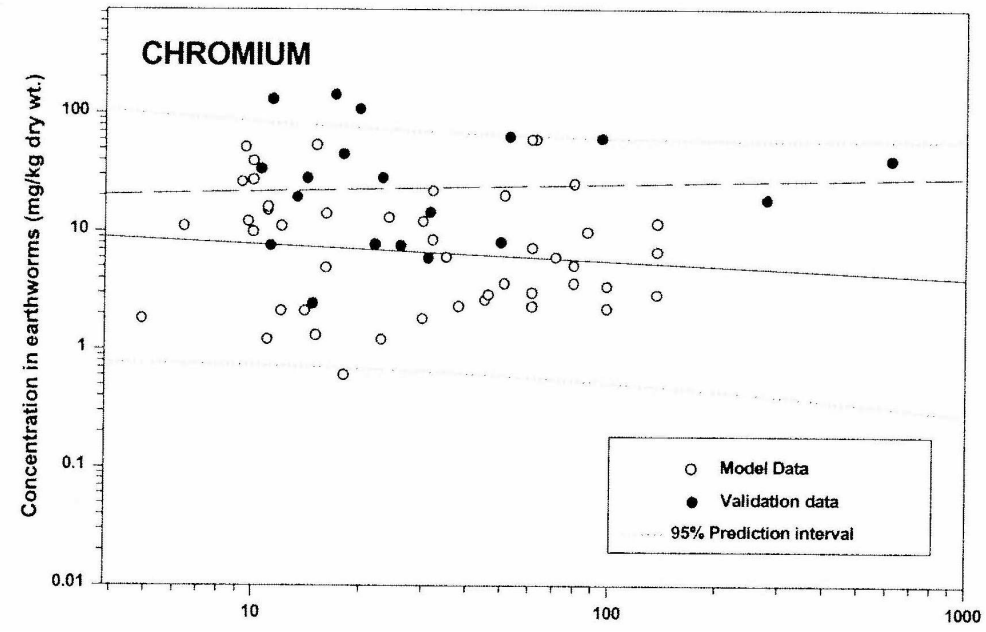
- Bioaccumulation factors for uptake of some COPECs from sediment into fish, amphibians, or aquatic invertebrate tissue are not available (i.e., most metals) and therefore terrestrial invertebrate BAFs were used as a surrogate to estimate bioaccumulation into fish, amphibians, or aquatic invertebrate tissue. Fish- and amphibian-specific BAFs were preferentially selected from the literature and were used, when available (approximately 75% of COPECs). BAFs for terrestrial invertebrates were used as surrogates for fish and amphibians only where BAFs for fish and amphibians were unavailable. BAFs for terrestrial invertebrates used as surrogates for fish and amphibians were based on soil water to invertebrate tissue equilibrium partitioning models obtained from Jager (1998). Equilibrium partitioning models account for the thermodynamic partitioning of organic chemicals between soil solids, porewater and resident organisms tissues. Jager (1998) uses equilibrium partitioning models to estimate the bioconcentration of organic chemicals from soil water to invertebrate tissue. The partitioning of organic chemicals between soil and soil water in terrestrial systems was assumed to be roughly analogous to partitioning of chemicals between sediment and porewater in aquatic systems.

Chromium EPCs in terrestrial and aquatic invertebrate tissue were not estimated using BAFs. Defensible BAFs were not available in the scientific literature. All three sources available(Sample *et al*., 1998a,b, USEPA, 1999) clearly demonstrate that chromium concentrations in aquatic invertebrate or terrestrial invertebrate (earthworm) tissue are nearly independent of corresponding concentrations in sediment and soil. In the absence of a defensible BAF or regression equations, a chromium tissue concentration of 20 mg/kg dw (corresponding to a 4 mg/kg ww concentration assuming invertebrates are 80 water) has been selected as representative of chromium concentrations in soil and aquatic invertebrates. For aquatic invertebrates, the 20 mg/kg concentration was obtained from the Sample *et al*., (1998b) chromium scatterpolt which shows a measured tissue concentration of approximately 20 mg/kg associated with a measured sediment concentration of about 1,300 mg/kg, which on the log scale lie in close proximity to the highest sediment RME and CTE concentrations in the aquatic exposure areas:



Notes
r^2= 0.20 (i.e. poor correlation)
Note log scales on x- and y-axis
Source: Sample *et al.,* 1998b

For soil invertebrates, the 20 mg/kg concentration was obtained from the Sample *et al.* (1998a) scatterplot that shows that earthworm tissue chromium concentrations are independent of soil chromium concentrations:



Notes
Trend line r^2= 0.04 (i.e. poor correlation)
Note log scales on x- and y-axis
Source: Sample *et al.*, 1998a.

20 mg/kg is an estimate of the median chromium earthworm concentration across all soil concentrations. This value is also used as surrogate for fish/amphibian chromium concentrations in tissue as explained in the last bullet, above.

A more detailed explanation of this approach is provided in the Uncertainty Section of the Baseline Ecological Risk Assessment.

3.3 Toxicity Reference Values (TRVs)

As described previously, to calculate a receptor's index of potential risk as a Hazard Quotient (HQ) associated with exposure to a particular chemical, the receptor's total dose for the chemical is divided by a chemical-specific TRV obtained from the literature. The toxicity data used for developing receptor TRVs consists primarily of oral ingestion studies. TRVs are developed to represent a threshold dose for effects to terrestrial wildlife and are expressed in mg/kg body weight/day (dose normalized to body weight). Attachment Table 5-11 and Table 5-12 present chemical-specific toxicity values for COPECs.

Where available, USEPA-derived taxa-specific TRVs established to calculate Soil Screening Levels (SSLs) were used. Other TRVs were obtained from toxicity benchmark reports prepared for ONRL (Sample *et al.,* 1996), government publications, and the primary literature, and were selected according to the following preferences:

- TRVs which were associated with chronic exposures, bounded (i.e., having reported NOAEL and LOAEL values), and associated with preferred endpoints (growth, development, reproduction, or survival) were selected preferentially over TRVs not meeting these conditions.

- Typically, the highest NOAEL and lowest LOAEL for an appropriate endpoint were selected. If NOAEL data for preferred endpoints were not available, then the lowest LOAEL for development, reproduction, or survival endpoints or the lowest lethal dose affecting 50% of the test population (LD50) were used instead and were divided by the appropriate uncertainty factors to approximate a NOAEL.

- TRVs were selected separately for birds and mammals.

- Oral exposures were selected over TRVs from other routes of administration (e.g., gavage, intravenous injection, etc.).

- If chronic data were not available, sub-chronic or acute data were used and were divided by the appropriate uncertainty factors to approximate a chronic value.

- If a reported (not extrapolated) LOAEL for an endpoint of equal or greater relevance

within a broad category of endpoints was lower than a reported NOAEL of equal or lesser relevance (i.e., with uncertain effects on a population of receptors), then the LOAEL was selected and divided by the appropriate uncertainty factor.

- If data from chronic studies with suitable endpoints were not available, then TRVs were selected from sub-chronic or acute studies with more suitable endpoints and uncertainty factors were applied.

An uncertainty factor of 10 was selected to convert from a LOAEL to a NOAEL. This value, although conservative, is typically used in risk assessments (Dourson *et al.,* 1996; USEPA, 1993; USEPA, 2002; ATSDR, 2001). Similarly, an uncertainty factor of 10 was applied to convert from an LD50 to a LOAEL value. To convert from sub-chronic to chronic effects, an uncertainty factor of 5 was used. The 5-fold factor was selected based on results of studies described in Dourson *et al.* (1996), indicating an average difference between sub-chronic and chronic values of 2 to 3. An uncertainty factor of 10 was used to convert from acute to chronic values; this factor is similar to that used in other risk assessments (Stickney, *et al.,* 2001). No uncertainty factors were applied for inter-species extrapolations or for laboratory to field circumstances. Whenever possible, TRVs were selected from studies involving species similar to the wildlife receptor species.

4.0 References

Agency for Toxic Substances and Disease Registry (ATSDR), 2001. ATSDR Public Health Assessment Guidance Manual. Available from http://atsdr.cdc.gov/HAC/HAGM/toc-html.html. Internet accessed January 11, 2005.

Baes, C.F., III. R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture; Oak Ridge National Laboratories, Environmental Sciences Division; ORNL-5786.

Dourson, M.L., S.P. Felter, and D. Robinson, 1996. Evolution of science-based uncertainty factors in noncancer risk assessment. Regulatory Toxicology and Pharmacology, 24, 108-120.

Sample, B.E., and D.M. Opresko, G.W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for U.S. Department of Energy. ES/ER/TM-86/R3. June 1996.

Sample, B.E., J.J. Beauchamp, R.A. Efroymsom, G.W. Suter, II, and T.L. Ashwood, 1998. Development and Validation of Bioaccumulation Models for Earthworms; Oak Ridge National Laboratories; Environmental Restoration Program; ES/ER/TM-220.

Stickney, J.A., M.M. Gates, E.M. Rainey, and C.H. Day, 2001. Determination of acceptable risk-based concentrations of BTEX in cattle's drinking water. Presented at the 8th International Petroleum Environmental Conference, University of Tulsa Integrated Environmental Petroleum Consortium. Available from http://ipec.utulsa.edu/Ipec/Conf2001/conf_toc.html

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental

Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment: Status and Needs. Offices of Water and Solid Waste. EPA-823-R-00-001. February.

USEPA, 2002. Determination of the Appropriate FQPA Safety Factor(s) in Tolerance Assessment. Office of Pesticide Programs, Washington, D.C. February 28.

USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Facilities Peer Review Draft, November 1999. Appendix C: Media to Receptor Bioconcentration Factors.

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Attachment 5-1
Wildlife Exposure Models Used To Estimate Daily Contaminant Intake For Terrestrial Receptors
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Estimated Daily Intake
$$DOSE_{total} = DOSE_{soil} + DOSE_{diet}$$
Incidental Soil Ingestion
$$DOSE_{soil} = \frac{C_{soil} * IR_{soil} * SFF}{BW}$$
Dietary Intake
$$DOSE_{diet} = DOSE_{plant} + DOSE_{invert} + DOSE_{\text{mammal}} + DOSE_{\text{bird}}$$
Terrestrial Plant Intake
$$DOSE_{plant} = \frac{C_{plant} * IR_{food} * P_{plant} * SFF}{BW}$$
Soil Invertebrate Intake
$$DOSE_{invert} = \frac{C_{invert} * IR_{food} * P_{invert} * SFF}{BW}$$
Small Mammal Intake
$$\text{DOSE}_{mammal} = \frac{C_{mammal} * IR_{food} * P_{mammal} * SFF}{BW}$$
Small Bird Intake
$$\text{DOSE}_{bird} = \frac{C_{bird} * IR_{food} * P_{bird} * SFF}{BW}$$

Attachment 5-1
Wildlife Exposure Models Used To Estimate Daily Contaminant Intake For Terrestrial Receptors
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Definition	Units	Value [a]
$DOSE_{total}$	Total estimated daily dose of a chemical for a receptor species	mg/kg-day	calculated
$DOSE_{soil}$	Total estimated daily dose of a chemical via the incidental soil ingestion pathway for a receptor	mg/kg-day	calculated
$DOSE_{diet}$	Total estimated daily dose of a chemical via the consumption of contaminated prey pathway for a receptor	mg/kg-day	calculated
SFF	Site Foraging Frequency (ratio of foraging or home range to Site area)	unitless	receptor-specific
BW	Body weight	kg	receptor-specific
C_{soil}	Chemical concentration in soil	mg/kg (dw)	chemical-specific
IR_{soil}	Ingestion rate of soil	kg/day (ww)	receptor-specific
$DOSE_{plant}$	Total estimated daily dose of a chemical via consumption of contaminated plants in the diet of a receptor	mg/kg-day	calculated
C_{plant}	Chemical concentration in plant forage [b]	mg/kg (ww)	chemical-specific
IR_{food}	Food ingestion rate	kg/day (ww)	receptor-specific
P_{plant}	Percentage of plant mass in the diet of a receptor	unitless	receptor-specific
$DOSE_{invert}$	Total estimated daily dose of a chemical via consumption of contaminated invertebrate prey in the diet of a receptor	mg/kg-day	calculated
C_{invert}	Chemical concentration in invertebrate prey [c]	mg/kg (ww)	chemical-specific
P_{invert}	Percentage of invertebrate mass in the diet of a receptor	unitless	receptor-specific

Attachment 5-1
Wildlife Exposure Models Used To Estimate Daily Contaminant Intake For Terrestrial Receptors
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Definition	Units	Value [a]
$DOSE_{bird}$	Total estimated daily dose of a chemical via consumption of contaminated avian prey in the diet of a receptor	mg/kg-day	calculated
C_{bird}	Chemical concentration in avian prey [d]	mg/kg (ww)	chemical-specific
P_{bird}	Percentage of avian mass in the diet of a receptor	unitless	receptor-specific
$DOSE_{mammal}$	Total estimated daily dose of a chemical via consumption of contaminated mammal prey in the diet of a receptor	mg/kg-day	calculated
C_{mammal}	Chemical concentration in mammal prey [d]	mg/kg (ww)	chemical-specific
P_{mammal}	Percentage of mammal mass in the diet of a receptor	unitless	receptor-specific

Notes:

[a] Chemical-specific exposure parameters for terrestrial wildlife are estimated as either the reasonable maximum exposure (RME) (based on the lesser of the 95% Upper Confidence Limit on the arithmetic mean concentration or the maximum detected concentration) or the central tendency exposure (CTE) (based on the lesser of the maximum detected concentration or the average concentration for each chemical using one-half the sample quantitation limit for non-detects; maximum detected concentration may be less than the average for chemicals with low frequency of detection and high sample quantitation limits). Receptor-specific exposure parameters for terrestrial wildlife are documented in Attachment Table 5-3 through Table 5-6. Receptors and exposure pathway are summarized in Attachment Table 5-14.

[b] Chemical concentration of plant forage will be estimated by multiplying the soil EPC by the terrestrial plant BAF for a given chemical; BAFs are summarized in Attachment Table 5-10.

[c] Chemical concentration of soil invertebrate prey will be estimated using literature based BAFs. BAFs are summarized in Attachment Table 5-11.

[d] Chemical concentration of small mammal and small bird prey will be estimated by summing the products of 50% of the estimated invertebrate and plant tissue concentrations and multiplying this term by the small mammal / small bird BAF. The estimated invertebrate and plant dietary components of the small mammal / small bird prey species will be estimated by multiplying the soil EPC by the soil invertebrate and terrestrial plant BAFs. BAFs are summarized in Attachment Table 5-11.

mg/kg-day – milligrams per kilogram per day
kg – kilograms
mg/kg – milligrams per kilogram
dw – dry weight
kg/day – kilograms per day
ww – wet weight

Attachment 5-2
Wildlife Exposure Models Used To Estimate Daily Contaminant Intake For Semi-Aquatic Receptors
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Estimated Daily Intake

$$DOSE_{total} = DOSE_{water} + DOSE_{sed} + DOSE_{diet}$$

Surface Water Ingestion

$$DOSE_{water} = \frac{C_{water} * IR_{water} * SFF}{BW}$$

Incidental Sediment Ingestion

$$\mathrm{DOSE}_{sed} = \frac{\mathrm{C}_{sed} * \mathrm{IR}_{sed} * \mathrm{SFF}}{\mathrm{BW}}$$

Dietary Intake

$$DOSE_{diet} = DOSE_{plant} + DOSE_{invert} + \mathrm{DOSE}_{amphib} + \mathrm{DOSE}_{fish}$$

Aquatic Plant Intake

$$DOSE_{plant} = \frac{C_{plant} * IR_{food} * P_{plant} * SFF}{BW}$$

Aquatic Invertebrate Intake

$$DOSE_{invert} = \frac{C_{invert} * IR_{food} * P_{invert} * SFF}{BW}$$

Amphibian Intake

$$\mathrm{DOSE}_{amphib} = \frac{C_{amphib} * IR_{food} * P_{amphib} * SFF}{BW}$$

Fish Intake

$$\mathrm{DOSE}_{fish} = \frac{C_{fish} * IR_{food} * P_{fish} * SFF}{BW}$$

Attachment 5-2
Wildlife Exposure Models Used To Estimate Daily Contaminant Intake For Semi-Aquatic Receptors
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Definition	Units	Value [a]
$DOSE_{total}$	Total estimated daily dose of a chemical for a receptor species	mg/kg-day	calculated
$DOSE_{water}$	Total estimated daily dose of a chemical via the incidental surface water ingestion pathway for a receptor	mg/kg-day	calculated
$DOSE_{sed}$	Total estimated daily dose of a chemical via the incidental sediment ingestion pathway for a receptor	mg/kg-day	calculated
$DOSE_{diet}$	Total estimated daily dose of a chemical via the consumption of contaminated prey pathway for a receptor	mg/kg-day	calculated
C_{water}	Chemical concentration in surface water	mg/L	chemical-specific
IR_{water}	Drinking water ingestion rate	L/day	receptor-specific
SFF	Site Foraging Frequency (ratio of foraging or home range to Site area)	unitless	receptor-specific
BW	Body weight	kg	receptor-specific
C_{sed}	Chemical concentration in sediment	mg/kg (dw)	chemical-specific
IR_{sed}	Ingestion rate of sediment	kg/day (ww)	receptor-specific
$DOSE_{plant}$	Total estimated daily dose of a chemical via consumption of contaminated plants in the diet of a receptor	mg/kg-day	calculated
C_{plant}	Chemical concentration in aquatic plant forage [b]	mg/kg (ww)	chemical-specific
IR_{food}	Food ingestion rate	kg/day (ww)	receptor-specific
P_{plant}	Percentage of plant mass in the diet of a receptor	unitless	receptor-specific
$DOSE_{invert}$	Total estimated daily dose of a chemical via consumption of contaminated invertebrate prey in the diet of a receptor	mg/kg-day	calculated
C_{invert}	Chemical concentration in invertebrate prey [c]	mg/kg (ww)	chemical-specific

Attachment 5-2
Wildlife Exposure Models Used To Estimate Daily Contaminant Intake For Semi-Aquatic Receptors
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Definition	Units	Value [a]
P_{invert}	Percentage of invertebrate mass in the diet of a receptor	unitless	receptor-specific
$DOSE_{amphib}$	Total estimated daily dose of a chemical via consumption of contaminated amphibian prey in the diet of a receptor	mg/kg-day	calculated
C_{amphib}	Chemical concentration in amphibian prey [d]	mg/kg (ww)	chemical-specific
P_{amphib}	Percentage of amphibian mass in the diet of a receptor	unitless	receptor-specific
$DOSE_{fish}$	Total estimated daily dose of a chemical via consumption of contaminated fish prey in the diet of a receptor	mg/kg-day	calculated
C_{fish}	Chemical concentration in fish prey [d]	mg/kg (ww)	chemical-specific
P_{fish}	Percentage of fish mass in the diet of a receptor	unitless	receptor-specific

Notes:

[a] Chemical-specific exposure parameters for semi-aquatic wildlife are estimated as either the reasonable maximum exposure (RME) (based on the lesser of the 95% Upper Confidence Limit on the arithmetic mean concentration or the maximum detected concentration) or the central tendency exposure (CTE) (based on the lesser of the maximum detected concentration or the average concentration using one-half the sample quantitation limit for non-detects; the maximum detected concentration may be less than the average for chemicals with low frequency of detection and high sample quantitation limits). Receptor-specific exposure parameters for semi-aquatic wildlife are documented in Attachment Table 5-7 through Table 5-10. Receptors and exposure pathway are summarized in Attachment Table 5-14.

[b] Chemical concentration of plant forage will be estimated by multiplying the sediment EPC by the aquatic plant BAF for a given chemical; BAFs are summarized in Attachment Table 5-11.

[c] Chemical concentration of sediment invertebrate prey will be estimated using literature based BAFs. BAFs are summarized in Attachment Table 5-11.

[d] Chemical concentration of amphibian and fish prey will be estimated using literature based BAFs. BAFs are summarized in Attachment Table 5-11.

mg/kg-day – milligrams per kilogram per day
mg/L – milligrams per liter
L/day – liters per day
mg/kg – milligrams per kilogram
dw – dry weight
kg/day – kilograms per day
ww – wet weight

Attachment 5-3
Exposure Parameters - American Robin
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**American Robin**				
Scientific Name	***Turdus migratorius***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	0.48	Average foraging home range of adults feeding nestlings and fledglings in an Ontario deciduous forest.	Weatherhead and McRae, 1990
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF= exposure area/home range, maximum of 1.	
Dietary Composition				Prefer earthworms but will also consume insects (fly, beetle, moth/butterfly larvae) and other soil invertebrates as well as vegitation.	USEPA, 1993
birds	P_{bird}	unitless	0%		
mammals	P_{mam}	unitless	0%		
invertebrates	P_{insect}	unitless	68%		USEPA, 1993
vegetation	P_{veg}	unitless	32%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.037	Calculated using regression equation for insectivorous birds: IR_{food} (g ww/day) = 1.633 * BW $^{0.705}$ (g).	Nagy, 2001
Soil Ingestion Rate	IR_{soil}	kg/day dw	0.00053	10% of daily food ingestion rate on a dry weight basis [b]. Value is selected based on the published value for the American woodcock.	Beyer *et al.* , 1994
Body Weight	BW	kg	0.082	Average adult breeding and nonbreeding female weights reported in one study (New York)	USEPA, 1993

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Notes:

[a] SFF values are presented by exposure area in Table 5-14.

[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
- 68% for mammals (used as a surrogate for bird tissue)
- 84% for invertebrates
- 85% for vegetation

dw - dry weight
g - grams
kg - kilograms
ww - wet weight

Attachment 5-3
Exposure Parameters - American Robin
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Beyer, N., E. Connor, and S. Gerould, 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage., 58(2): 375-382.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Weatherhead, P.J. and S.B. McRae, 1990. Brood care in American robins: implications for mixed reproductive strategies by females. Anim. Behav. 39: 1179-1188.

Attachment 5-4
Exposure Parameters - Red-tailed Hawk
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Red-Tailed Hawk**				
Scientific Name	***Buteo jamaicensis***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	859	Average for breeding pairs presented in USEPA, 1993	USEPA, 1993
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF= exposure area/home range, maximum of 1.	
Dietary Composition				Mostly small mammals and birds.	USEPA, 1993
birds	P_{bird}	unitless	10%		
mammals	P_{mam}	unitless	90%		
invertebrates	P_{insect}	unitless	0%		
vegetation	P_{veg}	unitless	0%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.33	Calculated using regression equation for carnivorous birds: IR_{food} (g ww/day) = 3.048 * BW $^{0.665}$ (g)	Nagy, 2001
Soil Ingestion Rate	IR_{soil}	kg/day dw	0.0010	No Sources Identified; Assumed 1% based on feeding strategy on a dry weight basis [b].	EC, 2012
Body Weight	BW	kg	1.1	Average adult weights presented in USEPA, 1993	USEPA, 1993

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Notes:

[a] SFF values are presented by exposure area in Table 5-14.

[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
- 68% for mammals (used as a surrogate for bird tissue)
- 84% for invertebrates
- 85% for vegetation

dw - dry weight
g - grams
kg - kilograms
ww - wet weight

Attachment 5-4
Exposure Parameters - Red-tailed Hawk
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Environment Canada (EC), 2012. Federal Contaminated Sites Action Plan (FCSAP). Ecological Risk Assessment Guidance. (see page A-61; http://www.geoenvirologic.ca/Documents/20120631_ERAGuidance_ModuleC_Eng_Final.pdf).

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Attachment 5-5
Exposure Parameters - Short Tailed Shrew
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Short-tailed Shrew**				
Scientific Name	***Blarina brevicauda***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	0.32	Average annual home ranges in southern Manitoba/tamarack bog habitat.	USEPA, 1993
Site Foraging Frequency	SFF	unitless	[a]	calculated: SFF=exposure area/home range, maximum of 1.	
Dietary Composition				Consumes plants, fungi, insects, worms, snails, and other invertebrates as well as mice, voles, and other vertebrates. Dietary composition estimated from a New York population based on % volume in stomach contents from samples collected between June and October.	USEPA, 1993; Whitaker and Feraro, 1963
birds	P_{bird}	unitless	0%		
mammals	P_{mam}	unitless	9%		
invertebrates	P_{insect}	unitless	77%		
vegetation	P_{veg}	unitless	14%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.0067	Calculated using regression equation for insectivorous mammals: IR_{food} (g ww/day) = 1.130 * BW $^{0.622}$ (g).	Nagy, 2001
Soil Ingestion Rate	IR_{soil}	kg/day dw	0.000025	2.2% of daily food ingestion rate (average of meadow vole and white-footed mouse) on a dry weight basis [b]	Beyer *et al.*, 1994
Body Weight	BW	kg	0.017	Average female weights in western Pennsylvania population	Guilday, 1957

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Notes:

[a] SFF values are presented by exposure area in Table 5-14.

[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
- 68% for mammals (used as a surrogate for bird tissue)
- 84% for invertebrates
- 85% for vegetation

dw - dry weight
g - grams
kg - kilograms
ww - wet weight

Attachment 5-5
Exposure Parameters - Short Tailed Shrew
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Beyer, N., E. Connor, and S. Gerould, 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage., 58(2): 375-382.

Guilday, J. E., 1957. Individual and geographic variation in Blarina brevicaudafrom Pennsylvania. Ann. Carnegie Mus. 35: 41-68.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Whitaker, J.O., Jr., and M.G. Ferraro, 1963. Summer food of 220 short-tailed shrews from Ithica, New York; J. Mammal. 44:419.

Attachment 5-6
Exposure Parameters - Red Fox
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Red Fox**				
Scientific Name	***Vulpes vulpes***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	699	Home range for an adult female in the spring in Minnesota woodland, field, and swamp habitats.	Sargeant, 1972
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF=exposure area/home range, maximum of 1.	
Dietary Composition				Red fox feed on small mammals, birds, insects, and fruit.	Korschgen, 1959; Samuel and Nelson, 1982; Knable, 1974
birds	P_{bird}	unitless	15%		
mammals	P_{mam}	unitless	65%		
invertebrates	P_{insect}	unitless	5%		
vegetation	P_{veg}	unitless	15%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.59	Calculated using regression equation for carnivorous mammals: IR_{food} (g ww/day) = 0.469 * BW $^{0.848}$ (g).	Nagy, 2001
Soil Ingestion Rate	IR_{soil}	kg/day dw	0.0047	2.8% of daily food ingestion rate on a dry weight basis [b]	Beyer *et al.*, 1994
Body Weight	BW	kg	4.5	Average male and female weights in the spring in Illinois and in the fall in Iowa.	Storm *et al.,* 1976

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Notes:

[a] SFF values are presented by exposure area in Table 5-14.

[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
- 68% for mammals (used as a surrogate for bird tissue)
- 84% for invertebrates
- 85% for vegetation

dw - dry weight
g - grams
kg - kilograms
ww - wet weight

Attachment 5-6
Exposure Parameters - Red Fox
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Beyer, N., E. Connor, and S. Gerould, 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage., 58(2): 375-382.

Knable, A.E., 1974. Seasonal trends in the utilization of major food groups by the red fox (Vulpes fulva) in Union County, Illinois. Trans. III. State Acad. Sc 66:113-115.

Korschgen, L.J., 1959. Food habits of the red fox in Missouri. J. Wildl. Manage. 23:168-176.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

Samuel, D.E. and B.B. Nelson, 1982. Foxes. *Cited in:* Chapman, J.A. and G.A. Feldhammer, eds. Wild mammals of North America. Baltimore, MD: Johns Hopkins University Press; pp. 475 - 490.

Sargeant, A.B., 1972. Red fox spatial characteristics in relation to waterfowl predation. J. Wildl. Manage. 36:225-236.

Storm, G.L., R.D. Andrews, R.L. Phillips, *et al.,* 1976. Morphology, reproduction, dispersal and mortality of midwestern red fox populations. Wildl. Monogr. 49: 1-82.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Attachment 5-7
Exposure Parameters - Marsh Wren
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Marsh Wren**				
Scientific Name	***Cistothorus palustris***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	0.12		USEPA, 1993
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF=exposure area/home range, maximum of 1.	
Dietary Composition				Diet almost entirely consists of aquatic invertebrates	USEPA, 1993
fish	P_{fish}	unitless	0%		
invertebrates	P_{invert}	unitless	100%		
amphibians	P_{amphib}	unitless	0%		
vegetation	P_{veg}	unitless	0%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.0092	Calculated using regression equation for omnivorous birds: IRfood (g ww /day) = 2.094 * BW $^{0.627}$ (g).	Nagy, 2001
Water Ingestion Rate	IR_{water}	l/day	0.0028	Calculated using regression equation for birds: IRwater (l/day) = 0.059 * BW $^{0.67}$ (kg) and selected body weight.	Calder and Braun, 1983
Sediment Ingestion Rate	IR_{sed}	kg/day dw	0.00013	9% of daily food ingestion rate on a dry weight basis [b]	Beyer *et al.*, 1994
Body Weight	BW	kg	0.011	Average adult value for studies done in georgia salt marsh habitats.	USEPA, 1993

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Notes:

[a] SFF values are presented by exposure area in Table 5-14.

[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
84% for invertebrates (used as a surrogate for fish and amphibian tissue)
85% for vegetation

dw - dry weight
g - grams
kg - kilograms
l - liters
ww - wet weight

Attachment 5-7
Exposure Parameters - Marsh Wren
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Beyer, N., E. Connor, and S. Gerould, 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage., 58(2): 375-382.

Calder, W.A., and E.J. Braun, 1983. Scaling of osmotic regulation in mammals and birds, Am. J. Physiol., 244: R601-R606.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Attachment 5-8
Exposure Parameters - Green Heron
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Green Heron**				
Scientific Name	***Butorides striatus***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	1.0	Value estimented for breeding pairs, which tend to remain within close proximity to their nest durring breeding season.	Davis and Kushlan, 1994.
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF= exposure area/home range, maximum of 1.	
Dietary Composition				Aquatic and terrestrial insects, fish, amphibians, reptiles and crustaceans	DeGraaf and Rudis, 1986
fish	P_{fish}	unitless	25%		
invertebrates	P_{invert}	unitless	50%		
amphibians	P_{amphib}	unitless	25%		
vegetation	P_{veg}	unitless	0%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.060	Calculated using regression equation for omnivorous birds: IRfood (g ww /day) = 2.094 * BW $^{0.627}$ (g).	Nagy, 2001
Water Ingestion Rate	IR_{water}	l/day	0.021	Calculated using regression equation for birds: IRwater (l/day) = 0.059 * BW $^{0.67}$ (kg) and selected body weight.	Calder and Braun, 1983
Sediment Ingestion Rate	IR_{sed}	kg/day dw	0.00032	3.3% of daily food ingestion rate on a dry weight basis [b]. Value is based on published value for the mallard.	Beyer *et al.*, 1994
Body Weight	BW	kg	0.21		Palmer, 1962

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Notes:
[a] SFF values are presented by exposure area in Table 5-14.
[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
84% for invertebrates (used as a surrogate for fish and amphibian tissue)
85% for vegetation

dw - dry weight
g - grams
kg - kilograms
l - liters
ww - wet weight

Attachment 5-8
Exposure Parameters - Green Heron
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Beyer, N., E. Connor, and S. Gerould, 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage., 58(2): 375-382.

Calder, W.A., and E.J. Braun, 1983. Scaling of osmotic regulation in mammals and birds, Am. J. Physiol., 244: R601-R606.

Davis, Jr., W. E. and J. A. Kushlan. 1994. Green Heron (Butorides virescens), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/129

DeGraff, R.M., and D.D. Rudis, 1986. New England Wildlife: Habitat, Natural History, and Distribution; General Technical Report NE-108; U.S.D.A. Forest Service, Northeastern Forest Experimentation Station.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

Palmer, R. S., ed. 1962. Handbook of North American birds. Vol. 1. Yale University Press, New Haven, CT. 567pp.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Attachment 5-9
Exposure Parameters - Raccoon
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Raccoon**				
Scientific Name	***Procyon lotor***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	108	Average for adult females in Michigan riparian habitats.	USEPA, 1993
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF= exposure area/home range, maximum of 1.	
Dietary Composition				Diet consists primarily of vegitable matter and crayfish, insects and frogs.	USEPA, 1993
fish	P_{fish}	unitless	0%		
amphibians	P_{amphib}	unitless	10%		
invertebrates	P_{invert}	unitless	10%		
vegetation	P_{veg}	unitless	80%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.48	Calculated using regression equation for omnivorous mammals: IR_{food} (g ww/day) = 1.346 * BW $^{0.678}$ (g).	Nagy, 2001
Water Ingestion Rate	IR_{water}	l/day	0.48	Calculated using regression equation for mammals: IRwater (l/day) = 0.099 * BW $^{0.90}$ (kg).	Calder and Braun, 1983
Sediment Ingestion Rate	IR_{sed}	kg/day dw	0.0068	9.4% of daily food ingestion rate on a dry weight basis [b].	Beyer *et al.*, 1994
Body Weight	BW	kg	5.7	Average for adult females in Missouri.	USEPA, 1993

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Notes:
[a] SFF values are presented by exposure area in Table 5-14.
[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
84% for invertebrates (used as a surrogate for fish and amphibian tissue)
85% for vegetation

dw - dry weight
g - grams
kg - kilograms
l - liters
ww - wet weight

Attachment 5-9
Exposure Parameters - Raccoon
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Beyer, N., E. Connor, and S. Gerould, 1994. Estimates of soil ingestion by wildlife. J. Wildl. Manage., 58(2): 375-382.

Calder, W.A., and E.J. Braun, 1983. Scaling of osmotic regulation in mammals and birds, Am. J. Physiol., 244: R601-R606.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Attachment 5-10
Exposure Parameters - Muskrat
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Common Name	**Muskrat**				
Scientific Name	***Ondatra zibethicus***				
Exposure parameter	**Symbol**	**Units**	**Selected Value**	**Reported Values/Notes**	**Reference**
Home Range	HR	ha	0.13	Muskrats are typically very territorial and remain within a small home range.	USEPA, 1993
Site Foraging Frequency	SFF	unitless	[a]	Calculated: SFF=exposure area/home range, maximum of 1.	
Dietary Composition				Mostly aquatic plants; also fish, frogs, crayfish, and mollusks. Values conservatively estimated to include 20% animal diet.	USEPA, 1993
fish	P_{fish}	unitless	5%		
invertebrates	P_{amphib}	unitless	10%	Includes crustaceans and mollusks	
amphibians	P_{invert}	unitless	5%		
vegetation	P_{veg}	unitless	80%		
Food Ingestion Rate	IR_{food}	kg/day ww	0.16	Calculated using regression equation for omnivorous mammals: IR_{food} (g ww/day) = 1.346 * BW $^{0.678}$ (g).	Nagy, 2001
Water Ingestion Rate	IR_{water}	l/day	0.11	Calculated using regression equation for mammals: IRwater (l/day) = 0.099 * BW $^{0.90}$ (kg).	Calder and Braun, 1993
Sediment Ingestion Rate	IR_{sed}	kg/day dw	0.00054	2.2% of daily food ingestion rate on a dry weight basis [b].	USEPA, 1999
Body Weight	BW	kg	1.2		USEPA, 1993

Prepared by: SFR 12/2/2013
Checked by: TR 12/4/2013

Notes:
[a] SFF values are presented by exposure area in Table 5-14.
[b] Calculated from wet weight food ingestion rates using dietary water content values from USEPA (2005). Water content values are:
84% for invertebrates (used as a surrogate for fish and amphibian tissue)
85% for vegetation

dw - dry weight
g - grams
kg - kilograms
l - liters
ww - wet weight

Attachment 5-10
Exposure Parameters - Muskrat
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

References:

Calder, W.A., and E.J. Braun, 1983. Scaling of osmotic regulation in mammals and birds, Am. J. Physiol., 244: R601-R606.

Nagy, K.A., 2001, Food Requirements of wild animals: predictive equations for free-living mammals, reptiles, and birds. Nutrition Abstracts and Reviews, Series B 71, 21R-31R.

USEPA, 1993. Wildlife Exposure Factors Handbook; United States Environmental Protection Agency, Office of Research and Development; EPA/600/R-93/187a; December 1993; Washington, D.C.

USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Volumes 1, 2 & 3. Peer Review Draft. (EPA 530-D-99-001A).

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Table 5-11
Summary of Bioacumulation Factors for Ecological Risk Model by Receptor Type
Preliminary Remedial Investigation Report
Operable Unit 1 for the Olin Property
Wilmington, Massachusetts

COPEC	log K_{ow} [a]		Terrestrial Plant [b]		Terrestrial Invertebrate [c]		Small Mammal [d]		Small Bird [d]		Aquatic Plant [d]		Aquatic Invertebrate [e]		Fish/ Amphibians [f]	
Volatile Organics																
2,4,4-Trimethyl-1-pentene	4.55		1.8E-02	2	1.0E+00	2	5.3E-02	2	5.3E-02	2	1.8E-02	2	1.0E+00	2	1.1E-01	6
2,4,4-Trimethyl-2-pentene	4.00		3.8E-02	2	1.0E+00	2	1.5E-02	2	1.5E-02	2	3.8E-02	2	1.0E+00	2	3.2E-01	6
4-iso-Propyltoluene	4.10		3.3E-02	2	1.0E+00	2	1.9E-02	2	1.9E-02	2	3.3E-02	2	1.0E+00	2	2.6E-01	6
Acetaldehyde	-0.34		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Acetone	-0.24		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Benzene	2.13		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Formaldehyde	0.35		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Tetrachloroethene	3.40		8.4E-02	2	1.0E+00	2	3.8E-03	2	3.8E-03	2	8.4E-02	2	1.0E+00	2	1.0E+00	4
Semivolatile Organics																
3 & 4 -Methylphenol	1.96		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Acetophenone	1.58		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Aniline	0.90		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Benzaldehyde	1.48		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Benzo(a)anthracene	5.76		3.6E-03	2	1.1E+00	2	8.7E-01	2	8.7E-01	2	3.6E-03	2	1.1E+00	2	3.4E-01	3
Benzo(a)pyrene	6.13		2.2E-03	2	1.1E+00	2	2.0E+00	2	2.0E+00	2	2.2E-03	2	1.1E+00	2	2.2E-01	3
Benzo(g,h,i)perylene	6.63		1.1E-03	2	1.1E+00	2	6.4E+00	2	6.4E+00	2	1.1E-03	2	1.1E+00	2	4.7E-02	3
Benzyl Alcohol	1.10		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Bis(2-ethylhexyl)phthalate	7.60		3.1E-04	2	1.1E+00	2	6.0E+01	2	6.0E+01	2	3.1E-04	2	1.1E+00	2	1.0E+00	4
Caprolactam	0.66		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Chrysene	5.81		3.4E-03	2	1.1E+00	2	9.7E-01	2	9.7E-01	2	3.4E-03	2	1.1E+00	2	4.4E-01	3
Dibenzo(a,h)anthracene	6.75		9.7E-04	2	1.1E+00	2	8.5E+00	2	8.5E+00	2	9.7E-04	2	1.1E+00	2	3.8E-01	3
Diphenylamine	3.50		7.3E-02	2	1.0E+00	2	4.8E-03	2	4.8E-03	2	7.3E-02	2	1.0E+00	2	8.6E-01	6
Diphenyl Ether	4.21		2.9E-02	2	1.0E+00	2	2.4E-02	2	2.4E-02	2	2.9E-02	2	1.0E+00	2	2.1E-01	6
Diphenylmethanone	3.18		1.1E-01	2	1.1E+00	2	2.3E-03	2	2.3E-03	2	1.1E-01	2	1.1E+00	2	1.6E+00	6
Fluoranthene	5.16		8.1E-03	2	1.1E+00	2	2.2E-01	2	2.2E-01	2	8.1E-03	2	1.1E+00	2	8.0E-01	3
Naphthalene	3.30		9.6E-02	2	1.0E+00	2	3.0E-03	2	3.0E-03	2	9.6E-02	2	1.0E+00	2	2.6E+00	3
N-Nitroso-diphenylamine	3.13		1.2E-01	2	1.1E+00	2	2.0E-03	2	2.0E-03	2	1.2E-01	2	1.1E+00	2	1.7E+00	6
Phenanthrene	4.46		2.0E-02	2	1.0E+00	2	4.3E-02	2	4.3E-02	2	2.0E-02	2	1.0E+00	2	3.0E-01	3
Phenol	1.46		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Pyrene	4.88		1.2E-02	2	1.0E+00	2	1.1E-01	2	1.1E-01	2	1.2E-02	2	1.0E+00	2	5.1E-01	3
Pesticides																
4,4'-DDD	6.02		2.4E-03	2	1.1E+00	2	1.7E+00	2	1.7E+00	2	2.4E-03	2	1.1E+00	2	2.8E-01	2
4,4'-DDE	6.51		9.6E-04	2	1.1E+00	2	8.7E+00	2	8.7E+00	2	9.6E-04	2	1.1E+00	2	7.7E+00	2
4,4'-DDT	6.91		1.4E-03	2	1.1E+00	2	4.2E+00	2	4.2E+00	2	1.4E-03	2	1.1E+00	2	1.7E+00	2
Alpha-BHC	3.80		5.1E-02	2	1.0E+00	2	9.1E-03	2	9.1E-03	2	5.1E-02	2	1.0E+00	2	2.5E+00	2
Gamma-BHC/Lindane	3.72		5.9E-02	2	1.0E+00	2	7.0E-03	2	7.0E-03	2	5.9E-02	2	1.0E+00	2	6.9E-01	2
Hexachlorobenzene	5.73		4.5E-03	2	1.1E+00	2	6.0E-01	2	6.0E-01	2	4.5E-03	2	1.1E+00	2	9.0E-02	2

Table 5-11
Summary of Bioacumulation Factors for Ecological Risk Model by Receptor Type
Preliminary Remedial Investigation Report
Operable Unit 1 for the Olin Property
Wilmington, Massachusetts

COPEC	log K_{ow} [a]		Terrestrial Plant [b]		Terrestrial Invertebrate [c]		Small Mammal [d]		Small Bird [d]		Aquatic Plant [d]		Aquatic Invertebrate [e]		Fish/ Amphibians [f]	
Metals																
Aluminum	-		5.7E-04	3	8.6E-03	3	5.3E-03	3	5.3E-03	3	5.7E-04	3	8.6E-03	3	8.6E-03	7
Antimony	0.73		2.0E-03	3	-		5.0E-02	3	5.0E-02	3	2.0E-03	3	-		-	
Arsenic	0.68		2.8E-02	3	3.6E-02	3	1.0E-01	3	1.0E-01	3	2.8E-02	3	1.3E-01	3	1.3E-01	7
Barium	0.23		3.1E-02	3	1.8E-02	3	1.1E-02	3	1.1E-02	3	3.1E-02	3	1.8E-02	3	1.8E-02	7
Beryllium	-0.57		2.0E-03	3	9.0E-03	3	5.0E-02	3	5.0E-02	3	2.0E-03	3	9.0E-03	3	9.0E-03	7
Cadmium	-0.07		5.6E-02	3	9.4E-02	3	8.7E-02	3	8.7E-02	3	5.6E-02	3	4.6E-01	3	4.6E-01	7
Chromium	0.23		8.2E-03	3	[g]		[g]		5.3E-02	3	8.2E-03	3	[g]		[g]	
Chromium, Hexavalient	-		8.2E-03	3	[g]		[g]		5.3E-02	3	8.2E-03	3	[g]		[g]	
Cobalt	0.23		1.5E-03	3	2.4E-02	3	4.1E-03	3	4.1E-03	3	1.5E-03	3	2.4E-02	3	2.4E-02	7
Copper	-0.57		4.1E-02	3	3.0E-02	3	1.4E-01	3	1.4E-01	3	4.1E-02	3	1.6E+00	3	1.6E+00	7
Iron	-0.77		8.5E-04	3	7.2E-03	3	1.1E-01	3	1.1E-01	3	8.5E-04	3	7.2E-03	3	7.2E-03	7
Lead	0.73		3.5E-02	3	7.6E-02	3	9.6E-02	3	9.6E-02	3	3.5E-02	3	6.6E-02	3	6.6E-02	7
Manganese	0.23		1.6E-02	3	4.4E-02	3	4.1E-03	3	4.1E-03	3	1.6E-02	3	4.4E-02	3	4.4E-02	7
Mercury	0.62		2.6E-02	3	6.5E-02	3	1.1E-02	3	1.1E-02	3	2.6E-02	3	2.8E+00	3	2.8E+00	7
Nickel	-0.57		4.7E-02	3	9.5E-01	3	7.1E-02	3	7.1E-02	3	4.7E-02	3	8.2E-01	3	8.2E-01	7
Silver	0.23		2.8E-03	3	4.1E-01	3	8.0E-04	3	8.0E-04	3	2.8E-03	3	4.1E-01	3	4.1E-01	7
Thallium	0.23		8.0E-04	4	-		2.2E-02	3	2.2E-02	3	8.0E-04	3	-		-	
Tin	-		6.0E-03	4	-		4.0E+00	3	4.0E+00	3	6.0E-03	3	-		-	
Selenium	0.24		8.6E-02	3	5.4E-02	3	4.1E-02	3	4.1E-02	3	8.6E-02	3	5.4E-02	3	5.4E-02	7
Vanadium	-		9.7E-04	3	8.4E-03	3	2.5E-03	3	2.5E-03	3	9.7E-04	3	8.4E-03	3	8.4E-03	7
Zinc	-0.47		5.0E-02	3	5.6E-02	3	2.7E-02	3	2.7E-02	3	5.0E-02	3	2.6E-02	3	2.6E-02	7
Inorganics																
Bromide	0.63		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
Chloride	0.54		-		-		-		-		-		-		-	
Cyanide	-0.69		-		-		-		-		-		-		-	
Nitrite	0.06		-		-		-		-		-		-		-	
Sulfate	-2.20		-		-		-		-		-		-		-	
Specialty Compounds																
4-Nonylphenol	5.92		2.9E-03	2	1.1E+00	2	1.3E+00	2	1.3E+00	2	2.9E-03	2	1.1E+00	2	6.5E-03	6
Hydrazine	-2.07		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1
N-N-Dimethylformamide	-1.01		0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1	0.0E+00	1

Prepared by: SFR 3/18/2011
Checked by: BJR 3/18/2011
Revised: SFR 2/5/2014

Notes:

COPEC - Chemical of Potential Ecological Concern

Units for bioaccumulation factors (BAFs) are mg/kg wet weight tissue over mg/kg dry weight sediment/soil.

Assumed that organic compounds with LogK_{ow} < 3.0 do not significantly accumulate in biological tissue.

- no value available

[a] Octanol-water partition coefficients obtained from the SRS Interactive LogK_{ow} database.

Table 5-11
Summary of Bioacumulation Factors for Ecological Risk Model by Receptor Type
Preliminary Remedial Investigation Report
Operable Unit 1 for the Olin Property
Wilmington, Massachusetts

[b] Basis for plant uptake factors:

1. Bioaccumulation assumed to be zero for organic analytes with LogK_{ow}s <3.0.
2. Calculated using the following equation from Travis and Arms (1988): log (Plant Uptake Factor) = 1.588 - 0.578 Log10K_{ow}. Estimate converted to wet-weight by multiplying by a factor of 0.2 assuming forage is 80% water based on water content values from USEPA (2005).
3. Selected BAFs for uptake of inorganics from soil to plants were derived from information provided in Sample et al., 1998a. Preference was given to recommended regression estimates, then median values derived for the full ORNL dataset. ORNL regression estimates are calculated by exposure point concentration. Values shown are based on a concentration of 10 ug/g dw. zinc, respectively.
4. Available Baes et al.(1984) Bv values were used for those analytes lacking ORNL data.

[c] Basis for terrestrial invertebrate uptake factors:

1. Bioaccumulation assumed to be zero for organic analytes with LogK_{ow}s <3.0.
2. Calculated using soil water to invertebrate equilibrium partitioning model (Jager, 1998); model estimated BCFs were divided by the soil partition coefficient to derive the BSAF. Units in kgsoil/kgworm. Model was parameterized with bulk density (water,lipid) and fraction water values as presented in Jager, 1998. Soil organic carbon content assumed to be 0 percent. BSAF not estimated for analytes with LogK_{ow}s < 3 (Jager, 1998).
3. BAFs for uptake of inorganics from soil to invertebrates were derived from information summarized in Sample et al., 1998b. ORNL regression estimates are calculated based on exposure point concentrations. Values shown are based on a concentration of 10 ug/g dw.

[d] Basis for BAFs for small mammals and birds:

1. Analytes with logK_{ow} < 3 are assumed not to bioaccumulate in ecological food webs.
2. Estimated using biotransfer factor QSAR model (Travis and Arms,1988) for organic analytes.
3. Selected value for inorganics from Sample et al., 1998c or Baes et al., 1984.

[e] Basis for aquatic invertebrate uptake factors:

1. Bioaccumulation assumed to be zero for organic analytes with LogK_{ow}s <3.0.
2. Calculated using soil water to invertebrate equilibrium partitioning model (Jager, 1998); model estimated BCFs were divided by the soil partition coefficient to derive the BSAF. Units in kgsoil/kgworm. Model was parameterized with bulk density (water,lipid) and fraction water values as presented in Jager, 1998. Soil organic carbon content assumed to be 0 percent. BSAF not estimated for analytes with LogK_{ow}s < 1 (Jager, 1998).
3. BAFs for uptake of inorganics from sediment to invertebrates were derived from information summarized in Sample et al., 1998d. Regression estimates are calculated by exposure point concentration. Values shown are based on a concentration of 10 ug/g dw.

[f] Basis for BAFs for fish:

1. Bioaccumulation assumed to be zero for organic analytes with LogK_{ow}s <3.0.
2. Selected BSAF as summarized in USEPA (1998).
3. Overall Mean value from USCOE, 2003 (BSAF database).
4. BSAFs presented in USEPA, 1997.
5. BSAFs derived using regression equations provided in PTI (2000).
6. BSAFs calculated using equilibrium-partitioning assumptions and a water-fish QSAR prediction model (Travis and Arms, 1988).
7. BSAFs for inorganic analytes were derived for aquatic invertebrates based on recommended values in Sample et al., 1998d.
8. BAF for aquatic invertebrate used as a surrogate uptake factor when no fish BAFs was available.

Table 5-11
Summary of Bioacumulation Factors for Ecological Risk Model by Receptor Type
Preliminary Remedial Investigation Report
Operable Unit 1 for the Olin Property
Wilmington, Massachusetts

[g] Defensible soil-to-invertebrate and sediment-to-invertebrate chromium BAFs were not available in the scientific literature. Instead Cinv was set to 20/mg/kg dw (4 mg/kg ww).

References:

Baes, C.F., III. R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture; Oak Ridge National Laboratories, Environmental Sciences Division; ORNL-5786.

Jager, T., 1998. Mechanistic approach for estimating bioconcentration of organic chemicals in earthworms (Oligochaeta); Environ. Toxicol. Chem. 17(10):2080-2090.

PTI, Environmental Services, 2000. Analysis of BSAF Values for Nonpolar Organic Compounds in Finfish and Shellfish; report prepared for the Washington State Department of Ecology.

Sample, B.E., J.J. Beauchamp, R.A. Efroymsom, G.W. Suter, II, and T.L. Ashwood, 1998a. Empirical Models for the Uptakd of Inorganic Chemicals from Soil to Plants; U.S. Department of Energy, Oak Ridge National Laboratories; BJC/OR-133.

Sample, B.E., J.J. Beauchamp, R.A. Efroymsom, G.W. Suter, II, and T.L. Ashwood, 1998b. Development and Validation of Bioaccumulation Models for Earthworms; Oak Ridge National Laboratories; Environmental Restoration Program; ES/ER/TM-220.

Sample, B.E., J.J. Beauchamp, R.A. Efroymsom, and G.W. Suter, l998c. Development and Validation of Bioaccumulation Models for Small Mammals; Oak Ridge National Laboratories; Environmental Restoration Program; ES/ER/TM-219.

Sample et al., 1998d. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation; U.S. Department of Energy; Oak Ridge National Laboratories, BJC/OR-112; August 1998.

Travis, C.C., and A.D. Arms, 1988. Bioconcentration of organics in beef, milk and vegetation; Environ. Sci. Technol. 22(3):271-274.

USCOE, 2003. U.S. Army Corps of Engineers Waterways Experiment Station BSAF database.

USEPA, 1997. Methods for Selecting Biota-Sediment Accumulation Factors and Percent Lipids in Fish Tissue Used for Deriving Theoretical Bioaccumulation Potentials; Appendix C in The Incidence and Severity of Sediment Contamination in Surface Waters of the United States; U.S. Environmental Protection Agency, Office of Science and Technology; EPA 823-R-97-006, September 1997.

USEPA, 1998. Ambient Water Quality Criteria Derivation Methodology Human Health Techical Support Document (Final Draft); Office of Science and Technology; EPA/822/B-98/005.

USEPA, 2005. Attachment 4-1: Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs) Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. OSWER Directive 9285.7-55 Issued November 2003. February 2005.

Attachment 5-12
TRVs For Birds
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
4-Nitrophenol	NA	NA															
Benzyl Alcohol	NA	NA															
Benzaldehyde	NA	NA															
Diphenyl ether	NA	NA															
Azobenzene	NA	NA															
Caprolactum	NA	NA															
2,4,4-Trimethyl-1-pentene	NA	NA															
2,4,4-Trimethyl-2-Pentene	NA	NA															
Phenol	NA	NA															
Bis(2-Ethylhexyl)phthalate	1.1E+00	1.1E+01	c	food	ringed dove	10 mg/kg food (1.1 mg/kg/d)	No effects on eggshell thickness, ashed egg weight, rate of water loss, surface area, or permeability of eggs laid.	Sample et al., 1996	NOAEL	1.1		4 w	7	1	1	1	
Di-n-octylphthalate	1.1E+00	1.1E+01	c	oral (diet)	ringed dove	10 ppm (1.1 mg/kg/d)	10% reduction in egg shell thickness	Sample et al., 1996	NOAEL	1.11		4 w	7	1	1	1	Di-n-butylphthalate used as a surrogate value
Hexachlorobenzene	2.9E+00	2.9E+01	sc	oral (capsule)	mallard		mortality	Hudson et al., 1984	LD50	1450		14 d	7	100	5	1	
Diphenylmethanone	NA	NA															
Diphenylamine	NA	NA															
Tetrachloroethene	NA	NA															
Pyrene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
3 & 4 - Methylphenol	NA	NA															
Methyl tert-Butyl Ether	NA	NA															
Chromium (VI)	1.6E+00	1.6E+01	sc	food	chicken	up to 100 ppm (8.2 mg/kg/d)	No adverse effects on survival, growth, or food utilization efficiency	Eisler, 1986	NOAEL	8.2		32 d	7	1	5	1	Chromium VI; males; assume BW=0.534; food consumption= 0.044 kg/d (EPA, 1988a)
Benzo(g,h,i)perylene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920.0		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Indeno(1,2,3-cd)pyrene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920.0		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Benzo(b)fluoranthene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Fluoranthene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Benzo(k)fluoranthene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920.0		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Chrysene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920.0		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Hydrazine	NA	NA															
alpha-BHC	2.0E+00	2.0E+01	c	oral intubation	mallard	20 mg/kg/d	egg shell thickness, egg production	Sample et al., 1996	LOAEL	20	20	8 w	7	10	1	1	Value for gamma-BHC used as a surrogate
Formaldehyde	NA	NA															
4,4'-DDT	1.3E+01	1.3E+02	c	food	Japanese quail		egg weight and egg production	Scott et al., 1975	NOAEL	12.99		15 w	7	1	1	1	
Benzo(a)pyrene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Dibenzo(a,h)anthracene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Benzo(a)anthracene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Gamma-BHC/Lindane	2.0E+00	2.0E+01	c	oral intubation	mallard	20 mg/kg/d	reduced eggshell thickness and egg production; longer interval between egg laying	Sample et al., 1996	LOAEL	20	20	8 w	7	10	1	1	

Attachment 5-12
TRVs For Birds
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
N-Nitroso-di-n-propylamine	NA	NA															
Aniline	NA	NA															
Benzoic acid	NA	NA															
Acetone	8.4E+03	8.4E+04	sc	oral (diet)	ring-necked pheasant		mortality	Hill et al., 1975	NOAEL	42137.0212		5 d	7	1	5	1	
Dimethylformamide	NA	NA															
4-Chlorophenyl-phenylether	NA	NA															
Benzene	NA	NA															
4,4`-DDD	1.3E+01	1.3E+02	c	food	Japanese quail		egg weight and egg production	Scott et al., 1975	NOAEL	12.99		15 w	7	1	1	1	Value for 4,4'-DDT used as a surrogate.
4,4`-DDE	1.3E+01	1.3E+02	c	food	Japanese quail		egg weight and egg production	Scott et al., 1975	NOAEL	12.99		15 w	7	1	1	1	Value for 4,4'-DDT used as a surrogate.
Aluminum	1.1E+02	1.1E+03	c	food	ringed dove	one dose level (1000 ppm Al)	reproduction	Sample et al., 1996	NOAEL	109.7		4 m	7	1	1	1	Al2(SO4)3
Lead	4.7E+00	8.3E+00	c	food	avian		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	1.63	1.63	na	7	1	1	1	
Manganese	9.8E+02	9.8E+03	c	food	Japanese quail	one dose level 5056 ppm	No reduction in growth.	Sample et al., 1996	NOAEL	977		75 d	7	1	1	1	Mn3O4
Mercury	4.5E-01	9.0E-01	c	oral (diet)	Japanese quail	2, 4, 8, 16, 32 mg Hg/kg diet (0.22, 0.45, 1.8, 3.6 mg/kg/d)	significant reduction in egg fertility and hatchability although egg production was positively correlated with dose	Sample et al., 1996	NOAEL	0.45	0.9	1 y	7	1	1	1	Mercuric chloride
Nickel	7.7E+01	1.1E+02	c	oral (diet)	mallard	176, 774, 1069 ppm (774 ppm = 77.4 mg/kg/d; 1069 ppm = 107 mg/kg/d)	75% reduction in survival of ducklings (age 60 days); 27% reduction in female duckling body weight at day 28.	Sample et al., 1996	NOAEL	77.4	107	90 d	7	1	1	1	Nickel sulfate
Silver	1.2E+01	1.2E+02	sc	oral	mallard		mortality	OPP, 2000 (ref 344)	LD50	5920.25147		14 d	7	100	5	1	
Thallium	6.1E-01	6.1E+00	c	food	heron		egg hatchability	Smith et al., 1968	NOAEL	0.61			7	1	1	1	
Tin	6.8E+00	1.7E+01	c	oral (diet)	Japanese quail	24, 60, 150, 375 mg/kg/day	reduced egg weight and hatchability	Sample et al., 1996	NOAEL	6.8	16.9	6 w	7	1	1	1	
Antimony	NA	NA															
Arsenic	5.1E+00	1.3E+01	c	oral (diet)	mallard	100, 250, 500, 1000 ppm (100 ppm = 5.135; 250 ppm = 12.8375 mg/kg/d)	12% increase in mortality	Sample et al., 1996	NOAEL	5.135	12.8375	128 d	7	1	1	1	Sodium arsenite. Mallards in 1000, 500, 250, and 100 ppm treatments experienced 92%, 60%, 12%, and 0% mortality, respectively.
Barium	4.2E+01	8.3E+01	sc	oral (diet)	chicken (1-d old)	250, 500, 1000, 2000, 4000, 8000, 16000, 32000 ppm (2000 ppm = 208.26; 4000 ppm =416.53 mg/kg/d)	5 to 10% mortality in 4000 and 32000 ppm groups; No mortality at 2000 ppm and below	Sample et al., 1996	NOAEL	208.26	416.53	4 w	7	1	5	1	Barium hydroxide
Beryllium	3.7E-03	3.7E-02	a	subcutaneous	chicken		mortality	WHO, 1990	LD50	3.7		single dose	7	100	10	1	Beryllium sulfate.
Cadmium	1.5E+00	5.5E+00	c	food	avian		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	1.47	1.47	na	7	1	1	1	
Chromium	2.7E+00	1.1E+01	c	food	avian		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	1.6	1.6	na	7	1	1	1	
Copper	1.9E+01	3.7E+01	c	food	avian		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	19.8	19.8	na	7	1	1	1	
Cobalt	NA	NA															
Iron	NA	NA															
Vanadium	1.1E+00	1.1E+01	c	food	chicken		decrease egg-laying	USEPA, 1988	LOAEL	11	11	6 w	7	10	1	1	
Vanadium	1.1E+01	1.1E+02	c	oral (diet)	mallard	2.84, 10.36, 110 ppm	no effects on survivorship, body weight, or blood chemistry	Sample et al., 1996	NOAEL	11.4		12 w	7	1	1	1	Vanadyl sulfate

Attachment 5-12
TRVs For Birds
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
Zinc	1.5E+01	1.3E+02	c	oral (diet)	white longhorn hen	20, 200, 2000 + 28 ppm base diet	reduced egg hatchability (<20% of controls)	Sample et al., 1996	NOAEL	14.5	131	44 w	7	1	1	1	Zinc sulfate
Acetaldehyde	NA	NA															
Carbon disulfide	NA	NA															
Selenium	4.4E-01	5.2E-01	c	food	avian		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	0.457	0.52	na	7	1	1	1	
4-Nonylphenol	NA	NA															
Phenanthrene	9.2E+02	9.2E+03	c	oral	mallard		mortality	Eisler, 1987	NOAEL	920		7 m	7	1	1	1	PAHs mostly as naphthalenes, napthenes, and phenanthrene
Butylbenzylphthalate	1.1E+00	1.1E+01	c	oral (diet)	ringed dove		10% reduction in egg shell thickness	Sample et al., 1996	NOAEL	1.11		4 w	7	1	1	1	Di-n-butylphthalate used as a surrogate value
N-Nitroso-diphenylamine	NA	NA															
Carbazole	NA	NA															
Naphthalene	5.4E+00	5.4E+01	sc	oral	bobwhite quail		mortality	OPP, 1995	LD50	2690.0		14 d	7	100	5	1	
Acetophenone	NA	NA															
4-iso-Propyltoluene	NA	NA															

Notes:

[a] Units in mg/kg-d.
[b] Study types include acute, subchronic, and chronic duration studies.
[c] Exposure duration include (d) - days, (w) - weeks, (y) - years, (g) - generations.
[d] Study results adjusted by extrapolation, uncertainty, and modifying factors.

MATC = Maximum Acceptable Threshold Concentration
NA = No value available
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
SSL = Soil Screening Level
TRV = Toxicity Reference Value
UFN = Uncertainty factor that study result is divided by to convert to a NOAEL.
UFC = Uncertainty factor that study result is divided by to convert to a chronic result.
MF = Modifying factor that study result is divided by to adjust for uncertainties not accounted for by UF_N or UF_C (Default MF = 1).
LD50 = Lethal Dose 50 = Dose in mg/kg BW/d resulting in a mortality of 50% of the test organisms.
LC50 = Lethal Concentration 50 = Concentration of substance resulting in mortality of 50% of the test organisms.

Attachment 5-13
TRVs For Mammals
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
4-Nitrophenol	1.3E+00	1.3E+01	sc	oral (gavage)	mouse		mortality	ATSDR, 1992	LD50	626		8 d	7	100	5	1	4-nitrophenol more toxic than 2-nitrophenol (ATSDR, 1992)
Benzyl Alcohol	1.4E+02	1.4E+03	c	oral (gavage - oil)	rat		neurotoxicity; lethality; body weight gain	EUSCF, 2002	NOAEL	200		103 w	5	1	1	1	
Benzaldehyde	4.3E+01	8.6E+01	sc	gavage	mouse		kidney toxicity (renal tubular necrosis)	IRIS, 2002	NOAEL	300	600	13 w	5	1	5	1	RfD based on forstomach hyperplasia and hyperkeratosis at a lower dose in rats; deemed less relevant
Diphenyl ether	3.0E+00	3.0E+01	sc	oral	rat		decreased weight gain	IITRI, 1990.	NOAEL	15		13 w	7	1	5	1	
Azobenzene	NA	NA															
Caprolactum	8.0E+02	8.0E+03	c	oral (diet)	rat	1000, 10000 ppm (1000ppm = 80 mg/kg/d, 10000ppm = 800 mg/kg/d)	No effects on maternal and fetal body weights.	OECD SIDS CAPROLACTUM, 2001	NOAEL	800		3 g	7	1	1	1	
2,4,4-Trimethyl-1-pentene	4.1E-01	4.1E+00	sc	oral	rat	288 mg/kg/day	Slight variation in liver cells	Dupont, 1978	LOAEL	205	205	2 w	7	10	5	1	
2,4,4-Trimethyl-2-Pentene	4.1E-01	4.1E+00	sc	oral	rat	288 mg/kg/day	Slight variation in liver cells	Dupont, 1978	LOAEL	205	205	2 w	7	10	5	1	
Phenol	4.0E+01	5.4E+01	c	oral (gavage)	rat		significant decrease in number of live-born pups; respiratory effects in dams	ATSDR, 1998	NOAEL	40	53.5	days 6-19 (gestation)	7	1	1	1	several other studies concluded NOAELs for developmental effects around 120 mg/kd-d
Bis(2-ethylhexyl)phthalate	1.8E+01	1.8E+02	c	oral (diet)	mouse	0.01%, 0.1%, 0.3% of diet (0.01%=18.33, 0.1=183.3 mg/kg/d)	[illegible] mice; 51% reduction in no. live pups/litter; 18% reduction in % pups born alive	Sample et al., 1996	NOAEL	18.3	183.3	105 d	7	1	1	1	
Di-n-octylphthalate	1.0E+02	4.0E+02	c	oral (diet)	mouse		significant reproductive effects including fewer number of live offspring/litter and increased incidence of external anomalies	WHO, 1997	NOAEL	100	400		7	1	1	1	Value for di-n-butylphthalate used as a surrogate.
Hexachlorobenzene	3.2E-01	1.6E+00	c	oral (diet)	rat		decrease neonatal viability of F1 pups	ATSDR, 2002	NOAEL	0.32	1.6	2 g	7	1	1	1	
Diphenylmethanone	3.8E+01	3.8E+02	c	oral	rat	0, 100, 450, 2000 ppm (450 ppm = 38 mg/kg/d)	inhibition of bodyweight gain in offspring	HSDB, 2011	NOAEL	38		2 g	7	1	1	1	
Diphenylamine	3.3E+01	3.3E+02	c	oral	rat	(0, 111,333, 1000 mg/kg/day)	decreased weight gain	HSDB, 2011	LOAEL	333	333	28 d	7	10	1	1	
Tetrachloroethene	1.4E+01	2.9E+01	sc	oral (gavage-oil)	mouse		severe hepatic necrosis	IRIS, 2002	NOAEL	100	200	6 w	5	1	5	1	Increased liver weights observed at 100 mg/kg-d. Similar nephrophathy observed in a 78-w study using rats and mice (NCI, 1977) at doses in 350 - 500 mg/kg-d range.
Pyrene	1.5E+01	2.5E+01	sc	oral (gavage - oil)	mouse		mortality, reduced food consumption, body weight loss and other clinical effects (including nephropathy)	IRIS, 2002	NOAEL	75	125	13 w	7	1	5	1	A dose dependent increase in kidney lesions (described as mild/moderate) was observed in female mice.
3 & 4 - Methylphenol	1.0E+02	1.0E+03	c	oral (gavage)	rabbit		Embryo toxicity and teratogenacity.	ATSDR, 2006.	NOAEL	100		days 6-18 (gestation)	7	1	1	1	
Methyl Tertbutyl Ether	NA	NA															
Chromium (VI)	2.2E+01	2.2E+01	c		mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	22	22	na	7	1	1	1	
Benzo(g,h,i)perylene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1995	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Value for benzo(a)pyrene used as a surrogate.
Indeno(1,2,3-cd)pyrene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1996	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Value for benzo(a)pyrene used as a surrogate.

Attachment 5-13
TRVs For Mammals
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
Benzo(b)fluoranthene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1994	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Value for benzo(a)pyrene used as a surrogate.
Fluoranthene	2.5E+01	5.0E+01	sc	oral (gavage)	mouse		nephropathy, increased liver weights; hematological alterations	IRIS, 2002	NOAEL	125	250	13 w	7	1	5	1	
Benzo(k)fluoranthene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1996	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Value for benzo(a)pyrene used as a surrogate.
Chrysene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1996	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Value for benzo(a)pyrene used as a surrogate.
Hydrazine	2.5E+00	5.0E+00	c	oral	rat	0,2.5,5,10 mg/kg	maternal toxicity, reduced fetal weights.	HSDB, 2011	NOAEL	2.5	5	6-15 gestation	7	1	1	1	
alpha-BHC	5.0E+00	2.0E+01	c	food	rat	5, 20 mg/kg/d	At 5 mg/kg/d during gestation and lactation, increased liver weight in pups; at 20 mg/kg/d during gestation increased fetal deaths	ATSDR	NOAEL	5	20	gestation / gestation and lactation	7	1	1	1	Value for beta-BHC used as a surrogate
Formaldehyde	1.0E-01	1.0E+00	a	oral	rat		Mortality	MSDS #FSS22 Effective (09/09/09)	LD50	100				100	10	1	
4,4'-DDT	8.0E-01	4.0E+00	c	oral (food)	rat	10, 50, 100, 600 ppm (10 ppm = 0.8, 50 ppm = 4 mg/kg/d)	% of young weaned reduced by 28%	Sample et al., 1998	NOAEL	0.8	4	2 y	7	1	1	1	
Benzo(a)pyrene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1993	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Benzo(a)pyrene exposure of 160 mg/kg-d significantly reduced pregnancy rates and percentage of viable offspring; total sterility was observed in 97% of offspring at 40 mg/kg-d.
Dibenzo(a,h)anthracene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1996	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Benzo(a)pyrene used as a surrogate value.
Benzo(a)anthracene	1.0E+00	1.0E+01	c	oral (intubation)	mouse	10, 40, 160 mg/kg/d	35% reduction in fertility; number of litters significantly fewer and smaller (19% reduction)	Sample et al., 1992	LOAEL	10	10	days 7 -16 (gestation)	7	10	1	1	Benzo(a)pyrene used as a surrogate value.
Gamma-BHC/Lindane	5.0E+00	1.0E+01	c		rat	5, 10 mg/kg/d	At 10 mg/kg/d, marked reductions in fecundity and litter size; no effect at 5 mg/kg/d.	EXTOXNET, 1996	NOAEL	5	10	138 d	7	1	1	1	
N-Nitroso-di-n-propylamine	7.3E-02	7.3E-01	sc	oral (water)	rat		decreased longevity due to tumor development	ATSDR, 1989	LOAEL	5.1	5.1	30 w	5	10	5	1	
Aniline	2.0E+00	2.0E+01	a	oral (diet)	rat		Increased incidence of splenic sarcomas, stromal hyperplasia and fibrosis of the splenic red pulp.	IRIS 2011	NOAEL	20		single dose	NA	1	10	1	Single dose exposure is not representative of typical environmental exposure.
Aniline	9.0E-01	9.0E+00	sc	oral	rat	45 , 225 mg/kg/d	reduced body weight	HSDB, 2011	LOAEL	45	45	6 m	7	10	5	1	
Benzoic acid	5.0E+01	7.5E+02	c	oral	rat		decreased food consumption and body weights	IRIS, 2002	NOAEL	50	750	na	7	1	1	1	
Acetone	2.0E+01	1.0E+02	sc	oral intubation	rat	100, 500, 2,500 mg/kg/d	liver/kidney damage	Sample et al., 1996	NOAEL	100	500	90 d	7	1	5	1	
Dimethylformamide	2.0E+01	2.0E+02	c	oral (diet)	rat	215, 750, 2500 ppm (2500 ppm = 200 mg/kg/day)	Reduced weight gain	HSBD, 2011	LOAEL	200	200	100 d	7	10	1	1	
4-Chlorophenyl-phenylether	1.0E+03	1.0E+04	c	oral (gavage)	mouse		embryotoxicity; developmental effects	WHO 1994	NOAEL	1000		days 5-14 (gestation)	7	1	1	1	No data available; values for 4-bromophenylphenylether used as a surrogate

Attachment 5-13
TRVs For Mammals
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
Benzene	2.6E+01	2.6E+02	c	gavage	mouse		fetal weights significantly reduced at all dose levels; maternal mortality and embryonic resorption significantly increased at 0.5 and 1.0 ml/kg/d	Sample et al., 1991	LOAEL	263.6	263.6	days 6-12 (gestation)	7	10	1	1	
4,4'-DDD	8.0E-01	4.0E+00	c	oral (food)	rat	10, 50, 100, 600 ppm (10 ppm = 0.8, 50 ppm = 4 mg/kg/d)	% of young weaned reduced by 28%	Sample et al., 1996	NOAEL	0.8	4	2 y	7	1	1	1	DDT used as a surrogate value.
4,4'-DDE	8.0E-01	4.0E+00	c	oral	rat	10, 50, 100, 600 ppm (10 ppm = 0.8, 50 ppm = 4 mg/kg/d)	% of young weaned reduced by 28%	Sample et al., 1997	NOAEL	0.8	4	2 y	7	1	1	1	DDT used as a surrogate value.
Aluminum	1.9E+00	1.9E+01	c	water	mouse	one dose level (19.3 mg Al/kg/d)	significant reducation in growth in second and third generations	Sample et al., 1996	LOAEL	19.3	19.3	3 g	7	10	1	1	AlCl3
Iron	NA	NA															
Lead	4.7E+00	1.5E+02	c	food	mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	4.7	4.7	na	7	1	1	1	
Manganese	8.8E+01	2.8E+02	c	food	rat	350, 1050, and 3500 ppm supplemented Mn + 50 ppm Mn in base diet	pregnancy percentage and fertility significantly reduced at 3550 ppm	Sample et al., 1996	NOAEL	88	284	224 d	7	1	1	1	Mn3O4
Mercury	1.0E+00	1.0E+01	c	oral (diet)	mink	10 ppm (1.01 mg/kg/d)	Kit weight was somewhat reduced (9%); no reduction in fertility or kit survival	Sample et al., 1997	NOAEL	1.01		6 m	7	1	1	1	Mercuric chloride; single dose
Nickel	4.0E+01	8.0E+01	c	food	rat	ppm (500ppm= 40 mg/kg/d; 1000 ppm = 80 mg/kg/d)	at 1,000 ppm, average weanling body weight significantly reduced by up to 29% compared to controls.	Sample et al., 1996	NOAEL	40	80	3 g	7	1	1	1	Nickel sulfate hexahydrate
Silver	3.6E+01	7.2E+01	sc	water	rat		mortality (3/12 died)	ATSDR, 1990	NOAEL	181.2	362.4	2 w	7	1	5	1	Silver Nitrate
Thallium	4.6E-02	4.6E-01	sc	food	rat		mortality, body weight gain	IRIS, 2002	NOAEL	0.23		90 d	7	1	5	1	Thallium sulfate
Tin	2.3E+01	3.5E+01	c	oral (intubation)	mouse	1.2, 3.5, 5.8, 11.7, 23.4, and 35 mg/kg/day	Reduced fetal weights, fetal survival and increased frequency of litter resorption.	Sample et al., 1996	LOAEL	23.4	35	days 6 - 15 (gestation)	7	10	1	1	
Antimony	1.3E+01	1.4E+01	c	water	mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	0.059	0.059	na	7	1	1	1	
Arsenic	1.3E-01	1.3E+00	c	oral (water)	mouse	1.261 mg/kg/d	Average litter sizes in each of 3 generations were substantially less than controls (25%, 7%, 23%, respectively)	Sample et al., 1996	LOAEL	1.261	1.261	3 g	7	10	1	1	Sodium arsenite (3+)
Barium	5.2E+01	1.2E+02	c	food	mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	51.8	51.8	na	7	1	1	1	
Beryllium	5.3E-01	5.3E-01	c	food	mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	0.532	0.532	na	7	1	1	1	
Cadmium	1.9E+00	7.1E+00	c	food	mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	0.77	0.77	na	7	1	1	1	
Chromium	2.4E+00	4.1E+01	c		mammal		miscellaneous	Eco-SSL (USEPA, 2013)	MATC	24.5	24.5	na	7	1	1	1	
Cobalt	NA	NA															
Copper	1.5E+01	1.5E+02	c	food	rat		fetotoxicity, CNS abnormalities	NIOSH, 1985	LOAEL	152	152	22 w	7	10	1	1	
Vanadium	2.1E-01	2.1E+00	c	oral (intubation)	rat	5, 10, 20 mg NaVO3/kg/d (5 dose = 2.1 mg V/kg/d)	At 2.1 mg/kg/d, 21% decrease in body weight of 21 day old pups	Sample et al., 1997	LOAEL	2.1	2.1	60 d through gestation	7	10	1	1	Effect was described as "slight"
Zinc	7.5E+01	2.6E+02	c	oral (diet)	rat	ppm (160 and 320 mg/kg/d)	increased rates of fetal resorption and reduced fetal growth rates	Sample et al., 1996	NOAEL	160	320	days 1-16 (gestation)	7	1	1	1	Zinc oxide
Acetaldehyde	2.4E+01	2.4E+02	c	oral (water)	rat	240 mg/kg/bw	reduced maternal body weights; reduced offspring bodyweights; visceral immaturity and hemorage of vital organs in offspring.	HSDB, 2011	LOAEL	240	240	gestation	7	10	1	1	

Attachment 5-13
TRVs For Mammals
Baseline Ecological Risk Assessment OU1 OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Toxicity Reference Dose NOAEL [a]	Toxicity Reference Dose LOAEL [a]	Study Type [b]	Exposure Route	Test Species	Dose	Effect	Reference	Study Endpoint	Study Result [a]	Reported LOAEL [a]	Exposure Duration [c]	Exposure Regime (# days/week)	UFN [d]	UFC [d]	MF [d]	Notes
Carbon disulfide	NA	NA															
Selenium	4.4E-01	7.9E-01	c	food	mammal			Eco-SSL (USEPA, 2013)	MATC	0.54	0.79	na	7	1	1	1	Sodium selenate; decreased fertility, pup survival, maternal toxicity and failure of second generation to reproduce observed in 1.05 mg/kg-d treatment.
4-Nonylphenol	5.0E+00	5.0E+01	sc	oral (gavage)	rat	0, 125, 250, mg/kg/d	reduction in male reproductive health	NHI, 2011	LOAEL	250	250	50 d	7	10	5	1	
Phenanthrene	7.0E-01	7.0E+00	a	food	rodents		mortality	Eisler, 1987	LD50	700			7	100	10	1	
Butylbenzylphthalate	3.2E+01	9.4E+01	sc	food	rat		increased liver-to-body weight and liver-to-brain weight ratios	IRIS, 2002; NTP, 1985d	NOAEL	159	470	6 m	7	1	5	1	
N-Nitrosodiphenylamine	2.0E+01	2.0E+02	c	oral (diet)	rat		30% mortality in females	ATSDR, 1993	LOAEL	200	200	100 w	7	10	1	1	
N-Nitroso-diphenylamine	2.0E+01	2.0E+02	c	oral (diet)	rat		30% mortality in females	ATSDR, 1993	LOAEL	200	200	100 w	7	10	1	1	
Carbazole	5.0E+00	5.0E+01	a	oral (diet)	rat		mortality	HSDB, 2002	LD50	5000			7	100	10	1	
Naphthalene	3.0E+01	3.0E+02	c	oral (gavage - oil)	mouse	300 mg/kg/d	19% decrease in number of live pups per litter (at day 3); >10% maternal mortality	ATSDR 1995	LOAEL	300	300	days (7-14) gestation	7	10	1	1	Mice appear to be more sensitive than rats (ATSDR, 1995) with single dose LD50s of 533 and 710 mg/kg for males and females, respectively (Shopp et al., 1984); dose response curve appears to be very steep.
Acetophenone	8.0E+02	8.0E+03	c	oral (diet)	rat	0,1000,2500,10000 ppm (10000ppm = 800mg/kg/day)	No observed reduction in bodyweight, no changes in hematological values, no macro or microscopic changes to tissues.	HSBD, 2011	NOAEL	800		17 w	7	1	1	1	
4-iso-Propyltoluene	NA	NA															

Notes:
[a] Units in mg/kg-d.
[b] Study types include acute, subchronic, and chronic duration studies.
[c] Exposure duration include (d) - days, (w) - weeks, (y) - years, (g) - generations.
[d] Study results adjusted by extrapolation, uncertainty, and modifying factors.

MATC = Maximum Acceptable Threshold Concentration
NA = No value available
NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
SSL = Soil Screening Level
TRV = Toxicity Reference Value
UF_N = Uncertainty factor that study result is divided by to convert to a NOAEL.
UF_C = Uncertainty factor that study result is divided by to convert to a chronic result.
MF = Modifying factor that study result is divided by to adjust for uncertainties not accounted for by UF_N or UF_C (Default MF = 1).
LD50 = Lethal Dose 50 = Dose in mg/kg BW/d resulting in a mortality of 50% of the test organisms.
LC50 = Lethal Concentration 50 = Concentration of substance resulting in mortality of 50% of the test organisms.

Attachment 5-14
Summary of Receptors and Exposure Pathways Evaluated in Food Chain Models
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Exposure Area				Exposure Media								Source of EPCs							
Receptor	Description	Area (ha) [a]	HR (ha)	SFF	SW	SD	SOIL	PLANT	INV	FISH/ AMPHIB	BIRD	MAM	SW	SD	Soil	PL	INV	FISH/ AMPHIB	BIRD	MAM
Terrestrial Receptors and Exposure Areas																				
American Robin	EA-2	0.94	0.48	1.0	No	No	Yes	Yes	Yes	No	No	No	NA	NA	M	E-Lit	E-Lit	NA	NA	NA
	EA-4	6.6	0.48	1.0	No	No	Yes	Yes	Yes	No	No	No	NA	NA	M	E-Lit	E-Lit	NA	NA	NA
	EA-5	0.34	0.48	1.0	No	No	Yes	Yes	Yes	No	No	No	NA	NA	M	E-Lit	E-Lit	NA	NA	NA
Red-Tailed Hawk	EA-2	0.94	859	0.0011	No	No	Yes	No	No	No	Yes	Yes	NA	NA	M	NA	NA	NA	E-Lit	E-Lit
	EA-4	6.6	859	0.0077183	No	No	Yes	No	No	No	Yes	Yes	NA	NA	M	NA	NA	NA	E-Lit	E-Lit
	EA-5	0.34	859	1.0	No	No	Yes	No	No	No	Yes	Yes	NA	NA	M	NA	NA	NA	E-Lit	E-Lit
Short-Tailed Shrew	EA-2	0.94	0.32	1.0	No	No	Yes	Yes	Yes	No	No	Yes	NA	NA	M	E-Lit	E-Lit	NA	NA	E-Lit
	EA-4	6.6	0.32	1.0	No	No	Yes	Yes	Yes	No	No	Yes	NA	NA	M	E-Lit	E-Lit	NA	NA	E-Lit
	EA-5	0.34	0.32	1.0	No	No	Yes	Yes	Yes	No	No	Yes	NA	NA	M	E-Lit	E-Lit	NA	NA	E-Lit
Red Fox	EA-2	0.94	699	0.0013505	No	No	Yes	Yes	No	No	Yes	Yes	NA	NA	M	E-Lit	E-Lit	NA	E-Lit	E-Lit
	EA-4	6.6	699	0.009485	No	No	Yes	Yes	No	No	Yes	Yes	NA	NA	M	E-Lit	E-Lit	NA	E-Lit	E-Lit
	EA-5	0.34	699	1.0	No	No	Yes	Yes	No	No	Yes	Yes	NA	NA	M	E-Lit	E-Lit	NA	E-Lit	E-Lit

Attachment 5-14
Summary of Receptors and Exposure Pathways Evaluated in Food Chain Models
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Exposure Area				Exposure Media								Source of EPCs							
Receptor	Description	Area (ha) [a]	HR (ha)	SFF	SW	SD	SOIL	PLANT	INV	FISH/ AMPHIB	BIRD	MAM	SW	SD	Soil	PL	INV	FISH/ AMPHIB	BIRD	MAM
Semi-Aquatic Receptors and Exposure Areas																				
Marsh Wren	USD	0.025	0.12	0.21	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	LSD	0.020	0.12	0.17	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	On-PWD/WDW	0.40	0.12	1.0	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	Central Pond	0.09	0.12	0.78	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	SWDB	0.11	0.12	0.92	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	Off-PWD	0.069	0.12	0.58	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	MMB Wetland	32	0.12	1.0	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
	North Pond	0.80	0.12	1.0	Yes	Yes	No	No	Yes	No	No	No	M	M	NA	NA	E-Lit	NA	NA	NA
Green Heron	USD	0.025	1.0	0.025	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	LSD	0.020	1.0	0.020	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	On-PWD/WDW	0.40	1.0	0.40	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	Central Pond	0.09	1.0	0.093	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	SWDB	0.11	1.0	0.11	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	Off-PWD	0.069	1.0	0.069	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	MMB Wetland	32	1.0	1.0	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
	North Pond	0.80	1.0	0.80	Yes	Yes	No	No	Yes	Yes	No	No	M	M	NA	NA	E-Lit	E-Lit	NA	NA
Raccoon	USD	0.025	108	0.00023	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	LSD	0.020	108	0.00019	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	On-PWD/WDW	0.40	108	0.0037	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	Central Pond	0.09	108	0.00086	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	SWDB	0.11	108	0.0010	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	Off-PWD	0.069	108	0.00064	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	MMB Wetland	32	108	0.30	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	North Pond	0.80	108	0.0074	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
Muskrat	USD	0.025	0.13	0.19	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	LSD	0.020	0.13	0.16	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	On-PWD/WDW	0.40	0.13	1.0	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	Central Pond	0.09	0.13	0.72	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	SWDB	0.11	0.13	0.85	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	Off-PWD	0.069	0.13	0.53	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	MMB Wetland	32	0.13	1.0	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA
	North Pond	0.80	0.13	1.0	Yes	Yes	No	Yes	Yes	Yes	No	No	M	M	NA	E-Lit	E-Lit	E-Lit	NA	NA

Attachment 5-14
Summary of Receptors and Exposure Pathways Evaluated in Food Chain Models
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: SFR 7/15/2013
Checked by: EYM 7/15/2013

Notes:

[a] Area - area encompased by exposure area. For surface water and sediment, reaches were calculated based on length from furthest upstream to furthest downstream sample location and average observed stream width.

E - Estimated value
EA - Exposure Area
HR - Home Range of receptor in hectares
INV - Invertebrate
Lit- Literature source
LSD - Lower South Ditch
M - Measured value
MAM - Mammal
MMB - Maple Meadow Brook
PL - Plant
SD - Sediment
SFF - Site Foraging Frequency (ratio of area over home range; max of 1)
SW - Sufrace Water
USD - Upper South Ditch

Table - MMB Wetlands - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetaldehyde		3.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone		7.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde		2.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4-Nitrophenol		9.1E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid		5.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzyl alcohol		2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		1.5E-01	3.2E-01	4.9E-02	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Caprolactam	6.6E-04	6.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbazole		9.3E-02	2.9E-01	2.7E-02	5.6E-01	5.2E-02	5.6E-01	5.2E-02
Benzo(a)pyrene	9.4E-05		3.1E-01	--	2.2E-01	--	2.2E-01	--
N-Nitrosodi-n-propylamine	7.8E-07		0.0E+00	--	0.0E+00	--	0.0E+00	--
Aluminum	1.7E-01	1.3E+04	8.6E-03	1.1E+02	8.6E-03	1.1E+02	8.6E-03	1.1E+02
Arsenic		1.7E+01	1.3E-01	2.2E+00	1.3E-01	2.2E+00	1.3E-01	2.2E+00
Barium	3.7E-02	1.0E+02	1.8E-02	1.9E+00	1.8E-02	1.9E+00	1.8E-02	1.9E+00
Beryllium		9.8E-01	9.0E-03	8.9E-03	9.0E-03	8.9E-03	9.0E-03	8.9E-03
Cadmium		2.1E+00	4.6E-01	9.4E-01	4.6E-01	9.4E-01	4.6E-01	9.4E-01
Copper	4.8E-03	3.9E+01	1.6E+00	6.4E+01	1.6E+00	6.4E+01	1.6E+00	6.4E+01
Iron	3.4E+00	2.6E+04	7.2E-03	1.8E+02	7.2E-03	1.8E+02	7.2E-03	1.8E+02
Lead	6.5E-03	1.4E+02	6.6E-02	9.1E+00	6.6E-02	9.1E+00	6.6E-02	9.1E+00
Manganese	9.1E-01	7.9E+02	2.4E-03	1.9E+00	2.4E-03	1.9E+00	2.4E-03	1.9E+00
Mercury		2.6E-01	2.8E+00	7.3E-01	2.8E+00	7.3E-01	2.8E+00	7.3E-01
Nickel		1.9E+01	8.2E-01	1.5E+01	8.2E-01	1.5E+01	8.2E-01	1.5E+01
Thallium		1.4E+00	--	--	1.0E+00	1.4E+00	1.0E+00	1.4E+00
Tin		8.6E+00	--	--	--	--	--	--
Vanadium		3.2E+01	8.4E-03	2.7E-01	8.4E-03	2.7E-01	8.4E-03	2.7E-01
Zinc		2.1E+02	2.6E-02	5.4E+00	2.6E-02	5.4E+00	2.6E-02	5.4E+00
Bromide	5.5E-02		0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		4.9E+02	--	--	--	--	--	--
Nitrogen, as Ammonia		5.7E+02	--	--	--	--	--	--
Sulfate		6.0E+02	--	--	--	--	--	--
Kempore (Azodicarbonamide)	5.5E-01		--	--	--	--	--	--

Table - MMB Wetlands - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - MMB Wetlands - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	--	3.5E-01	--	--	--	--	5.2E-04	--	--	--	5.2E-04	--	--	--	--
Acetone	--	7.2E-01	--	--	--	--	1.1E-03	--	--	--	1.1E-03	8.4E+03	1.3E-07	8.4E+04	1.3E-08
Formaldehyde	--	2.2E+00	--	--	--	--	3.2E-03	--	--	--	3.2E-03	--	--	--	--
3 & 4 Methylphenol	--	1.2E-01	--	--	--	--	1.8E-04	--	--	--	1.8E-04	--	--	--	--
4-Nitrophenol	--	9.1E-02	--	--	--	--	1.4E-04	--	--	--	1.4E-04	--	--	--	--
Benzaldehyde	--	1.2E-01	--	--	--	--	1.8E-04	--	--	--	1.8E-04	--	--	--	--
Benzoic Acid	--	5.9E-01	--	--	--	--	8.8E-04	--	--	--	8.8E-04	--	--	--	--
Benzyl alcohol	--	2.0E-01	--	--	--	--	3.0E-04	--	--	--	3.0E-04	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	1.5E-01	4.9E-02	1.5E-01	1.5E-01	--	2.3E-04	7.0E-03	1.1E-02	1.1E-02	2.9E-02	1.1E+00	2.7E-02	1.1E+01	2.7E-03
Caprolactam	6.6E-04	6.8E-02	--	--	--	6.5E-05	1.0E-04	--	--	--	1.7E-04	--	--	--	--
Carbazole	--	9.3E-02	2.7E-02	5.2E-02	5.2E-02	--	1.4E-04	3.9E-03	3.7E-03	3.7E-03	1.1E-02	--	--	--	--
Benzo(a)pyrene	9.4E-05	--	--	--	--	9.2E-06	--	--	--	--	9.2E-06	9.2E+02	1.0E-08	9.2E+03	1.0E-09
N-Nitrosodi-n-propylamine	7.8E-07	--	--	--	--	7.7E-08	--	--	--	--	7.7E-08	--	--	--	--
Aluminum	1.7E-01	1.3E+04	1.1E+02	1.1E+02	1.1E+02	1.7E-02	1.9E+01	1.6E+01	7.9E+00	7.9E+00	5.1E+01	1.1E+02	4.7E-01	1.1E+03	4.7E-02
Arsenic	--	1.7E+01	2.2E+00	2.2E+00	2.2E+00	--	2.6E-02	3.1E-01	1.5E-01	1.5E-01	6.5E-01	5.1E+00	1.3E-01	1.3E+01	5.0E-02
Barium	3.7E-02	1.0E+02	1.9E+00	1.9E+00	1.9E+00	3.6E-03	1.5E-01	2.6E-01	1.3E-01	1.3E-01	6.9E-01	4.2E+01	1.7E-02	8.3E+01	8.3E-03
Beryllium	--	9.8E-01	8.9E-03	8.9E-03	8.9E-03	--	1.5E-03	1.3E-03	6.3E-04	6.3E-04	4.0E-03	3.7E-03	1.1E+00	3.7E-02	1.1E-01
Cadmium	--	2.1E+00	9.4E-01	9.4E-01	9.4E-01	--	3.1E-03	1.3E-01	6.7E-02	6.7E-02	2.7E-01	1.5E+00	1.8E-01	5.5E+00	4.9E-02
Copper	4.8E-03	3.9E+01	6.4E+01	6.4E+01	6.4E+01	4.8E-04	5.8E-02	9.1E+00	4.6E+00	4.6E+00	1.8E+01	1.9E+01	9.9E-01	3.7E+01	4.9E-01
Iron	3.4E+00	2.6E+04	1.8E+02	1.8E+02	1.8E+02	3.4E-01	3.8E+01	2.6E+01	1.3E+01	1.3E+01	9.1E+01	--	--	--	--
Lead	6.5E-03	1.4E+02	9.1E+00	9.1E+00	9.1E+00	6.4E-04	2.1E-01	1.3E+00	6.5E-01	6.5E-01	2.8E+00	4.7E+00	6.0E-01	8.3E+00	3.4E-01
Manganese	9.1E-01	7.9E+02	1.9E+00	1.9E+00	1.9E+00	8.9E-02	1.2E+00	2.7E-01	1.4E-01	1.4E-01	1.8E+00	9.8E+02	1.9E-03	9.8E+03	1.9E-04
Mercury	--	2.6E-01	7.3E-01	7.3E-01	7.3E-01	--	3.8E-04	1.0E-01	5.2E-02	5.2E-02	2.1E-01	4.5E-01	4.6E-01	9.0E-01	2.3E-01
Nickel	--	1.9E+01	1.5E+01	1.5E+01	1.5E+01	--	2.8E-02	2.2E+00	1.1E+00	1.1E+00	4.3E+00	7.7E+01	5.6E-02	1.1E+02	4.1E-02
Thallium	--	1.4E+00	--	1.4E+00	1.4E+00	--	2.1E-03	--	9.9E-02	9.9E-02	2.0E-01	6.1E-01	3.3E-01	6.1E+00	3.3E-02
Tin	--	8.6E+00	--	--	--	--	1.3E-02	--	--	--	1.3E-02	6.8E+00	1.9E-03	1.7E+01	7.6E-04
Vanadium	--	3.2E+01	2.7E-01	2.7E-01	2.7E-01	--	4.8E-02	3.8E-02	1.9E-02	1.9E-02	1.2E-01	1.1E+00	1.1E-01	1.1E+01	1.1E-02
Zinc	--	2.1E+02	5.4E+00	5.4E+00	5.4E+00	--	3.1E-01	7.6E-01	3.8E-01	3.8E-01	1.8E+00	1.5E+01	1.3E-01	1.3E+02	1.4E-02
Bromide	5.5E-02	--	--	--	--	5.5E-03	--	--	--	--	5.5E-03	--	--	--	--
Chloride	--	4.9E+02	--	--	--	--	7.3E-01	--	--	--	7.3E-01	--	--	--	--
Nitrogen, as Ammonia	--	5.7E+02	--	--	--	--	8.5E-01	--	--	--	8.5E-01	--	--	--	--
Sulfate	--	6.0E+02	--	--	--	--	9.0E-01	--	--	--	9.0E-01	--	--	--	--
Kempore (Azodicarbonamide)	5.5E-01	--	--	--	--	5.4E-02	--	--	--	--	5.4E-02	--	--	--	--

Table - MMB Wetlands - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetland Reference - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	--	2.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	--	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid	2.1E-03	5.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	3.2E-01	8.3E-02	1.0E+00	2.6E-01	1.0E+00	2.6E-01
Caprolactam	1.4E-03	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)pyrene	--	9.6E-02	3.1E-01	3.0E-02	2.2E-01	2.1E-02	2.2E-01	2.1E-02
Aluminum	2.4E-01	5.5E+03	8.6E-03	4.7E+01	8.6E-03	4.7E+01	8.6E-03	4.7E+01
Arsenic	--	6.6E+00	1.3E-01	8.4E-01	1.3E-01	8.4E-01	1.3E-01	8.4E-01
Barium	3.8E-02	8.4E+01	1.8E-02	1.5E+00	1.8E-02	1.5E+00	1.8E-02	1.5E+00
Beryllium	--	7.0E-01	9.0E-03	6.3E-03	9.0E-03	6.3E-03	9.0E-03	6.3E-03
Cadmium	--	9.0E-01	4.6E-01	4.1E-01	4.6E-01	4.1E-01	4.6E-01	4.1E-01
Copper	2.6E-03	1.5E+01	1.6E+00	2.5E+01	1.6E+00	2.5E+01	1.6E+00	2.5E+01
Iron	1.1E+00	7.5E+03	7.2E-03	5.4E+01	7.2E-03	5.4E+01	7.2E-03	5.4E+01
Lead	1.1E-03	4.6E+01	6.6E-02	3.0E+00	6.6E-02	3.0E+00	6.6E-02	3.0E+00
Manganese	3.1E-01	5.0E+02	3.3E-03	1.7E+00	3.3E-03	1.7E+00	3.3E-03	1.7E+00
Nickel	3.6E-03	6.1E+00	8.2E-01	5.0E+00	8.2E-01	5.0E+00	8.2E-01	5.0E+00
Tin	--	7.3E+00	--	--	--	--	--	--
Vanadium	3.3E-03	1.1E+01	8.4E-03	9.2E-02	8.4E-03	9.2E-02	8.4E-03	9.2E-02
Zinc	1.8E-02	7.3E+01	2.6E-02	1.9E+00	2.6E-02	1.9E+00	2.6E-02	1.9E+00
Chloride	1.1E+02	4.2E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	1.5E-01	8.3E+02	--	--	--	--	--	--
Sulfate	1.7E+01	4.2E+02	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - MMB Wetland Reference - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	--	2.0E+00	--	--	--	--	3.0E-03	--	--	--	3.0E-03	8.4E+03	3.6E-07	8.4E+04	3.6E-08
Benzaldehyde	--	3.3E-01	--	--	--	--	4.9E-04	--	--	--	4.9E-04	--	--	--	--
Benzoic Acid	2.1E-03	5.4E-01	--	--	--	2.1E-04	8.1E-04	--	--	--	1.0E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	8.3E-02	2.6E-01	2.6E-01	--	3.9E-04	1.2E-02	1.8E-02	1.8E-02	4.9E-02	1.1E+00	4.5E-02	1.1E+01	4.5E-03
Caprolactam	1.4E-03	--	--	--	--	1.4E-04	--	--	--	--	1.4E-04	--	--	--	--
Benzo(a)pyrene	--	9.6E-02	3.0E-02	2.1E-02	2.1E-02	--	1.4E-04	4.2E-03	1.5E-03	1.5E-03	7.4E-03	9.2E+02	8.0E-06	9.2E+03	8.0E-07
Aluminum	2.4E-01	5.5E+03	4.7E+01	4.7E+01	4.7E+01	2.4E-02	8.2E+00	6.7E+00	3.4E+00	3.4E+00	2.2E+01	1.1E+02	2.0E-01	1.1E+03	2.0E-02
Arsenic	--	6.6E+00	8.4E-01	8.4E-01	8.4E-01	--	9.9E-03	1.2E-01	6.0E-02	6.0E-02	2.5E-01	5.1E+00	4.8E-02	1.3E+01	1.9E-02
Barium	3.8E-02	8.4E+01	1.5E+00	1.5E+00	1.5E+00	3.7E-03	1.3E-01	2.2E-01	1.1E-01	1.1E-01	5.6E-01	4.2E+01	1.4E-02	8.3E+01	6.8E-03
Beryllium	--	7.0E-01	6.3E-03	6.3E-03	6.3E-03	--	1.0E-03	8.9E-04	4.5E-04	4.5E-04	2.8E-03	3.7E-03	7.7E-01	3.7E-02	7.7E-02
Cadmium	--	9.0E-01	4.1E-01	4.1E-01	4.1E-01	--	1.3E-03	5.9E-02	2.9E-02	2.9E-02	1.2E-01	1.5E+00	7.9E-02	5.5E+00	2.2E-02
Copper	2.6E-03	1.5E+01	2.5E+01	2.5E+01	2.5E+01	2.5E-04	2.2E-02	3.5E+00	1.8E+00	1.8E+00	7.0E+00	1.9E+01	3.8E-01	3.7E+01	1.9E-01
Iron	1.1E+00	7.5E+03	5.4E+01	5.4E+01	5.4E+01	1.1E-01	1.1E+01	7.7E+00	3.8E+00	3.8E+00	2.7E+01	--	--	--	--
Lead	1.1E-03	4.6E+01	3.0E+00	3.0E+00	3.0E+00	1.1E-04	6.9E-02	4.3E-01	2.2E-01	2.2E-01	9.3E-01	4.7E+00	2.0E-01	8.3E+00	1.1E-01
Manganese	3.1E-01	5.0E+02	1.7E+00	1.7E+00	1.7E+00	3.1E-02	7.5E-01	2.3E-01	1.2E-01	1.2E-01	1.3E+00	9.8E+02	1.3E-03	9.8E+03	1.3E-04
Nickel	3.6E-03	6.1E+00	5.0E+00	5.0E+00	5.0E+00	3.5E-04	9.1E-03	7.1E-01	3.5E-01	3.5E-01	1.4E+00	7.7E+01	1.8E-02	1.1E+02	1.3E-02
Tin	--	7.3E+00	--	--	--	--	1.1E-02	--	--	--	1.1E-02	6.8E+00	1.6E-03	1.7E+01	6.5E-04
Vanadium	3.3E-03	1.1E+01	9.2E-02	9.2E-02	9.2E-02	3.2E-04	1.6E-02	1.3E-02	6.6E-03	6.6E-03	4.3E-02	1.1E+00	3.9E-02	1.1E+01	3.9E-03
Zinc	1.8E-02	7.3E+01	1.9E+00	1.9E+00	1.9E+00	1.7E-03	1.1E-01	2.7E-01	1.3E-01	1.3E-01	6.5E-01	1.5E+01	4.5E-02	1.3E+02	5.0E-03
Chloride	1.1E+02	4.2E+02	--	--	--	1.1E+01	6.3E-01	--	--	--	1.1E+01	--	--	--	--
Nitrogen, as Ammonia	1.5E-01	8.3E+02	--	--	--	1.5E-02	1.2E+00	--	--	--	1.3E+00	--	--	--	--
Sulfate	1.7E+01	4.2E+02	--	--	--	1.7E+00	6.3E-01	--	--	--	2.3E+00	--	--	--	--

Table - MMB Wetland Reference - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	MMB Wetland Reference

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetlands - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Acetaldehyde		3.50E-01	0.00E+00	0.00E+00
Acetone		7.23E-01	0.00E+00	0.00E+00
Formaldehyde		2.16E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		1.22E-01	0.00E+00	0.00E+00
4-Nitrophenol		9.10E-02	0.00E+00	0.00E+00
Benzaldehyde		1.17E-01	0.00E+00	0.00E+00
Benzoic Acid		5.86E-01	0.00E+00	0.00E+00
Benzyl alcohol		1.99E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		1.55E-01	3.19E-01	4.94E-02
Caprolactam	6.60E-04	6.76E-02	0.00E+00	0.00E+00
Carbazole		9.28E-02	2.94E-01	2.73E-02
Benzo(a)pyrene	9.39E-05		3.07E-01	--
N-Nitrosodi-n-propylamine	7.80E-07		0.00E+00	--
Aluminum	1.69E-01	1.30E+04	8.60E-03	1.12E+02
Arsenic		1.72E+01	1.27E-01	2.18E+00
Barium	3.68E-02	1.03E+02	1.82E-02	1.87E+00
Beryllium		9.85E-01	9.00E-03	8.86E-03
Cadmium		2.06E+00	4.59E-01	9.43E-01
Copper	4.83E-03	3.90E+01	1.65E+00	6.42E+01
Iron	3.41E+00	2.55E+04	7.20E-03	1.84E+02
Lead	6.49E-03	1.38E+02	6.60E-02	9.13E+00
Manganese	9.08E-01	7.88E+02	2.45E-03	1.93E+00
Mercury		2.57E-01	2.84E+00	7.28E-01
Nickel		1.86E+01	8.18E-01	1.52E+01
Thallium		1.40E+00	--	--
Tin		8.59E+00	--	--
Vanadium		3.21E+01	8.40E-03	2.69E-01
Zinc		2.07E+02	2.60E-02	5.37E+00
Bromide	5.55E-02		0.00E+00	--
Chloride		4.85E+02	--	--
Nitrogen, as Ammonia		5.67E+02	--	--
Sulfate		6.00E+02	--	--
Kempore (Azodicarbonamide)	5.53E-01		--	--

Table - MMB Wetlands - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Table - MMB Wetlands - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	--	3.50E-01	0.00E+00	--	4.37E-03	0.00E+00	4.4E-03	--	--	--	--
Acetone	--	7.23E-01	0.00E+00	--	9.03E-03	0.00E+00	9.0E-03	8.43E+03	1.1E-06	8.43E+04	1.1E-07
Formaldehyde	--	2.16E+00	0.00E+00	--	2.70E-02	0.00E+00	2.7E-02	--	--	--	--
3 & 4 Methylphenol	--	1.22E-01	0.00E+00	--	1.53E-03	0.00E+00	1.5E-03	--	--	--	--
4-Nitrophenol	--	9.10E-02	0.00E+00	--	1.14E-03	0.00E+00	1.1E-03	--	--	--	--
Benzaldehyde	--	1.17E-01	0.00E+00	--	1.47E-03	0.00E+00	1.5E-03	--	--	--	--
Benzoic Acid	--	5.86E-01	0.00E+00	--	7.32E-03	0.00E+00	7.3E-03	--	--	--	--
Benzyl alcohol	--	1.99E-01	0.00E+00	--	2.48E-03	0.00E+00	2.5E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	1.55E-01	4.94E-02	--	1.93E-03	4.29E-02	4.5E-02	1.10E+00	4.1E-02	1.10E+01	4.1E-03
Caprolactam	6.60E-04	6.76E-02	0.00E+00	1.74E-04	8.44E-04	0.00E+00	1.0E-03	--	--	--	--
Carbazole	--	9.28E-02	2.73E-02	--	1.16E-03	2.36E-02	2.5E-02	--	--	--	--
Benzo(a)pyrene	9.39E-05	--	--	2.48E-05	--	--	2.5E-05	9.20E+02	2.7E-08	9.20E+03	2.7E-09
N-Nitrosodi-n-propylamine	7.80E-07	--	--	2.06E-07	--	--	2.1E-07	--	--	--	--
Aluminum	1.69E-01	1.30E+04	1.12E+02	4.48E-02	1.62E+02	9.67E+01	2.6E+02	1.10E+02	2.4E+00	1.10E+03	2.4E-01
Arsenic	--	1.72E+01	2.18E+00	--	2.15E-01	1.89E+00	2.1E+00	5.14E+00	4.1E-01	1.28E+01	1.6E-01
Barium	3.68E-02	1.03E+02	1.87E+00	9.73E-03	1.28E+00	1.62E+00	2.9E+00	4.17E+01	7.0E-02	8.33E+01	3.5E-02
Beryllium	--	9.85E-01	8.86E-03	--	1.23E-02	7.69E-03	2.0E-02	3.70E-03	5.4E+00	3.70E-02	5.4E-01
Cadmium	--	2.06E+00	9.43E-01	--	2.57E-02	8.18E-01	8.4E-01	1.50E+00	5.6E-01	5.50E+00	1.5E-01
Copper	4.83E-03	3.90E+01	6.42E+01	1.28E-03	4.87E-01	5.57E+01	5.6E+01	1.85E+01	3.0E+00	3.70E+01	1.5E+00
Iron	3.41E+00	2.55E+04	1.84E+02	9.02E-01	3.19E+02	1.59E+02	4.8E+02	--	--	--	--
Lead	6.49E-03	1.38E+02	9.13E+00	1.71E-03	1.73E+00	7.91E+00	9.6E+00	4.70E+00	2.1E+00	8.28E+00	1.2E+00
Manganese	9.08E-01	7.88E+02	1.93E+00	2.40E-01	9.85E+00	1.68E+00	1.2E+01	9.77E+02	1.2E-02	9.77E+03	1.2E-03
Mercury	--	2.57E-01	7.28E-01	--	3.21E-03	6.32E-01	6.3E-01	4.50E-01	1.4E+00	9.00E-01	7.1E-01
Nickel	--	1.86E+01	1.52E+01	--	2.32E-01	1.32E+01	1.3E+01	7.74E+01	1.7E-01	1.07E+02	1.3E-01
Thallium	--	1.40E+00	--	--	1.75E-02	--	1.7E-02	6.10E-01	2.9E-02	6.10E+00	2.9E-03
Tin	--	8.59E+00	--	--	1.07E-01	--	1.1E-01	6.80E+00	1.6E-02	1.69E+01	6.3E-03
Vanadium	--	3.21E+01	2.69E-01	--	4.01E-01	2.34E-01	6.3E-01	1.10E+00	5.8E-01	1.10E+01	5.8E-02
Zinc	--	2.07E+02	5.37E+00	--	2.58E+00	4.66E+00	7.2E+00	1.45E+01	5.0E-01	1.31E+02	5.5E-02
Bromide	5.55E-02	--	--	1.47E-02	--	--	1.5E-02	--	--	--	--
Chloride	--	4.85E+02	--	--	6.06E+00	--	6.1E+00	--	--	--	--
Nitrogen, as Ammonia	--	5.67E+02	--	--	7.08E+00	--	7.1E+00	--	--	--	--
Sulfate	--	6.00E+02	--	--	7.49E+00	--	7.5E+00	--	--	--	--
Kempore (Azodicarbonamide)	5.53E-01	--	--	1.46E-01	--	--	1.5E-01	--	--	--	--

Table - MMB Wetlands - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetland Reference - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
Acetone	--	2.00E+00	0.00E+00	0.00E+00
Benzaldehyde	--	3.30E-01	0.00E+00	0.00E+00
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	3.19E-01	8.30E-02
Caprolactam	1.41E-03	--	0.00E+00	--
Benzo(a)pyrene	--	9.60E-02	3.07E-01	2.95E-02
Aluminum	2.43E-01	5.50E+03	8.60E-03	4.73E+01
Arsenic	--	6.60E+00	1.27E-01	8.38E-01
Barium	3.75E-02	8.40E+01	1.82E-02	1.53E+00
Beryllium	--	7.00E-01	9.00E-03	6.30E-03
Cadmium	--	9.00E-01	4.59E-01	4.13E-01
Copper	2.55E-03	1.50E+01	1.65E+00	2.47E+01
Iron	1.14E+00	7.50E+03	7.20E-03	5.40E+01
Lead	1.11E-03	4.60E+01	6.60E-02	3.04E+00
Manganese	3.14E-01	5.00E+02	3.31E-03	1.65E+00
Nickel	3.55E-03	6.10E+00	8.18E-01	4.99E+00
Tin	--	7.30E+00	--	--
Vanadium	3.25E-03	1.10E+01	8.40E-03	9.24E-02
Zinc	1.75E-02	7.30E+01	2.60E-02	1.90E+00
Chloride	1.09E+02	4.20E+02	--	--
Nitrogen, as Ammonia	1.50E-01	8.30E+02	--	--
Sulfate	1.71E+01	4.20E+02	--	--

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - MMB Wetland Reference - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetone	--	2.00E+00	0.00E+00	--	2.50E-02	0.00E+00	2.5E-02	8.43E+03	3.0E-06	8.43E+04	3.0E-07
Benzaldehyde	--	3.30E-01	0.00E+00	--	4.12E-03	0.00E+00	4.1E-03	--	--	--	--
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	5.55E-04	6.74E-03	0.00E+00	7.3E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	8.30E-02	--	3.25E-03	7.19E-02	7.5E-02	1.10E+00	6.8E-02	1.10E+01	6.8E-03
Caprolactam	1.41E-03	--	--	3.71E-04	--	--	3.7E-04	--	--	--	--
Benzo(a)pyrene	--	9.60E-02	2.95E-02	--	1.20E-03	2.56E-02	2.7E-02	9.20E+02	2.9E-05	9.20E+03	2.9E-06
Aluminum	2.43E-01	5.50E+03	4.73E+01	6.42E-02	6.87E+01	4.10E+01	1.1E+02	1.10E+02	1.0E+00	1.10E+03	1.0E-01
Arsenic	--	6.60E+00	8.38E-01	--	8.24E-02	7.27E-01	8.1E-01	5.14E+00	1.6E-01	1.28E+01	6.3E-02
Barium	3.75E-02	8.40E+01	1.53E+00	9.91E-03	1.05E+00	1.33E+00	2.4E+00	4.17E+01	5.7E-02	8.33E+01	2.9E-02
Beryllium	--	7.00E-01	6.30E-03	--	8.74E-03	5.46E-03	1.4E-02	3.70E-03	3.8E+00	3.70E-02	3.8E-01
Cadmium	--	9.00E-01	4.13E-01	--	1.12E-02	3.58E-01	3.7E-01	1.50E+00	2.5E-01	5.50E+00	6.7E-02
Copper	2.55E-03	1.50E+01	2.47E+01	6.74E-04	1.87E-01	2.14E+01	2.2E+01	1.85E+01	1.2E+00	3.70E+01	5.8E-01
Iron	1.14E+00	7.50E+03	5.40E+01	3.01E-01	9.37E+01	4.68E+01	1.4E+02	--	--	--	--
Lead	1.11E-03	4.60E+01	3.04E+00	2.92E-04	5.74E-01	2.63E+00	3.2E+00	4.70E+00	6.8E-01	8.28E+00	3.9E-01
Manganese	3.14E-01	5.00E+02	1.65E+00	8.30E-02	6.24E+00	1.43E+00	7.8E+00	9.77E+02	7.9E-03	9.77E+03	7.9E-04
Nickel	3.55E-03	6.10E+00	4.99E+00	9.38E-04	7.62E-02	4.33E+00	4.4E+00	7.74E+01	5.7E-02	1.07E+02	4.1E-02
Tin	--	7.30E+00	--	--	9.12E-02	--	9.1E-02	6.80E+00	1.3E-02	1.69E+01	5.4E-03
Vanadium	3.25E-03	1.10E+01	9.24E-02	8.59E-04	1.37E-01	8.01E-02	2.2E-01	1.10E+00	2.0E-01	1.10E+01	2.0E-02
Zinc	1.75E-02	7.30E+01	1.90E+00	4.63E-03	9.12E-01	1.65E+00	2.6E+00	1.45E+01	1.8E-01	1.31E+02	2.0E-02
Chloride	1.09E+02	4.20E+02	--	2.87E+01	5.25E+00	--	3.4E+01	--	--	--	--
Nitrogen, as Ammonia	1.50E-01	8.30E+02	--	3.97E-02	1.04E+01	--	1.0E+01	--	--	--	--
Sulfate	1.71E+01	4.20E+02	--	4.51E+00	5.25E+00	--	9.8E+00	--	--	--	--

Table - MMB Wetland Reference - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	MMB Wetland Reference

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetlands - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetaldehyde		3.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone		7.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde		2.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4-Nitrophenol		9.1E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid		5.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzyl alcohol		2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		1.5E-01	3.1E-04	4.9E-05	1.1E+00	1.7E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Caprolactam	6.6E-04	6.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbazole		9.3E-02	5.5E-02	5.1E-03	1.0E+00	9.5E-02	5.6E-01	5.2E-02	5.6E-01	5.2E-02
Benzo(a)pyrene	9.4E-05		2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
N-Nitrosodi-n-propylamine	7.8E-07		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Aluminum	1.7E-01	1.3E+04	5.7E-04	7.4E+00	8.6E-03	1.1E+02	8.6E-03	1.1E+02	8.6E-03	1.1E+02
Arsenic		1.7E+01	2.8E-02	4.8E-01	1.3E-01	2.2E+00	1.3E-01	2.2E+00	1.3E-01	2.2E+00
Barium	3.7E-02	1.0E+02	3.1E-02	3.2E+00	1.8E-02	1.9E+00	1.8E-02	1.9E+00	1.8E-02	1.9E+00
Beryllium		9.8E-01	2.0E-03	2.0E-03	9.0E-03	8.9E-03	9.0E-03	8.9E-03	9.0E-03	8.9E-03
Cadmium		2.1E+00	5.6E-02	1.2E-01	4.6E-01	9.4E-01	4.6E-01	9.4E-01	4.6E-01	9.4E-01
Copper	4.8E-03	3.9E+01	4.1E-02	1.6E+00	1.6E+00	6.4E+01	1.6E+00	6.4E+01	1.6E+00	6.4E+01
Iron	3.4E+00	2.6E+04	8.5E-04	2.2E+01	7.2E-03	1.8E+02	7.2E-03	1.8E+02	7.2E-03	1.8E+02
Lead	6.5E-03	1.4E+02	3.5E-02	4.8E+00	6.6E-02	9.1E+00	6.6E-02	9.1E+00	6.6E-02	9.1E+00
Manganese	9.1E-01	7.9E+02	1.6E-02	1.2E+01	4.4E-02	3.4E+01	4.4E-02	3.4E+01	4.4E-02	3.4E+01
Mercury		2.6E-01	2.6E-02	6.6E-03	2.8E+00	7.3E-01	2.8E+00	7.3E-01	2.8E+00	7.3E-01
Nickel		1.9E+01	4.7E-02	8.7E-01	8.2E-01	1.5E+01	8.2E-01	1.5E+01	8.2E-01	1.5E+01
Thallium		1.4E+00	8.0E-04	1.1E-03	--	--	1.0E+00	1.4E+00	1.0E+00	1.4E+00
Tin		8.6E+00	6.0E-03	5.2E-02	--	--	--	--	--	--
Vanadium		3.2E+01	9.7E-04	3.1E-02	8.4E-03	2.7E-01	8.4E-03	2.7E-01	8.4E-03	2.7E-01
Zinc		2.1E+02	5.0E-02	1.0E+01	2.6E-02	5.4E+00	2.6E-02	5.4E+00	2.6E-02	5.4E+00
Bromide	5.5E-02		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		4.9E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia		5.7E+02	--	--	--	--	--	--	--	--
Sulfate		6.0E+02	--	--	--	--	--	--	--	--
Kempore (Azodicarbonamide)	5.5E-01		--	--	--	--	--	--	--	--

Table - MMB Wetlands - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - MMB Wetlands - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	--	3.5E-01	--	--	--	--	--	1.6E-04	--	--	--	--	1.6E-04	2.4E+01	6.7E-06	2.4E+02	6.7E-07
Acetone	--	7.2E-01	--	--	--	--	--	3.3E-04	--	--	--	--	3.3E-04	2.0E+01	1.7E-05	1.0E+02	3.3E-06
Formaldehyde	--	2.2E+00	--	--	--	--	--	1.0E-03	--	--	--	--	1.0E-03	1.0E-01	1.0E-02	1.0E+00	1.0E-03
3 & 4 Methylphenol	--	1.2E-01	--	--	--	--	--	5.7E-05	--	--	--	--	5.7E-05	1.0E+02	5.7E-07	1.0E+03	5.7E-08
4-Nitrophenol	--	9.1E-02	--	--	--	--	--	4.2E-05	--	--	--	--	4.2E-05	1.3E+00	3.4E-05	1.3E+01	3.4E-06
Benzaldehyde	--	1.2E-01	--	--	--	--	--	5.4E-05	--	--	--	--	5.4E-05	4.3E+01	1.3E-06	8.6E+01	6.3E-07
Benzoic Acid	--	5.9E-01	--	--	--	--	--	2.7E-04	--	--	--	--	2.7E-04	5.0E+01	5.4E-06	7.5E+02	3.6E-07
Benzyl alcohol	--	2.0E-01	--	--	--	--	--	9.2E-05	--	--	--	--	9.2E-05	1.4E+02	6.4E-07	1.4E+03	6.4E-08
Bis(2-Ethylhexyl)phthalate	--	1.5E-01	4.9E-05	1.7E-01	1.5E-01	1.5E-01	--	7.2E-05	5.4E-06	2.4E-03	1.1E-03	1.1E-03	4.6E-03	1.8E+01	2.5E-04	1.8E+02	2.5E-05
Caprolactam	6.6E-04	6.8E-02	--	--	--	--	6.4E-05	3.1E-05	--	--	--	--	9.6E-05	8.0E+02	1.2E-07	8.0E+03	1.2E-08
Carbazole	--	9.3E-02	5.1E-03	9.5E-02	5.2E-02	5.2E-02	--	4.3E-05	5.6E-04	1.3E-03	3.6E-04	3.6E-04	2.6E-03	5.0E+00	5.3E-04	5.0E+01	5.3E-05
Benzo(a)pyrene	9.4E-05	--	--	--	--	--	9.1E-06	--	--	--	--	--	9.1E-06	1.0E+00	9.1E-06	1.0E+01	9.1E-07
N-Nitrosodi-n-propylamine	7.8E-07	--	--	--	--	--	7.6E-08	--	--	--	--	--	7.6E-08	7.3E-02	1.0E-06	7.3E-01	1.0E-07
Aluminum	1.7E-01	1.3E+04	7.4E+00	1.1E+02	1.1E+02	1.1E+02	1.6E-02	6.0E+00	8.2E-01	1.5E+00	7.7E-01	7.7E-01	9.9E+00	1.9E+00	5.1E+00	1.9E+01	5.1E-01
Arsenic	--	1.7E+01	4.8E-01	2.2E+00	2.2E+00	2.2E+00	--	7.9E-03	5.3E-02	3.0E-02	1.5E-02	1.5E-02	1.2E-01	1.3E-01	9.6E-01	1.3E+00	9.6E-02
Barium	3.7E-02	1.0E+02	3.2E+00	1.9E+00	1.9E+00	1.9E+00	3.6E-03	4.7E-02	3.5E-01	2.6E-02	1.3E-02	1.3E-02	4.6E-01	5.2E+01	8.8E-03	1.2E+02	3.8E-03
Beryllium	--	9.8E-01	2.0E-03	8.9E-03	8.9E-03	8.9E-03	--	4.6E-04	2.2E-04	1.2E-04	6.1E-05	6.1E-05	9.2E-04	5.3E-01	1.7E-03	5.3E-01	1.7E-03
Cadmium	--	2.1E+00	1.2E-01	9.4E-01	9.4E-01	9.4E-01	--	9.5E-04	1.3E-02	1.3E-02	6.5E-03	6.5E-03	4.0E-02	1.9E+00	2.1E-02	7.1E+00	5.6E-03
Copper	4.8E-03	3.9E+01	1.6E+00	6.4E+01	6.4E+01	6.4E+01	4.7E-04	1.8E-02	1.8E-01	8.9E-01	4.4E-01	4.4E-01	2.0E+00	1.5E+01	1.3E-01	1.5E+02	1.3E-02
Iron	3.4E+00	2.6E+04	2.2E+01	1.8E+02	1.8E+02	1.8E+02	3.3E-01	1.2E+01	2.4E+00	2.5E+00	1.3E+00	1.3E+00	2.0E+01	--	--	--	--
Lead	6.5E-03	1.4E+02	4.8E+00	9.1E+00	9.1E+00	9.1E+00	6.3E-04	6.4E-02	5.4E-01	1.3E-01	6.3E-02	6.3E-02	8.5E-01	4.7E+00	1.8E-01	1.5E+02	5.5E-03
Manganese	9.1E-01	7.9E+02	1.2E+01	3.4E+01	3.4E+01	3.4E+01	8.8E-02	3.6E-01	1.4E+00	4.8E-01	2.4E-01	2.4E-01	2.8E+00	8.8E+01	3.2E-02	2.8E+02	9.8E-03
Mercury	--	2.6E-01	6.6E-03	7.3E-01	7.3E-01	7.3E-01	--	1.2E-04	7.3E-04	1.0E-02	5.0E-03	5.0E-03	2.1E-02	1.0E+00	2.1E-02	1.0E+01	2.1E-03
Nickel	--	1.9E+01	8.7E-01	1.5E+01	1.5E+01	1.5E+01	--	8.6E-03	9.7E-02	2.1E-01	1.1E-01	1.1E-01	5.3E-01	4.0E+01	1.3E-02	8.0E+01	6.6E-03
Thallium	--	1.4E+00	1.1E-03	--	1.4E+00	1.4E+00	--	6.5E-04	1.2E-04	--	9.7E-03	9.7E-03	2.0E-02	4.6E-02	4.4E-01	4.6E-01	4.4E-02
Tin	--	8.6E+00	5.2E-02	--	--	--	--	4.0E-03	5.7E-03	--	--	--	9.7E-03	2.3E+01	4.1E-04	3.5E+01	2.8E-04
Vanadium	--	3.2E+01	3.1E-02	2.7E-01	2.7E-01	2.7E-01	--	1.5E-02	3.4E-03	3.7E-03	1.9E-03	1.9E-03	2.6E-02	2.1E-01	1.2E-01	2.1E+00	1.2E-02
Zinc	--	2.1E+02	1.0E+01	5.4E+00	5.4E+00	5.4E+00	--	9.6E-02	1.2E+00	7.4E-02	3.7E-02	3.7E-02	1.4E+00	7.5E+01	1.9E-02	2.6E+02	5.5E-03
Bromide	5.5E-02	--	--	--	--	--	5.4E-03	--	--	--	--	--	5.4E-03	--	--	--	--
Chloride	--	4.9E+02	--	--	--	--	--	2.2E-01	--	--	--	--	2.2E-01	--	--	--	--
Nitrogen, as Ammonia	--	5.7E+02	--	--	--	--	--	2.6E-01	--	--	--	--	2.6E-01	--	--	--	--
Sulfate	--	6.0E+02	--	--	--	--	--	2.8E-01	--	--	--	--	2.8E-01	--	--	--	--
Kempore (Azodicarbonamid	5.5E-01	--	--	--	--	--	5.4E-02	--	--	--	--	--	5.4E-02	--	--	--	--

Table - MMB Wetlands - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetland Reference - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	--	2.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	--	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid	2.1E-03	5.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	3.1E-04	8.2E-05	1.1E+00	2.9E-01	1.0E+00	2.6E-01	1.0E+00	2.6E-01
Caprolactam	1.4E-03	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)pyrene	--	9.6E-02	2.2E-03	2.1E-04	1.1E+00	1.0E-01	2.2E-01	2.1E-02	2.2E-01	2.1E-02
Aluminum	2.4E-01	5.5E+03	5.7E-04	3.2E+00	8.6E-03	4.7E+01	8.6E-03	4.7E+01	8.6E-03	4.7E+01
Arsenic	--	6.6E+00	2.8E-02	1.8E-01	1.3E-01	8.4E-01	1.3E-01	8.4E-01	1.3E-01	8.4E-01
Barium	3.8E-02	8.4E+01	3.1E-02	2.6E+00	1.8E-02	1.5E+00	1.8E-02	1.5E+00	1.8E-02	1.5E+00
Beryllium	--	7.0E-01	2.0E-03	1.4E-03	9.0E-03	6.3E-03	9.0E-03	6.3E-03	9.0E-03	6.3E-03
Cadmium	--	9.0E-01	5.6E-02	5.0E-02	4.6E-01	4.1E-01	4.6E-01	4.1E-01	4.6E-01	4.1E-01
Copper	2.6E-03	1.5E+01	4.1E-02	6.2E-01	1.6E+00	2.5E+01	1.6E+00	2.5E+01	1.6E+00	2.5E+01
Iron	1.1E+00	7.5E+03	8.5E-04	6.4E+00	7.2E-03	5.4E+01	7.2E-03	5.4E+01	7.2E-03	5.4E+01
Lead	1.1E-03	4.6E+01	3.5E-02	1.6E+00	6.6E-02	3.0E+00	6.6E-02	3.0E+00	6.6E-02	3.0E+00
Manganese	3.1E-01	5.0E+02	1.6E-02	7.9E+00	4.4E-02	2.2E+01	4.4E-02	2.2E+01	4.4E-02	2.2E+01
Nickel	3.6E-03	6.1E+00	4.7E-02	2.9E-01	8.2E-01	5.0E+00	8.2E-01	5.0E+00	8.2E-01	5.0E+00
Tin	--	7.3E+00	6.0E-03	4.4E-02	--	--	--	--	--	--
Vanadium	3.3E-03	1.1E+01	9.7E-04	1.1E-02	8.4E-03	9.2E-02	8.4E-03	9.2E-02	8.4E-03	9.2E-02
Zinc	1.8E-02	7.3E+01	5.0E-02	3.7E+00	2.6E-02	1.9E+00	2.6E-02	1.9E+00	2.6E-02	1.9E+00
Chloride	1.1E+02	4.2E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	1.5E-01	8.3E+02	--	--	--	--	--	--	--	--
Sulfate	1.7E+01	4.2E+02	--	--	--	--	--	--	--	--

Table - MMB Wetland Reference - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetland Reference

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - MMB Wetland Reference - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	--	2.0E+00	--	--	--	--	--	9.2E-04	--	--	--	--	9.2E-04	2.0E+01	4.6E-05	1.0E+02	9.2E-06
Benzaldehyde	--	3.3E-01	--	--	--	--	--	1.5E-04	--	--	--	--	1.5E-04	4.3E+01	3.6E-06	8.6E+01	1.8E-06
Benzoic Acid	2.1E-03	5.4E-01	--	--	--	--	2.0E-04	2.5E-04	--	--	--	--	4.5E-04	5.0E+01	9.1E-06	7.5E+02	6.1E-07
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	8.2E-05	2.9E-01	2.6E-01	2.6E-01	--	1.2E-04	9.0E-06	4.0E-03	1.8E-03	1.8E-03	7.7E-03	1.8E+01	4.2E-04	1.8E+02	4.2E-05
Caprolactam	1.4E-03	--	--	--	--	--	1.4E-04	--	--	--	--	--	1.4E-04	8.0E+02	1.7E-07	8.0E+03	1.7E-08
Benzo(a)pyrene	--	9.6E-02	2.1E-04	1.0E-01	2.1E-02	2.1E-02	--	4.4E-05	2.4E-05	1.4E-03	1.5E-04	1.5E-04	1.8E-03	1.0E+00	1.8E-03	1.0E+01	1.8E-04
Aluminum	2.4E-01	5.5E+03	3.2E+00	4.7E+01	4.7E+01	4.7E+01	2.4E-02	2.5E+00	3.5E-01	6.5E-01	3.3E-01	3.3E-01	4.2E+00	1.9E+00	2.2E+00	1.9E+01	2.2E-01
Arsenic	--	6.6E+00	1.8E-01	8.4E-01	8.4E-01	8.4E-01	--	3.1E-03	2.0E-02	1.2E-02	5.8E-03	5.8E-03	4.7E-02	1.3E-01	3.7E-01	1.3E+00	3.7E-02
Barium	3.8E-02	8.4E+01	2.6E+00	1.5E+00	1.5E+00	1.5E+00	3.7E-03	3.9E-02	2.9E-01	2.1E-02	1.1E-02	1.1E-02	3.7E-01	5.2E+01	7.2E-03	1.2E+02	3.1E-03
Beryllium	--	7.0E-01	1.4E-03	6.3E-03	6.3E-03	6.3E-03	--	3.2E-04	1.5E-04	8.7E-05	4.4E-05	4.4E-05	6.5E-04	5.3E-01	1.2E-03	5.3E-01	1.2E-03
Cadmium	--	9.0E-01	5.0E-02	4.1E-01	4.1E-01	4.1E-01	--	4.2E-04	5.6E-03	5.7E-03	2.9E-03	2.9E-03	1.7E-02	1.9E+00	9.4E-03	7.1E+00	2.5E-03
Copper	2.6E-03	1.5E+01	6.2E-01	2.5E+01	2.5E+01	2.5E+01	2.5E-04	6.9E-03	6.8E-02	3.4E-01	1.7E-01	1.7E-01	7.6E-01	1.5E+01	5.0E-02	1.5E+02	5.0E-03
Iron	1.1E+00	7.5E+03	6.4E+00	5.4E+01	5.4E+01	5.4E+01	1.1E-01	3.5E+00	7.0E-01	7.5E-01	3.7E-01	3.7E-01	5.8E+00	--	--	--	--
Lead	1.1E-03	4.6E+01	1.6E+00	3.0E+00	3.0E+00	3.0E+00	1.1E-04	2.1E-02	1.8E-01	4.2E-02	2.1E-02	2.1E-02	2.8E-01	4.7E+00	6.0E-02	1.5E+02	1.8E-03
Manganese	3.1E-01	5.0E+02	7.9E+00	2.2E+01	2.2E+01	2.2E+01	3.1E-02	2.3E-01	8.8E-01	3.0E-01	1.5E-01	1.5E-01	1.7E+00	8.8E+01	2.0E-02	2.8E+02	6.1E-03
Nickel	3.6E-03	6.1E+00	2.9E-01	5.0E+00	5.0E+00	5.0E+00	3.5E-04	2.8E-03	3.2E-02	6.9E-02	3.4E-02	3.4E-02	1.7E-01	4.0E+01	4.3E-03	8.0E+01	2.2E-03
Tin	--	7.3E+00	4.4E-02	--	--	--	--	3.4E-03	4.8E-03	--	--	--	8.2E-03	2.3E+01	3.5E-04	3.5E+01	2.3E-04
Vanadium	3.3E-03	1.1E+01	1.1E-02	9.2E-02	9.2E-02	9.2E-02	3.2E-04	5.1E-03	1.2E-03	1.3E-03	6.4E-04	6.4E-04	9.1E-03	2.1E-01	4.4E-02	2.1E+00	4.4E-03
Zinc	1.8E-02	7.3E+01	3.7E+00	1.9E+00	1.9E+00	1.9E+00	1.7E-03	3.4E-02	4.1E-01	2.6E-02	1.3E-02	1.3E-02	5.0E-01	7.5E+01	6.6E-03	2.6E+02	1.9E-03
Chloride	1.1E+02	4.2E+02	--	--	--	--	1.1E+01	1.9E-01	--	--	--	--	1.1E+01	--	--	--	--
Nitrogen, as Ammonia	1.5E-01	8.3E+02	--	--	--	--	1.5E-02	3.8E-01	--	--	--	--	4.0E-01	--	--	--	--
Sulfate	1.7E+01	4.2E+02	--	--	--	--	1.7E+00	1.9E-01	--	--	--	--	1.9E+00	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table MMB Wetlands - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Acetaldehyde		3.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetone		7.23E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde		2.16E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		1.22E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4-Nitrophenol		9.10E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde		1.17E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzoic Acid		5.86E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzyl alcohol		1.99E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		1.55E-01	3.13E-04	4.86E-05	1.12E+00	1.73E-01	1.00E+00	1.55E-01
Caprolactam	6.60E-04	6.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbazole		9.28E-02	5.48E-02	5.08E-03	1.03E+00	9.54E-02	5.59E-01	5.19E-02
Benzo(a)pyrene	9.39E-05		2.22E-03	--	1.08E+00	--	2.23E-01	--
N-Nitrosodi-n-propylamine	7.80E-07		0.00E+00	--	0.00E+00	--	0.00E+00	--
Aluminum	1.69E-01	1.30E+04	5.74E-04	7.44E+00	8.60E-03	1.12E+02	8.60E-03	1.12E+02
Arsenic		1.72E+01	2.79E-02	4.80E-01	1.27E-01	2.18E+00	1.27E-01	2.18E+00
Barium	3.68E-02	1.03E+02	3.12E-02	3.20E+00	1.82E-02	1.87E+00	1.82E-02	1.87E+00
Beryllium		9.85E-01	2.00E-03	1.97E-03	9.00E-03	8.86E-03	9.00E-03	8.86E-03
Cadmium		2.06E+00	5.60E-02	1.15E-01	4.59E-01	9.43E-01	4.59E-01	9.43E-01
Copper	4.83E-03	3.90E+01	4.12E-02	1.61E+00	1.65E+00	6.42E+01	1.65E+00	6.42E+01
Iron	3.41E+00	2.55E+04	8.50E-04	2.17E+01	7.20E-03	1.84E+02	7.20E-03	1.84E+02
Lead	6.49E-03	1.38E+02	3.50E-02	4.84E+00	6.60E-02	9.13E+00	6.60E-02	9.13E+00
Manganese	9.08E-01	7.88E+02	1.58E-02	1.25E+01	4.38E-02	3.45E+01	4.38E-02	3.45E+01
Mercury		2.57E-01	2.57E-02	6.60E-03	2.84E+00	7.28E-01	2.84E+00	7.28E-01
Nickel		1.86E+01	4.70E-02	8.73E-01	8.18E-01	1.52E+01	8.18E-01	1.52E+01
Thallium		1.40E+00	8.00E-04	1.12E-03	--	--	1.00E+00	1.40E+00
Tin		8.59E+00	6.00E-03	5.15E-02	--	--	--	--
Vanadium		3.21E+01	9.70E-04	3.11E-02	8.40E-03	2.69E-01	8.40E-03	2.69E-01
Zinc		2.07E+02	5.05E-02	1.04E+01	2.60E-02	5.37E+00	2.60E-02	5.37E+00
Bromide	5.55E-02		0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride		4.85E+02	--	--	--	--	--	--
Nitrogen, as Ammonia		5.67E+02	--	--	--	--	--	--
Sulfate		6.00E+02	--	--	--	--	--	--
Kempore (Azodicarbonamide)	5.53E-01		--	--	--	--	--	--

Table MMB Wetlands - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table MMB Wetlands - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Acetaldehyde	--	3.50E-01	0.00E+00	0.00E+00	0.00E+00	--	1.23E-04	0.00E+00	0.00E+00	0.00E+00	1.2E-04	2.40E+01	5.1E-06	2.40E+02	5.1E-07
Acetone	--	7.23E-01	0.00E+00	0.00E+00	0.00E+00	--	2.54E-04	0.00E+00	0.00E+00	0.00E+00	2.5E-04	2.00E+01	1.3E-05	1.00E+02	2.5E-06
Formaldehyde	--	2.16E+00	0.00E+00	0.00E+00	0.00E+00	--	7.58E-04	0.00E+00	0.00E+00	0.00E+00	7.6E-04	1.00E-01	7.6E-03	1.00E+00	7.6E-04
3 & 4 Methylphenol	--	1.22E-01	0.00E+00	0.00E+00	0.00E+00	--	4.30E-05	0.00E+00	0.00E+00	0.00E+00	4.3E-05	1.00E+02	4.3E-07	1.00E+03	4.3E-08
4-Nitrophenol	--	9.10E-02	0.00E+00	0.00E+00	0.00E+00	--	3.19E-05	0.00E+00	0.00E+00	0.00E+00	3.2E-05	1.25E+00	2.6E-05	1.25E+01	2.6E-06
Benzaldehyde	--	1.17E-01	0.00E+00	0.00E+00	0.00E+00	--	4.12E-05	0.00E+00	0.00E+00	0.00E+00	4.1E-05	4.29E+01	9.6E-07	8.57E+01	4.8E-07
Benzoic Acid	--	5.86E-01	0.00E+00	0.00E+00	0.00E+00	--	2.06E-04	0.00E+00	0.00E+00	0.00E+00	2.1E-04	5.00E+01	4.1E-06	7.50E+02	2.7E-07
Benzyl alcohol	--	1.99E-01	0.00E+00	0.00E+00	0.00E+00	--	6.98E-05	0.00E+00	0.00E+00	0.00E+00	7.0E-05	1.43E+02	4.9E-07	1.43E+03	4.9E-08
Bis(2-Ethylhexyl)phthalate	--	1.55E-01	4.86E-05	1.73E-01	1.55E-01	--	5.44E-05	9.55E-07	4.25E-04	3.81E-04	8.6E-04	1.83E+01	4.7E-05	1.83E+02	4.7E-06
Caprolactam	6.60E-04	6.76E-02	0.00E+00	0.00E+00	0.00E+00	1.63E-05	2.37E-05	0.00E+00	0.00E+00	0.00E+00	4.0E-05	8.00E+02	5.0E-08	8.00E+03	5.0E-09
Carbazole	--	9.28E-02	5.08E-03	9.54E-02	5.19E-02	--	3.26E-05	9.99E-05	2.35E-04	1.27E-04	4.9E-04	5.00E+00	9.9E-05	5.00E+01	9.9E-06
Benzo(a)pyrene	9.39E-05	--	--	--	--	2.31E-06	--	--	--		2.3E-06	1.00E+00	2.3E-06	1.00E+01	2.3E-07
N-Nitrosodi-n-propylamine	7.80E-07	--	--	--	--	1.92E-08	--	--	--		1.9E-08	7.29E-02	2.6E-07	7.29E-01	2.6E-08
Aluminum	1.69E-01	1.30E+04	7.44E+00	1.12E+02	1.12E+02	4.17E-03	4.55E+00	1.46E-01	2.74E-01	2.74E-01	5.3E+00	1.93E+00	2.7E+00	1.93E+01	2.7E-01
Arsenic	--	1.72E+01	4.80E-01	2.18E+00	2.18E+00	--	6.03E-03	9.43E-03	5.36E-03	5.36E-03	2.6E-02	1.26E-01	2.1E-01	1.26E+00	2.1E-02
Barium	3.68E-02	1.03E+02	3.20E+00	1.87E+00	1.87E+00	9.07E-04	3.60E-02	6.29E-02	4.59E-03	4.59E-03	1.1E-01	5.18E+01	2.1E-03	1.19E+02	9.2E-04
Beryllium	--	9.85E-01	1.97E-03	8.86E-03	8.86E-03	--	3.46E-04	3.87E-05	2.18E-05	2.18E-05	4.3E-04	5.32E-01	8.0E-04	5.32E-01	8.0E-04
Cadmium	--	2.06E+00	1.15E-01	9.43E-01	9.43E-01	--	7.22E-04	2.26E-03	2.32E-03	2.32E-03	7.6E-03	1.86E+00	4.1E-03	7.10E+00	1.1E-03
Copper	4.83E-03	3.90E+01	1.61E+00	6.42E+01	6.42E+01	1.19E-04	1.37E-02	3.16E-02	1.58E-01	1.58E-01	3.6E-01	1.52E+01	2.4E-02	1.52E+02	2.4E-03
Iron	3.41E+00	2.55E+04	2.17E+01	1.84E+02	1.84E+02	8.41E-02	8.95E+00	4.26E-01	4.51E-01	4.51E-01	1.0E+01	--	--	--	--
Lead	6.49E-03	1.38E+02	4.84E+00	9.13E+00	9.13E+00	1.60E-04	4.85E-02	9.51E-02	2.24E-02	2.24E-02	1.9E-01	4.70E+00	4.0E-02	1.54E+02	1.2E-03
Manganese	9.08E-01	7.88E+02	1.25E+01	3.45E+01	3.45E+01	2.24E-02	2.77E-01	2.45E-01	8.48E-02	8.48E-02	7.1E-01	8.80E+01	8.1E-03	2.84E+02	2.5E-03
Mercury	--	2.57E-01	6.60E-03	7.28E-01	7.28E-01	--	9.01E-05	1.30E-04	1.79E-03	1.79E-03	3.8E-03	1.01E+00	3.8E-03	1.01E+01	3.8E-04
Nickel	--	1.86E+01	8.73E-01	1.52E+01	1.52E+01	--	6.52E-03	1.72E-02	3.73E-02	3.73E-02	9.8E-02	4.00E+01	2.5E-03	8.00E+01	1.2E-03
Thallium	--	1.40E+00	1.12E-03	--	1.40E+00	--	4.91E-04	2.20E-05	--	3.44E-03	4.0E-03	4.60E-02	8.6E-02	4.60E-01	8.6E-03
Tin	--	8.59E+00	5.15E-02	--	--	--	3.02E-03	1.01E-03	--		4.0E-03	2.34E+01	1.7E-04	3.50E+01	1.2E-04
Vanadium	--	3.21E+01	3.11E-02	2.69E-01	2.69E-01	--	1.13E-02	6.11E-04	6.62E-04	6.62E-04	1.3E-02	2.10E-01	6.3E-02	2.10E+00	6.3E-03
Zinc	--	2.07E+02	1.04E+01	5.37E+00	5.37E+00	--	7.26E-02	2.05E-01	1.32E-02	1.32E-02	3.0E-01	7.54E+01	4.0E-03	2.55E+02	1.2E-03
Bromide	5.55E-02	--	--	--	--	1.37E-03	--	--	--		1.4E-03	--	--	--	--
Chloride	--	4.85E+02	--	--	--	--	1.70E-01	--	--		1.7E-01	--	--	--	--
Nitrogen, as Ammonia	--	5.67E+02	--	--	--	--	1.99E-01	--	--		2.0E-01	--	--	--	--
Sulfate	--	6.00E+02	--	--	--	--	2.11E-01	--	--		2.1E-01	--	--	--	--
Kempore (Azodicarbonamide)	5.53E-01	--	--	--	--	1.36E-02	--	--	--		1.4E-02	--	--	--	--

Table MMB Wetlands - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table MMB Wetlands Reference - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands Reference

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Acetone	--	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde	--	3.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	3.13E-04	8.15E-05	1.12E+00	2.90E-01	1.00E+00	2.60E-01
Caprolactam	1.41E-03	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Benzo(a)pyrene	--	9.60E-02	2.22E-03	2.13E-04	1.08E+00	1.03E-01	2.23E-01	2.14E-02
Aluminum	2.43E-01	5.50E+03	5.74E-04	3.16E+00	8.60E-03	4.73E+01	8.60E-03	4.73E+01
Arsenic	--	6.60E+00	2.79E-02	1.84E-01	1.27E-01	8.38E-01	1.27E-01	8.38E-01
Barium	3.75E-02	8.40E+01	3.12E-02	2.62E+00	1.82E-02	1.53E+00	1.82E-02	1.53E+00
Beryllium	--	7.00E-01	2.00E-03	1.40E-03	9.00E-03	6.30E-03	9.00E-03	6.30E-03
Cadmium	--	9.00E-01	5.60E-02	5.04E-02	4.59E-01	4.13E-01	4.59E-01	4.13E-01
Copper	2.55E-03	1.50E+01	4.12E-02	6.18E-01	1.65E+00	2.47E+01	1.65E+00	2.47E+01
Iron	1.14E+00	7.50E+03	8.50E-04	6.38E+00	7.20E-03	5.40E+01	7.20E-03	5.40E+01
Lead	1.11E-03	4.60E+01	3.50E-02	1.61E+00	6.60E-02	3.04E+00	6.60E-02	3.04E+00
Manganese	3.14E-01	5.00E+02	1.58E-02	7.92E+00	4.38E-02	2.19E+01	4.38E-02	2.19E+01
Nickel	3.55E-03	6.10E+00	4.70E-02	2.87E-01	8.18E-01	4.99E+00	8.18E-01	4.99E+00
Tin	--	7.30E+00	6.00E-03	4.38E-02	--	--	--	--
Vanadium	3.25E-03	1.10E+01	9.70E-04	1.07E-02	8.40E-03	9.24E-02	8.40E-03	9.24E-02
Zinc	1.75E-02	7.30E+01	5.05E-02	3.68E+00	2.60E-02	1.90E+00	2.60E-02	1.90E+00
Chloride	1.09E+02	4.20E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	1.50E-01	8.30E+02	--	--	--	--	--	--
Sulfate	1.71E+01	4.20E+02	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table MMB Wetlands Reference - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	MMB Wetlands Reference

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Acetone	--	2.00E+00	0.00E+00	0.00E+00	0.00E+00	--	7.02E-04	0.00E+00	0.00E+00	0.00E+00	7.0E-04	2.00E+01	3.5E-05	1.00E+02	7.0E-06
Benzaldehyde	--	3.30E-01	0.00E+00	0.00E+00	0.00E+00	--	1.16E-04	0.00E+00	0.00E+00	0.00E+00	1.2E-04	4.29E+01	2.7E-06	8.57E+01	1.4E-06
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	0.00E+00	0.00E+00	5.17E-05	1.90E-04	0.00E+00	0.00E+00	0.00E+00	2.4E-04	5.00E+01	4.8E-06	7.50E+02	3.2E-07
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	8.15E-05	2.90E-01	2.60E-01	--	9.13E-05	1.60E-06	7.14E-04	6.39E-04	1.4E-03	1.83E+01	7.9E-05	1.83E+02	7.9E-06
Caprolactam	1.41E-03	--	--	--	--	3.46E-05	--	--	--		3.5E-05	8.00E+02	4.3E-08	8.00E+03	4.3E-09
Benzo(a)pyrene	--	9.60E-02	2.13E-04	1.03E-01	2.14E-02	--	3.37E-05	4.18E-06	2.54E-04	5.26E-05	3.4E-04	1.00E+00	3.4E-04	1.00E+01	3.4E-05
Aluminum	2.43E-01	5.50E+03	3.16E+00	4.73E+01	4.73E+01	5.99E-03	1.93E+00	6.21E-02	1.16E-01	1.16E-01	2.2E+00	1.93E+00	1.2E+00	1.93E+01	1.2E-01
Arsenic	--	6.60E+00	1.84E-01	8.38E-01	8.38E-01	--	2.32E-03	3.62E-03	2.06E-03	2.06E-03	1.0E-02	1.26E-01	8.0E-02	1.26E+00	8.0E-03
Barium	3.75E-02	8.40E+01	2.62E+00	1.53E+00	1.53E+00	9.24E-04	2.95E-02	5.15E-02	3.76E-03	3.76E-03	8.9E-02	5.18E+01	1.7E-03	1.19E+02	7.5E-04
Beryllium	--	7.00E-01	1.40E-03	6.30E-03	6.30E-03	--	2.46E-04	2.75E-05	1.55E-05	1.55E-05	3.0E-04	5.32E-01	5.7E-04	5.32E-01	5.7E-04
Cadmium	--	9.00E-01	5.04E-02	4.13E-01	4.13E-01	--	3.16E-04	9.90E-04	1.01E-03	1.01E-03	3.3E-03	1.86E+00	1.8E-03	7.10E+00	4.7E-04
Copper	2.55E-03	1.50E+01	6.18E-01	2.47E+01	2.47E+01	6.28E-05	5.27E-03	1.22E-02	6.07E-02	6.07E-02	1.4E-01	1.52E+01	9.1E-03	1.52E+02	9.1E-04
Iron	1.14E+00	7.50E+03	6.38E+00	5.40E+01	5.40E+01	2.81E-02	2.63E+00	1.25E-01	1.33E-01	1.33E-01	3.1E+00	--	--	--	--
Lead	1.11E-03	4.60E+01	1.61E+00	3.04E+00	3.04E+00	2.72E-05	1.61E-02	3.16E-02	7.46E-03	7.46E-03	6.3E-02	4.70E+00	1.3E-02	1.54E+02	4.1E-04
Manganese	3.14E-01	5.00E+02	7.92E+00	2.19E+01	2.19E+01	7.73E-03	1.76E-01	1.56E-01	5.38E-02	5.38E-02	4.5E-01	8.80E+01	5.1E-03	2.84E+02	1.6E-03
Nickel	3.55E-03	6.10E+00	2.87E-01	4.99E+00	4.99E+00	8.74E-05	2.14E-03	5.63E-03	1.23E-02	1.23E-02	3.2E-02	4.00E+01	8.1E-04	8.00E+01	4.0E-04
Tin	--	7.30E+00	4.38E-02	--	--	--	2.56E-03	8.61E-04	--		3.4E-03	2.34E+01	1.5E-04	3.50E+01	9.8E-05
Vanadium	3.25E-03	1.10E+01	1.07E-02	9.24E-02	9.24E-02	8.00E-05	3.86E-03	2.10E-04	2.27E-04	2.27E-04	4.6E-03	2.10E-01	2.2E-02	2.10E+00	2.2E-03
Zinc	1.75E-02	7.30E+01	3.68E+00	1.90E+00	1.90E+00	4.31E-04	2.56E-02	7.24E-02	4.66E-03	4.66E-03	1.1E-01	7.54E+01	1.4E-03	2.55E+02	4.2E-04
Chloride	1.09E+02	4.20E+02	--	--	--	2.67E+00	1.47E-01	--	--		2.8E+00	--	--	--	--
Nitrogen, as Ammonia	1.50E-01	8.30E+02	--	--	--	3.69E-03	2.91E-01	--	--		3.0E-01	--	--	--	--
Sulfate	1.71E+01	4.20E+02	--	--	--	4.20E-01	1.47E-01	--	--		5.7E-01	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - CTE - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.9E-02	2.0E+00	3.8E-02	2.0E+00	3.8E-02
Bis(2-Ethylhexyl)phthalate	1.9E-02	6.0E+01	1.1E+00	6.0E+01	1.1E+00
Fluoranthene	2.6E-02	2.2E-01	5.7E-03	2.2E-01	5.7E-03
Phenanthrene	2.2E-02	4.3E-02	9.6E-04	4.3E-02	9.6E-04
Pyrene	2.8E-02	1.1E-01	3.2E-03	1.1E-01	3.2E-03
Aluminum	7.4E+03	5.3E-03	3.9E+01	5.3E-03	3.9E+01
Arsenic	5.0E+00	1.0E-01	5.2E-01	1.0E-01	5.2E-01
Cadmium	1.5E-01	8.7E-02	1.3E-02	8.7E-02	1.3E-02
Chromium	6.2E+00	5.3E-02	3.2E-01	5.3E-02	3.2E-01
Cobalt	1.6E+00	4.1E-03	6.4E-03	4.1E-03	6.4E-03
Copper	4.1E+00	1.4E-01	5.6E-01	1.4E-01	5.6E-01
Iron	6.3E+03	1.1E-01	7.1E+02	1.1E-01	7.1E+02
Lead	1.6E+01	9.6E-02	1.5E+00	9.6E-02	1.5E+00
Manganese	2.8E+01	4.1E-03	1.1E-01	4.1E-03	1.1E-01
Mercury	7.7E-02	1.1E-02	8.4E-04	1.1E-02	8.4E-04
Nickel	4.0E+00	7.1E-02	2.8E-01	7.1E-02	2.8E-01
Selenium	4.1E-01	4.1E-02	1.7E-02	4.1E-02	1.7E-02
Tin	2.3E+00	4.0E+00	9.0E+00	4.0E+00	9.0E+00
Vanadium	1.2E+01	2.5E-03	2.9E-02	2.5E-03	2.9E-02
Zinc	8.5E+00	2.7E-02	2.3E-01	2.7E-02	2.3E-01
Nitrogen, as Ammonia	1.3E+02	--	--	--	--
Sulfate	2.8E+01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	2.3E-08	0.0E+00	0.0E+00	2.3E-08	--	--	--	--
Benzo(a)pyrene	1.9E-02	3.8E-02	3.8E-02	6.9E-09	4.4E-07	4.0E-06	4.4E-06	9.2E+02	4.8E-09	9.2E+03	4.8E-10
Bis(2-Ethylhexyl)phthalate	1.9E-02	1.1E+00	1.1E+00	6.8E-09	1.3E-05	1.1E-04	1.3E-04	1.1E+00	1.2E-04	1.1E+01	1.2E-05
Fluoranthene	2.6E-02	5.7E-03	5.7E-03	9.5E-09	6.5E-08	5.8E-07	6.6E-07	9.2E+02	7.1E-10	9.2E+03	7.1E-11
Phenanthrene	2.2E-02	9.6E-04	9.6E-04	8.1E-09	1.1E-08	9.8E-08	1.2E-07	9.2E+02	1.3E-10	9.2E+03	1.3E-11
Pyrene	2.8E-02	3.2E-03	3.2E-03	1.0E-08	3.7E-08	3.3E-07	3.8E-07	9.2E+02	4.1E-10	9.2E+03	4.1E-11
Aluminum	7.4E+03	3.9E+01	3.9E+01	2.7E-03	4.4E-04	4.0E-03	7.1E-03	1.1E+02	6.5E-05	1.1E+03	6.5E-06
Arsenic	5.0E+00	5.2E-01	5.2E-01	1.8E-06	6.0E-06	5.4E-05	6.1E-05	5.1E+00	1.2E-05	1.3E+01	4.8E-06
Cadmium	1.5E-01	1.3E-02	1.3E-02	5.5E-08	1.5E-07	1.4E-06	1.6E-06	1.5E+00	1.0E-06	5.5E+00	2.8E-07
Chromium	6.2E+00	3.2E-01	3.2E-01	2.3E-06	3.7E-06	3.3E-05	3.9E-05	2.7E+00	1.5E-05	1.1E+01	3.6E-06
Cobalt	1.6E+00	6.4E-03	6.4E-03	5.7E-07	7.3E-08	6.6E-07	1.3E-06	--	--	--	--
Copper	4.1E+00	5.6E-01	5.6E-01	1.5E-06	6.4E-06	5.8E-05	6.6E-05	1.9E+01	3.5E-06	3.7E+01	1.8E-06
Iron	6.3E+03	7.1E+02	7.1E+02	2.3E-03	8.1E-03	7.3E-02	8.4E-02	--	--	--	--
Lead	1.6E+01	1.5E+00	1.5E+00	5.7E-06	1.7E-05	1.5E-04	1.8E-04	4.7E+00	3.8E-05	8.3E+00	2.1E-05
Manganese	2.8E+01	1.1E-01	1.1E-01	1.0E-05	1.3E-06	1.2E-05	2.3E-05	9.8E+02	2.4E-08	9.8E+03	2.4E-09
Mercury	7.7E-02	8.4E-04	8.4E-04	2.8E-08	9.5E-09	8.6E-08	1.2E-07	4.5E-01	2.7E-07	9.0E-01	1.4E-07
Nickel	4.0E+00	2.8E-01	2.8E-01	1.5E-06	3.2E-06	2.9E-05	3.4E-05	7.7E+01	4.4E-07	1.1E+02	3.2E-07
Selenium	4.1E-01	1.7E-02	1.7E-02	1.5E-07	1.9E-07	1.7E-06	2.1E-06	4.4E-01	4.7E-06	5.2E-01	4.0E-06
Tin	2.3E+00	9.0E+00	9.0E+00	8.2E-07	1.0E-04	9.3E-04	1.0E-03	6.8E+00	1.5E-04	1.7E+01	6.1E-05
Vanadium	1.2E+01	2.9E-02	2.9E-02	4.4E-06	3.4E-07	3.0E-06	7.7E-06	1.1E+00	7.0E-06	1.1E+01	7.0E-07
Zinc	8.5E+00	2.3E-01	2.3E-01	3.1E-06	2.6E-06	2.4E-05	2.9E-05	1.5E+01	2.0E-06	1.3E+02	2.2E-07
Nitrogen, as Ammonia	1.3E+02	--	--	4.7E-05	--	--	4.7E-05	--	--	--	--
Sulfate	2.8E+01	--	--	1.0E-05	--	--	1.0E-05	--	--	--	--

Table - Background - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	Background

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-2 - CTE - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.4E-01	2.0E+00	4.9E-01	2.0E+00	4.9E-01
Bis(2-Ethylhexyl)phthalate	2.2E+01	6.0E+01	1.3E+03	6.0E+01	1.3E+03
Diphenyl ether	1.2E-01	2.4E-02	2.9E-03	2.4E-02	2.9E-03
Fluoranthene	9.4E-01	2.2E-01	2.0E-01	2.2E-01	2.0E-01
Phenanthrene	6.8E-01	4.3E-02	3.0E-02	4.3E-02	3.0E-02
Pyrene	6.6E-01	1.1E-01	7.5E-02	1.1E-01	7.5E-02
4,4'-DDD	3.9E-02	1.7E+00	6.7E-02	1.7E+00	6.7E-02
4,4'-DDE	4.9E-02	8.7E+00	4.2E-01	8.7E+00	4.2E-01
4,4'-DDT	2.7E-01	4.2E+00	1.1E+00	4.2E+00	1.1E+00
Aluminum	8.7E+03	5.3E-03	4.6E+01	5.3E-03	4.6E+01
Arsenic	6.7E+00	1.0E-01	7.0E-01	1.0E-01	7.0E-01
Cadmium	5.1E-01	8.7E-02	4.5E-02	8.7E-02	4.5E-02
Chromium	3.9E+01	5.3E-02	2.1E+00	5.3E-02	2.1E+00
Copper	1.8E+01	1.4E-01	2.4E+00	1.4E-01	2.4E+00
Iron	1.1E+04	1.1E-01	1.2E+03	1.1E-01	1.2E+03
Lead	4.0E+01	9.6E-02	3.8E+00	9.6E-02	3.8E+00
Mercury	1.5E-01	1.1E-02	1.6E-03	1.1E-02	1.6E-03
Selenium	1.1E+00	4.1E-02	4.5E-02	4.1E-02	4.5E-02
Vanadium	2.4E+01	2.5E-03	5.8E-02	2.5E-03	5.8E-02
Zinc	4.9E+01	2.7E-02	1.3E+00	2.7E-02	1.3E+00
Chloride	7.9E+01	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-2 - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	2.0E-07	0.0E+00	0.0E+00	2.0E-07	--	--	--	--
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	1.9E-06	0.0E+00	0.0E+00	1.9E-06	--	--	--	--
Benzo(a)pyrene	2.4E-01	4.9E-01	4.9E-01	2.4E-07	1.5E-05	1.4E-04	1.5E-04	9.2E+02	1.7E-07	9.2E+03	1.7E-08
Bis(2-Ethylhexyl)phthalate	2.2E+01	1.3E+03	1.3E+03	2.3E-05	4.3E-02	3.8E-01	4.3E-01	1.1E+00	3.9E-01	1.1E+01	3.9E-02
Diphenyl ether	1.2E-01	2.9E-03	2.9E-03	1.2E-07	9.3E-08	8.3E-07	1.0E-06	--	--	--	--
Fluoranthene	9.4E-01	2.0E-01	2.0E-01	9.5E-07	6.5E-06	5.8E-05	6.6E-05	9.2E+02	7.1E-08	9.2E+03	7.1E-09
Phenanthrene	6.8E-01	3.0E-02	3.0E-02	6.9E-07	9.3E-07	8.4E-06	1.0E-05	9.2E+02	1.1E-08	9.2E+03	1.1E-09
Pyrene	6.6E-01	7.5E-02	7.5E-02	6.7E-07	2.4E-06	2.1E-05	2.5E-05	9.2E+02	2.7E-08	9.2E+03	2.7E-09
4,4'-DDD	3.9E-02	6.7E-02	6.7E-02	3.9E-08	2.1E-06	1.9E-05	2.1E-05	1.3E+01	1.6E-06	1.3E+02	1.6E-07
4,4'-DDE	4.9E-02	4.2E-01	4.2E-01	5.0E-08	1.3E-05	1.2E-04	1.3E-04	1.3E+01	1.0E-05	1.3E+02	1.0E-06
4,4'-DDT	2.7E-01	1.1E+00	1.1E+00	2.7E-07	3.6E-05	3.3E-04	3.6E-04	1.3E+01	2.8E-05	1.3E+02	2.8E-06
Aluminum	8.7E+03	4.6E+01	4.6E+01	8.8E-03	1.4E-03	1.3E-02	2.3E-02	1.1E+02	2.1E-04	1.1E+03	2.1E-05
Arsenic	6.7E+00	7.0E-01	7.0E-01	6.7E-06	2.2E-05	2.0E-04	2.3E-04	5.1E+00	4.4E-05	1.3E+01	1.8E-05
Cadmium	5.1E-01	4.5E-02	4.5E-02	5.2E-07	1.4E-06	1.3E-05	1.5E-05	1.5E+00	9.8E-06	5.5E+00	2.7E-06
Chromium	3.9E+01	2.1E+00	2.1E+00	4.0E-05	6.6E-05	5.9E-04	7.0E-04	2.7E+00	2.6E-04	1.1E+01	6.3E-05
Copper	1.8E+01	2.4E+00	2.4E+00	1.8E-05	7.7E-05	6.9E-04	7.8E-04	1.9E+01	4.2E-05	3.7E+01	2.1E-05
Iron	1.1E+04	1.2E+03	1.2E+03	1.1E-02	3.9E-02	3.5E-01	4.0E-01	--	--	--	--
Lead	4.0E+01	3.8E+00	3.8E+00	4.0E-05	1.2E-04	1.1E-03	1.2E-03	4.7E+00	2.7E-04	8.3E+00	1.5E-04
Mercury	1.5E-01	1.6E-03	1.6E-03	1.5E-07	5.1E-08	4.5E-07	6.5E-07	4.5E-01	1.5E-06	9.0E-01	7.3E-07
Selenium	1.1E+00	4.5E-02	4.5E-02	1.1E-06	1.4E-06	1.3E-05	1.5E-05	4.4E-01	3.5E-05	5.2E-01	3.0E-05
Vanadium	2.4E+01	5.8E-02	5.8E-02	2.4E-05	1.8E-06	1.7E-05	4.2E-05	1.1E+00	3.8E-05	1.1E+01	3.8E-06
Zinc	4.9E+01	1.3E+00	1.3E+00	4.9E-05	4.2E-05	3.7E-04	4.7E-04	1.5E+01	3.2E-05	1.3E+02	3.6E-06
Chloride	7.9E+01	--	--	8.0E-05	--	--	8.0E-05	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	4.4E-04	--	--	4.4E-04	--	--	--	--

Table - EA-2 - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-4 - CTE - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.3E-01	2.0E+00	6.8E-01	2.0E+00	6.8E-01
Bis(2-Ethylhexyl)phthalate	9.0E+00	6.0E+01	5.4E+02	6.0E+01	5.4E+02
Fluoranthene	8.5E-01	2.2E-01	1.9E-01	2.2E-01	1.9E-01
Naphthalene	2.1E-01	3.0E-03	6.3E-04	3.0E-03	6.3E-04
Phenanthrene	6.9E-01	4.3E-02	3.0E-02	4.3E-02	3.0E-02
Pyrene	8.2E-01	1.1E-01	9.4E-02	1.1E-01	9.4E-02
4,4'-DDD	2.1E-02	1.7E+00	3.7E-02	1.7E+00	3.7E-02
4,4'-DDE	1.1E-02	8.7E+00	9.5E-02	8.7E+00	9.5E-02
4,4'-DDT	2.5E-02	4.2E+00	1.1E-01	4.2E+00	1.1E-01
Alpha-BHC	5.8E-03	9.1E-03	5.3E-05	9.1E-03	5.3E-05
Gamma-BHC/Lindane	1.9E-02	7.0E-03	1.4E-04	7.0E-03	1.4E-04
Aluminum	7.0E+03	5.3E-03	3.7E+01	5.3E-03	3.7E+01
Arsenic	7.6E+00	1.0E-01	8.0E-01	1.0E-01	8.0E-01
Cadmium	4.2E-01	8.7E-02	3.7E-02	8.7E-02	3.7E-02
Chromium	2.7E+02	5.3E-02	1.4E+01	5.3E-02	1.4E+01
Chromium, Hexavalent	1.1E+01	5.3E-02	5.5E-01	5.3E-02	5.5E-01
Cobalt	5.0E+00	4.1E-03	2.1E-02	4.1E-03	2.1E-02
Copper	1.4E+01	1.4E-01	1.9E+00	1.4E-01	1.9E+00
Iron	9.0E+03	1.1E-01	1.0E+03	1.1E-01	1.0E+03
Lead	2.4E+01	9.6E-02	2.3E+00	9.6E-02	2.3E+00
Manganese	8.4E+01	4.1E-03	3.4E-01	4.1E-03	3.4E-01
Mercury	1.2E-01	1.1E-02	1.3E-03	1.1E-02	1.3E-03
Nickel	1.0E+01	7.1E-02	7.2E-01	7.1E-02	7.2E-01
Vanadium	1.7E+01	2.5E-03	4.1E-02	2.5E-03	4.1E-02
Zinc	2.3E+01	2.7E-02	6.1E-01	2.7E-02	6.1E-01
Chloride	5.4E+01	--	--	--	--
Cyanide, Total	5.8E+00	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	--	--
Sulfate	1.1E+03	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	--	--

Table - EA-4 - CTE - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{bird} - Chemical concentration in bird tissue

C_{mam} - Chemical concentration in mammal tissue

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-4 - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	3.3E-07	0.0E+00	0.0E+00	3.3E-07	--	--	--	--
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	1.7E-06	0.0E+00	0.0E+00	1.7E-06	--	--	--	--
Benzo(a)pyrene	3.3E-01	6.8E-01	6.8E-01	2.4E-06	1.5E-04	1.4E-03	1.5E-03	9.2E+02	1.6E-06	9.2E+03	1.6E-07
Bis(2-Ethylhexyl)phthalate	9.0E+00	5.4E+02	5.4E+02	6.4E-05	1.2E-01	1.1E+00	1.2E+00	1.1E+00	1.1E+00	1.1E+01	1.1E-01
Fluoranthene	8.5E-01	1.9E-01	1.9E-01	6.1E-06	4.1E-05	3.7E-04	4.2E-04	9.2E+02	4.5E-07	9.2E+03	4.5E-08
Naphthalene	2.1E-01	6.3E-04	6.3E-04	1.5E-06	1.4E-07	1.3E-06	2.9E-06	5.4E+00	5.4E-07	5.4E+01	5.4E-08
Phenanthrene	6.9E-01	3.0E-02	3.0E-02	4.9E-06	6.7E-06	6.0E-05	7.1E-05	9.2E+02	7.8E-08	9.2E+03	7.8E-09
Pyrene	8.2E-01	9.4E-02	9.4E-02	5.8E-06	2.1E-05	1.9E-04	2.1E-04	9.2E+02	2.3E-07	9.2E+03	2.3E-08
4,4'-DDD	2.1E-02	3.7E-02	3.7E-02	1.5E-07	8.2E-06	7.4E-05	8.2E-05	1.3E+01	6.3E-06	1.3E+02	6.3E-07
4,4'-DDE	1.1E-02	9.5E-02	9.5E-02	7.8E-08	2.1E-05	1.9E-04	2.1E-04	1.3E+01	1.6E-05	1.3E+02	1.6E-06
4,4'-DDT	2.5E-02	1.1E-01	1.1E-01	1.8E-07	2.4E-05	2.1E-04	2.4E-04	1.3E+01	1.8E-05	1.3E+02	1.8E-06
Alpha-BHC	5.8E-03	5.3E-05	5.3E-05	4.1E-08	1.2E-08	1.1E-07	1.6E-07	2.0E+00	7.9E-08	2.0E+01	7.9E-09
Gamma-BHC/Lindane	1.9E-02	1.4E-04	1.4E-04	1.4E-07	3.0E-08	2.7E-07	4.4E-07	2.0E+00	2.2E-07	2.0E+01	2.2E-08
Aluminum	7.0E+03	3.7E+01	3.7E+01	5.0E-02	8.2E-03	7.4E-02	1.3E-01	1.1E+02	1.2E-03	1.1E+03	1.2E-04
Arsenic	7.6E+00	8.0E-01	8.0E-01	5.4E-05	1.8E-04	1.6E-03	1.8E-03	5.1E+00	3.6E-04	1.3E+01	1.4E-04
Cadmium	4.2E-01	3.7E-02	3.7E-02	3.0E-06	8.2E-06	7.3E-05	8.5E-05	1.5E+00	5.6E-05	5.5E+00	1.5E-05
Chromium	2.7E+02	1.4E+01	1.4E+01	1.9E-03	3.2E-03	2.9E-02	3.4E-02	2.7E+00	1.2E-02	1.1E+01	3.1E-03
Chromium, Hexavalent	1.1E+01	5.5E-01	5.5E-01	7.5E-05	1.2E-04	1.1E-03	1.3E-03	1.6E+00	8.0E-04	1.6E+01	8.0E-05
Cobalt	5.0E+00	2.1E-02	2.1E-02	3.6E-05	4.6E-06	4.1E-05	8.1E-05	--	--	--	--
Copper	1.4E+01	1.9E+00	1.9E+00	9.9E-05	4.2E-04	3.8E-03	4.3E-03	1.9E+01	2.3E-04	3.7E+01	1.2E-04
Iron	9.0E+03	1.0E+03	1.0E+03	6.4E-02	2.2E-01	2.0E+00	2.3E+00	--	--	--	--
Lead	2.4E+01	2.3E+00	2.3E+00	1.7E-04	5.2E-04	4.6E-03	5.3E-03	4.7E+00	1.1E-03	8.3E+00	6.4E-04
Manganese	8.4E+01	3.4E-01	3.4E-01	6.0E-04	7.6E-05	6.9E-04	1.4E-03	9.8E+02	1.4E-06	9.8E+03	1.4E-07
Mercury	1.2E-01	1.3E-03	1.3E-03	8.4E-07	2.8E-07	2.6E-06	3.7E-06	4.5E-01	8.2E-06	9.0E-01	4.1E-06
Nickel	1.0E+01	7.2E-01	7.2E-01	7.2E-05	1.6E-04	1.4E-03	1.7E-03	7.7E+01	2.2E-05	1.1E+02	1.6E-05
Vanadium	1.7E+01	4.1E-02	4.1E-02	1.2E-04	9.2E-06	8.3E-05	2.1E-04	1.1E+00	1.9E-04	1.1E+01	1.9E-05
Zinc	2.3E+01	6.1E-01	6.1E-01	1.6E-04	1.4E-04	1.2E-03	1.5E-03	1.5E+01	1.1E-04	1.3E+02	1.2E-05
Chloride	5.4E+01	--	--	3.8E-04	--	--	3.8E-04	--	--	--	--
Cyanide, Total	5.8E+00	--	--	4.1E-05	--	--	4.1E-05	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	1.9E-03	--	--	1.9E-03	--	--	--	--
Sulfate	1.1E+03	--	--	7.8E-03	--	--	7.8E-03	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	2.3E-04	--	--	2.3E-04	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	3.0E-04	--	--	3.0E-04	--	--	--	--

Table - EA-4 - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-5 - CTE - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	7.2E-02	2.0E+00	1.5E-01	2.0E+00	1.5E-01
Bis(2-Ethylhexyl)phthalate	3.1E+01	6.0E+01	1.9E+03	6.0E+01	1.9E+03
Diphenyl ether	3.7E-01	2.4E-02	9.1E-03	2.4E-02	9.1E-03
Fluoranthene	4.4E-01	2.2E-01	9.6E-02	2.2E-01	9.6E-02
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	2.6E-01	4.3E-02	1.1E-02	4.3E-02	1.1E-02
Pyrene	2.8E-01	1.1E-01	3.3E-02	1.1E-01	3.3E-02
4,4'-DDT	4.5E-02	4.2E+00	1.9E-01	4.2E+00	1.9E-01
Hexachlorobenzene	2.9E-02	6.0E-01	1.7E-02	6.0E-01	1.7E-02
Aluminum	1.1E+04	5.3E-03	5.7E+01	5.3E-03	5.7E+01
Antimony	3.4E-01	5.0E-02	1.7E-02	5.0E-02	1.7E-02
Arsenic	1.9E+01	1.0E-01	2.0E+00	1.0E-01	2.0E+00
Cadmium	5.2E-01	8.7E-02	4.5E-02	8.7E-02	4.5E-02
Chromium	6.6E+03	5.3E-02	3.5E+02	5.3E-02	3.5E+02
Chromium, Hexavalent	7.9E+01	5.3E-02	4.1E+00	5.3E-02	4.1E+00
Copper	3.8E+01	1.4E-01	5.2E+00	1.4E-01	5.2E+00
Iron	1.4E+04	1.1E-01	1.6E+03	1.1E-01	1.6E+03
Lead	7.1E+01	9.6E-02	6.8E+00	9.6E-02	6.8E+00
Mercury	6.4E-01	1.1E-02	7.0E-03	1.1E-02	7.0E-03
Silver	1.0E+02	8.0E-04	8.2E-02	8.0E-04	8.2E-02
Thallium	1.9E+00	2.2E-02	4.2E-02	2.2E-02	4.2E-02
Tin	2.9E+03	4.0E+00	1.2E+04	4.0E+00	1.2E+04
Vanadium	3.9E+01	2.5E-03	9.6E-02	2.5E-03	9.6E-02
Zinc	1.7E+01	2.7E-02	4.6E-01	2.7E-02	4.6E-01
Cyanide, Total	6.5E+00	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	--	--
Sulfate	7.4E+01	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	--	--

Table - EA-5 - CTE - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{bird} - Chemical concentration in bird tissue

C_{mam} - Chemical concentration in mammal tissue

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-5 - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	3.0E-08	0.0E+00	0.0E+00	3.0E-08	--	--	--	--
Aniline	1.2E-01	0.0E+00	0.0E+00	4.4E-08	0.0E+00	0.0E+00	4.4E-08	--	--	--	--
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	4.4E-08	0.0E+00	0.0E+00	4.4E-08	--	--	--	--
Benzo(a)pyrene	7.2E-02	1.5E-01	1.5E-01	2.6E-08	1.7E-06	1.5E-05	1.7E-05	9.2E+02	1.8E-08	9.2E+03	1.8E-09
Bis(2-Ethylhexyl)phthalate	3.1E+01	1.9E+03	1.9E+03	1.1E-05	2.1E-02	1.9E-01	2.1E-01	1.1E+00	2.0E-01	1.1E+01	2.0E-02
Diphenyl ether	3.7E-01	9.1E-03	9.1E-03	1.4E-07	1.0E-07	9.4E-07	1.2E-06	--	--	--	--
Fluoranthene	4.4E-01	9.6E-02	9.6E-02	1.6E-07	1.1E-06	9.9E-06	1.1E-05	9.2E+02	1.2E-08	9.2E+03	1.2E-09
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	9.5E-08	0.0E+00	0.0E+00	9.5E-08	--	--	--	--
Phenanthrene	2.6E-01	1.1E-02	1.1E-02	9.4E-08	1.3E-07	1.1E-06	1.4E-06	9.2E+02	1.5E-09	9.2E+03	1.5E-10
Pyrene	2.8E-01	3.3E-02	3.3E-02	1.0E-07	3.7E-07	3.4E-06	3.8E-06	9.2E+02	4.2E-09	9.2E+03	4.2E-10
4,4'-DDT	4.5E-02	1.9E-01	1.9E-01	1.6E-08	2.2E-06	2.0E-05	2.2E-05	1.3E+01	1.7E-06	1.3E+02	1.7E-07
Hexachlorobenzene	2.9E-02	1.7E-02	1.7E-02	1.1E-08	2.0E-07	1.8E-06	2.0E-06	2.9E+00	6.9E-07	2.9E+01	6.9E-08
Aluminum	1.1E+04	5.7E+01	5.7E+01	3.9E-03	6.5E-04	5.8E-03	1.0E-02	1.1E+02	9.5E-05	1.1E+03	9.5E-06
Antimony	3.4E-01	1.7E-02	1.7E-02	1.2E-07	1.9E-07	1.7E-06	2.1E-06	--	--	--	--
Arsenic	1.9E+01	2.0E+00	2.0E+00	7.1E-06	2.3E-05	2.1E-04	2.4E-04	5.1E+00	4.7E-05	1.3E+01	1.9E-05
Cadmium	5.2E-01	4.5E-02	4.5E-02	1.9E-07	5.2E-07	4.7E-06	5.4E-06	1.5E+00	3.6E-06	5.5E+00	9.8E-07
Chromium	6.6E+03	3.5E+02	3.5E+02	2.4E-03	4.0E-03	3.6E-02	4.2E-02	2.7E+00	1.6E-02	1.1E+01	3.9E-03
Chromium, Hexavalent	7.9E+01	4.1E+00	4.1E+00	2.9E-05	4.7E-05	4.3E-04	5.0E-04	1.6E+00	3.1E-04	1.6E+01	3.1E-05
Copper	3.8E+01	5.2E+00	5.2E+00	1.4E-05	5.9E-05	5.3E-04	6.1E-04	1.9E+01	3.3E-05	3.7E+01	1.6E-05
Iron	1.4E+04	1.6E+03	1.6E+03	5.1E-03	1.8E-02	1.6E-01	1.9E-01	--	--	--	--
Lead	7.1E+01	6.8E+00	6.8E+00	2.6E-05	7.7E-05	7.0E-04	8.0E-04	4.7E+00	1.7E-04	8.3E+00	9.7E-05
Mercury	6.4E-01	7.0E-03	7.0E-03	2.4E-07	8.0E-08	7.2E-07	1.0E-06	4.5E-01	2.3E-06	9.0E-01	1.1E-06
Silver	1.0E+02	8.2E-02	8.2E-02	3.8E-05	9.4E-07	8.5E-06	4.7E-05	1.2E+01	4.0E-06	1.2E+02	4.0E-07
Thallium	1.9E+00	4.2E-02	4.2E-02	6.8E-07	4.8E-07	4.3E-06	5.5E-06	6.1E-01	9.0E-06	6.1E+00	9.0E-07
Tin	2.9E+03	1.2E+04	1.2E+04	1.1E-03	1.3E-01	1.2E+00	1.3E+00	6.8E+00	2.0E-01	1.7E+01	7.9E-02
Vanadium	3.9E+01	9.6E-02	9.6E-02	1.4E-05	1.1E-06	9.9E-06	2.5E-05	1.1E+00	2.3E-05	1.1E+01	2.3E-06
Zinc	1.7E+01	4.6E-01	4.6E-01	6.2E-06	5.2E-06	4.7E-05	5.9E-05	1.5E+01	4.0E-06	1.3E+02	4.5E-07
Cyanide, Total	6.5E+00	--	--	2.4E-06	--	--	2.4E-06	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	1.5E-04	--	--	1.5E-04	--	--	--	--
Sulfate	7.4E+01	--	--	2.7E-05	--	--	2.7E-05	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	1.6E-03	--	--	1.6E-03	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	1.2E-03	--	--	1.2E-03	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	1.8E-04	--	--	1.8E-04	--	--	--	--

Table - EA-5 - CTE - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetlands - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetaldehyde		3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone		9.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde		2.8E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		3.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4-Nitrophenol		9.1E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid		7.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzyl alcohol		3.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		2.0E-01	3.2E-01	6.4E-02	1.0E+00	2.0E-01	1.0E+00	2.0E-01
Caprolactam	6.6E-04	8.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbazole		9.7E-02	2.9E-01	2.9E-02	5.6E-01	5.4E-02	5.6E-01	5.4E-02
Benzo(a)pyrene	1.3E-04		3.1E-01	--	2.2E-01	--	2.2E-01	--
N-Nitrosodi-n-propylamine	7.8E-07		0.0E+00	--	0.0E+00	--	0.0E+00	--
Aluminum	6.8E-01	1.7E+04	8.6E-03	1.5E+02	8.6E-03	1.5E+02	8.6E-03	1.5E+02
Arsenic		2.6E+01	1.3E-01	3.3E+00	1.3E-01	3.3E+00	1.3E-01	3.3E+00
Barium	4.6E-02	1.3E+02	1.8E-02	2.4E+00	1.8E-02	2.4E+00	1.8E-02	2.4E+00
Beryllium		1.4E+00	9.0E-03	1.3E-02	9.0E-03	1.3E-02	9.0E-03	1.3E-02
Cadmium		2.9E+00	4.6E-01	1.3E+00	4.6E-01	1.3E+00	4.6E-01	1.3E+00
Copper	1.5E-02	5.3E+01	1.6E+00	8.8E+01	1.6E+00	8.8E+01	1.6E+00	8.8E+01
Iron	9.9E+00	3.9E+04	7.2E-03	2.8E+02	7.2E-03	2.8E+02	7.2E-03	2.8E+02
Lead	3.8E-02	2.0E+02	6.6E-02	1.3E+01	6.6E-02	1.3E+01	6.6E-02	1.3E+01
Manganese	2.7E+00	1.3E+03	1.8E-03	2.3E+00	1.8E-03	2.3E+00	1.8E-03	2.3E+00
Mercury		4.1E-01	2.8E+00	1.2E+00	2.8E+00	1.2E+00	2.8E+00	1.2E+00
Nickel		2.5E+01	8.2E-01	2.0E+01	8.2E-01	2.0E+01	8.2E-01	2.0E+01
Thallium		1.4E+00	--	--	1.0E+00	1.4E+00	1.0E+00	1.4E+00
Tin		1.0E+01	--	--	--	--	--	--
Vanadium		4.1E+01	8.4E-03	3.4E-01	8.4E-03	3.4E-01	8.4E-03	3.4E-01
Zinc		2.9E+02	2.6E-02	7.5E+00	2.6E-02	7.5E+00	2.6E-02	7.5E+00
Bromide	1.0E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		6.6E+02	--	--	--	--	--	--
Nitrogen, as Ammonia		7.7E+02	--	--	--	--	--	--
Sulfate		8.3E+02	--	--	--	--	--	--
Kempore (Azodicarbonamide)			--	--	--	--	--	--

Table - MMB Wetlands - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - MMB Wetlands - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	--	3.3E-01	--	--	--	--	5.0E-04	--	--	--	5.0E-04	--	--	--	--
Acetone	--	9.6E-01	--	--	--	--	1.4E-03	--	--	--	1.4E-03	8.4E+03	1.7E-07	8.4E+04	1.7E-08
Formaldehyde	--	2.8E+00	--	--	--	--	4.1E-03	--	--	--	4.1E-03	--	--	--	--
3 & 4 Methylphenol	--	3.2E-01	--	--	--	--	4.8E-04	--	--	--	4.8E-04	--	--	--	--
4-Nitrophenol	--	9.1E-02	--	--	--	--	1.4E-04	--	--	--	1.4E-04	--	--	--	--
Benzaldehyde	--	2.0E-01	--	--	--	--	3.1E-04	--	--	--	3.1E-04	--	--	--	--
Benzoic Acid	--	7.6E-01	--	--	--	--	1.1E-03	--	--	--	1.1E-03	--	--	--	--
Benzyl alcohol	--	3.5E-01	--	--	--	--	5.2E-04	--	--	--	5.2E-04	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.0E-01	6.4E-02	2.0E-01	2.0E-01	--	3.0E-04	9.2E-03	1.4E-02	1.4E-02	3.8E-02	1.1E+00	3.5E-02	1.1E+01	3.5E-03
Caprolactam	6.6E-04	8.8E-02	--	--	--	6.5E-05	1.3E-04	--	--	--	2.0E-04	--	--	--	--
Carbazole	--	9.7E-02	2.9E-02	5.4E-02	5.4E-02	--	1.5E-04	4.0E-03	3.9E-03	3.9E-03	1.2E-02	--	--	--	--
Benzo(a)pyrene	1.3E-04	--	--	--	--	1.3E-05	--	--	--	--	1.3E-05	9.2E+02	1.4E-08	9.2E+03	1.4E-09
N-Nitrosodi-n-propylamine	7.8E-07	--	--	--	--	7.7E-08	--	--	--	--	7.7E-08	--	--	--	--
Aluminum	6.8E-01	1.7E+04	1.5E+02	1.5E+02	1.5E+02	6.7E-02	2.6E+01	2.1E+01	1.1E+01	1.1E+01	6.9E+01	1.1E+02	6.3E-01	1.1E+03	6.3E-02
Arsenic	--	2.6E+01	3.3E+00	3.3E+00	3.3E+00	--	3.9E-02	4.7E-01	2.4E-01	2.4E-01	9.8E-01	5.1E+00	1.9E-01	1.3E+01	7.7E-02
Barium	4.6E-02	1.3E+02	2.4E+00	2.4E+00	2.4E+00	4.5E-03	2.0E-01	3.4E-01	1.7E-01	1.7E-01	8.8E-01	4.2E+01	2.1E-02	8.3E+01	1.1E-02
Beryllium	--	1.4E+00	1.3E-02	1.3E-02	1.3E-02	--	2.1E-03	1.8E-03	9.1E-04	9.1E-04	5.8E-03	3.7E-03	1.6E+00	3.7E-02	1.6E-01
Cadmium	--	2.9E+00	1.3E+00	1.3E+00	1.3E+00	--	4.4E-03	1.9E-01	9.5E-02	9.5E-02	3.8E-01	1.5E+00	2.6E-01	5.5E+00	7.0E-02
Copper	1.5E-02	5.3E+01	8.8E+01	8.8E+01	8.8E+01	1.5E-03	8.0E-02	1.2E+01	6.2E+00	6.2E+00	2.5E+01	1.9E+01	1.4E+00	3.7E+01	6.8E-01
Iron	9.9E+00	3.9E+04	2.8E+02	2.8E+02	2.8E+02	9.8E-01	5.8E+01	3.9E+01	2.0E+01	2.0E+01	1.4E+02	--	--	--	--
Lead	3.8E-02	2.0E+02	1.3E+01	1.3E+01	1.3E+01	3.7E-03	3.1E-01	1.9E+00	9.5E-01	9.5E-01	4.1E+00	4.7E+00	8.8E-01	8.3E+00	5.0E-01
Manganese	2.7E+00	1.3E+03	2.3E+00	2.3E+00	2.3E+00	2.7E-01	1.9E+00	3.2E-01	1.6E-01	1.6E-01	2.8E+00	9.8E+02	2.9E-03	9.8E+03	2.9E-04
Mercury	--	4.1E-01	1.2E+00	1.2E+00	1.2E+00	--	6.2E-04	1.7E-01	8.3E-02	8.3E-02	3.3E-01	4.5E-01	7.4E-01	9.0E-01	3.7E-01
Nickel	--	2.5E+01	2.0E+01	2.0E+01	2.0E+01	--	3.7E-02	2.9E+00	1.4E+00	1.4E+00	5.8E+00	7.7E+01	7.5E-02	1.1E+02	5.5E-02
Thallium	--	1.4E+00	--	1.4E+00	1.4E+00	--	2.1E-03	--	9.9E-02	9.9E-02	2.0E-01	6.1E-01	3.3E-01	6.1E+00	3.3E-02
Tin	--	1.0E+01	--	--	--	--	1.5E-02	--	--	--	1.5E-02	6.8E+00	2.2E-03	1.7E+01	9.0E-04
Vanadium	--	4.1E+01	3.4E-01	3.4E-01	3.4E-01	--	6.1E-02	4.9E-02	2.4E-02	2.4E-02	1.6E-01	1.1E+00	1.4E-01	1.1E+01	1.4E-02
Zinc	--	2.9E+02	7.5E+00	7.5E+00	7.5E+00	--	4.3E-01	1.1E+00	5.3E-01	5.3E-01	2.6E+00	1.5E+01	1.8E-01	1.3E+02	1.9E-02
Bromide	1.0E-01	--	--	--	--	1.0E-02	--	--	--	--	1.0E-02	--	--	--	--
Chloride	--	6.6E+02	--	--	--	--	9.9E-01	--	--	--	9.9E-01	--	--	--	--
Nitrogen, as Ammonia	--	7.7E+02	--	--	--	--	1.2E+00	--	--	--	1.2E+00	--	--	--	--
Sulfate	--	8.3E+02	--	--	--	--	1.3E+00	--	--	--	1.3E+00	--	--	--	--
Kempore (Azodicarbonamide)	--	--	--	--	--	--	--	--	--	--		--	--	--	--

Table - MMB Wetlands - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetland Reference - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	--	2.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	--	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid	2.1E-03	5.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	3.2E-01	8.3E-02	1.0E+00	2.6E-01	1.0E+00	2.6E-01
Caprolactam	5.6E-04	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)pyrene	--	9.6E-02	3.1E-01	3.0E-02	2.2E-01	2.1E-02	2.2E-01	2.1E-02
Aluminum	4.4E-01	5.5E+03	8.6E-03	4.7E+01	8.6E-03	4.7E+01	8.6E-03	4.7E+01
Arsenic	--	6.6E+00	1.3E-01	8.4E-01	1.3E-01	8.4E-01	1.3E-01	8.4E-01
Barium	5.0E-02	8.4E+01	1.8E-02	1.5E+00	1.8E-02	1.5E+00	1.8E-02	1.5E+00
Beryllium	--	7.0E-01	9.0E-03	6.3E-03	9.0E-03	6.3E-03	9.0E-03	6.3E-03
Cadmium	--	9.0E-01	4.6E-01	4.1E-01	4.6E-01	4.1E-01	4.6E-01	4.1E-01
Copper	3.9E-03	1.5E+01	1.6E+00	2.5E+01	1.6E+00	2.5E+01	1.6E+00	2.5E+01
Iron	2.0E+00	7.5E+03	7.2E-03	5.4E+01	7.2E-03	5.4E+01	7.2E-03	5.4E+01
Lead	1.3E-03	4.6E+01	6.6E-02	3.0E+00	6.6E-02	3.0E+00	6.6E-02	3.0E+00
Manganese	5.9E-01	5.0E+02	3.3E-03	1.7E+00	3.3E-03	1.7E+00	3.3E-03	1.7E+00
Nickel	2.1E-03	6.1E+00	8.2E-01	5.0E+00	8.2E-01	5.0E+00	8.2E-01	5.0E+00
Tin	--	7.3E+00	--	--	--	--	--	--
Vanadium	1.5E-03	1.1E+01	8.4E-03	9.2E-02	8.4E-03	9.2E-02	8.4E-03	9.2E-02
Zinc	2.4E-02	7.3E+01	2.6E-02	1.9E+00	2.6E-02	1.9E+00	2.6E-02	1.9E+00
Chloride	1.4E+02	4.2E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	2.5E-01	8.3E+02	--	--	--	--	--	--
Sulfate	2.6E+01	4.2E+02	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - MMB Wetland Reference - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	--	2.0E+00	--	--	--	--	3.0E-03	--	--	--	3.0E-03	8.4E+03	3.6E-07	8.4E+04	3.6E-08
Benzaldehyde	--	3.3E-01	--	--	--	--	4.9E-04	--	--	--	4.9E-04	--	--	--	--
Benzoic Acid	2.1E-03	5.4E-01	--	--	--	2.1E-04	8.1E-04	--	--	--	1.0E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	8.3E-02	2.6E-01	2.6E-01	--	3.9E-04	1.2E-02	1.8E-02	1.8E-02	4.9E-02	1.1E+00	4.5E-02	1.1E+01	4.5E-03
Caprolactam	5.6E-04	--	--	--	--	5.5E-05	--	--	--	--	5.5E-05	--	--	--	--
Benzo(a)pyrene	--	9.6E-02	3.0E-02	2.1E-02	2.1E-02	--	1.4E-04	4.2E-03	1.5E-03	1.5E-03	7.4E-03	9.2E+02	8.0E-06	9.2E+03	8.0E-07
Aluminum	4.4E-01	5.5E+03	4.7E+01	4.7E+01	4.7E+01	4.3E-02	8.2E+00	6.7E+00	3.4E+00	3.4E+00	2.2E+01	1.1E+02	2.0E-01	1.1E+03	2.0E-02
Arsenic	--	6.6E+00	8.4E-01	8.4E-01	8.4E-01	--	9.9E-03	1.2E-01	6.0E-02	6.0E-02	2.5E-01	5.1E+00	4.8E-02	1.3E+01	1.9E-02
Barium	5.0E-02	8.4E+01	1.5E+00	1.5E+00	1.5E+00	4.9E-03	1.3E-01	2.2E-01	1.1E-01	1.1E-01	5.6E-01	4.2E+01	1.4E-02	8.3E+01	6.8E-03
Beryllium	--	7.0E-01	6.3E-03	6.3E-03	6.3E-03	--	1.0E-03	8.9E-04	4.5E-04	4.5E-04	2.8E-03	3.7E-03	7.7E-01	3.7E-02	7.7E-02
Cadmium	--	9.0E-01	4.1E-01	4.1E-01	4.1E-01	--	1.3E-03	5.9E-02	2.9E-02	2.9E-02	1.2E-01	1.5E+00	7.9E-02	5.5E+00	2.2E-02
Copper	3.9E-03	1.5E+01	2.5E+01	2.5E+01	2.5E+01	3.8E-04	2.2E-02	3.5E+00	1.8E+00	1.8E+00	7.0E+00	1.9E+01	3.8E-01	3.7E+01	1.9E-01
Iron	2.0E+00	7.5E+03	5.4E+01	5.4E+01	5.4E+01	2.0E-01	1.1E+01	7.7E+00	3.8E+00	3.8E+00	2.7E+01	--	--	--	--
Lead	1.3E-03	4.6E+01	3.0E+00	3.0E+00	3.0E+00	1.3E-04	6.9E-02	4.3E-01	2.2E-01	2.2E-01	9.3E-01	4.7E+00	2.0E-01	8.3E+00	1.1E-01
Manganese	5.9E-01	5.0E+02	1.7E+00	1.7E+00	1.7E+00	5.8E-02	7.5E-01	2.3E-01	1.2E-01	1.2E-01	1.3E+00	9.8E+02	1.3E-03	9.8E+03	1.3E-04
Nickel	2.1E-03	6.1E+00	5.0E+00	5.0E+00	5.0E+00	2.1E-04	9.1E-03	7.1E-01	3.5E-01	3.5E-01	1.4E+00	7.7E+01	1.8E-02	1.1E+02	1.3E-02
Tin	--	7.3E+00	--	--	--	--	1.1E-02	--	--	--	1.1E-02	6.8E+00	1.6E-03	1.7E+01	6.5E-04
Vanadium	1.5E-03	1.1E+01	9.2E-02	9.2E-02	9.2E-02	1.5E-04	1.6E-02	1.3E-02	6.6E-03	6.6E-03	4.3E-02	1.1E+00	3.9E-02	1.1E+01	3.9E-03
Zinc	2.4E-02	7.3E+01	1.9E+00	1.9E+00	1.9E+00	2.4E-03	1.1E-01	2.7E-01	1.3E-01	1.3E-01	6.5E-01	1.5E+01	4.5E-02	1.3E+02	5.0E-03
Chloride	1.4E+02	4.2E+02	--	--	--	1.4E+01	6.3E-01	--	--	--	1.4E+01	--	--	--	--
Nitrogen, as Ammonia	2.5E-01	8.3E+02	--	--	--	2.5E-02	1.2E+00	--	--	--	1.3E+00	--	--	--	--
Sulfate	2.6E+01	4.2E+02	--	--	--	2.6E+00	6.3E-01	--	--	--	3.2E+00	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetlands - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Acetaldehyde		3.33E-01	0.00E+00	0.00E+00
Acetone		9.62E-01	0.00E+00	0.00E+00
Formaldehyde		2.77E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		3.20E-01	0.00E+00	0.00E+00
4-Nitrophenol		9.10E-02	0.00E+00	0.00E+00
Benzaldehyde		2.04E-01	0.00E+00	0.00E+00
Benzoic Acid		7.63E-01	0.00E+00	0.00E+00
Benzyl alcohol		3.50E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		2.02E-01	3.19E-01	6.44E-02
Caprolactam	6.60E-04	8.80E-02	0.00E+00	0.00E+00
Carbazole		9.70E-02	2.94E-01	2.85E-02
Benzo(a)pyrene	1.30E-04		3.07E-01	--
N-Nitrosodi-n-propylamine	7.80E-07		0.00E+00	--
Aluminum	6.76E-01	1.75E+04	8.60E-03	1.50E+02
Arsenic		2.62E+01	1.27E-01	3.33E+00
Barium	4.56E-02	1.31E+02	1.82E-02	2.39E+00
Beryllium		1.42E+00	9.00E-03	1.28E-02
Cadmium		2.92E+00	4.59E-01	1.34E+00
Copper	1.52E-02	5.33E+01	1.65E+00	8.79E+01
Iron	9.94E+00	3.86E+04	7.20E-03	2.78E+02
Lead	3.77E-02	2.04E+02	6.60E-02	1.34E+01
Manganese	2.73E+00	1.27E+03	1.79E-03	2.27E+00
Mercury		4.11E-01	2.84E+00	1.17E+00
Nickel		2.50E+01	8.18E-01	2.04E+01
Thallium		1.40E+00	--	--
Tin		1.01E+01	--	--
Vanadium		4.10E+01	8.40E-03	3.44E-01
Zinc		2.88E+02	2.60E-02	7.48E+00
Bromide	1.03E-01		0.00E+00	--
Chloride		6.58E+02	--	--
Nitrogen, as Ammonia		7.71E+02	--	--
Sulfate		8.34E+02	--	--
Kempore (Azodicarbonamide)			--	--

Table - MMB Wetlands - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

Notes:
RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - MMB Wetlands - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	--	3.33E-01	0.00E+00	--	4.16E-03	0.00E+00	4.2E-03	--	--	--	--
Acetone	--	9.62E-01	0.00E+00	--	1.20E-02	0.00E+00	1.2E-02	8.43E+03	1.4E-06	8.43E+04	1.4E-07
Formaldehyde	--	2.77E+00	0.00E+00	--	3.46E-02	0.00E+00	3.5E-02	--	--	--	--
3 & 4 Methylphenol	--	3.20E-01	0.00E+00	--	4.00E-03	0.00E+00	4.0E-03	--	--	--	--
4-Nitrophenol	--	9.10E-02	0.00E+00	--	1.14E-03	0.00E+00	1.1E-03	--	--	--	--
Benzaldehyde	--	2.04E-01	0.00E+00	--	2.55E-03	0.00E+00	2.5E-03	--	--	--	--
Benzoic Acid	--	7.63E-01	0.00E+00	--	9.53E-03	0.00E+00	9.5E-03	--	--	--	--
Benzyl alcohol	--	3.50E-01	0.00E+00	--	4.37E-03	0.00E+00	4.4E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.02E-01	6.44E-02	--	2.52E-03	5.59E-02	5.8E-02	1.10E+00	5.3E-02	1.10E+01	5.3E-03
Caprolactam	6.60E-04	8.80E-02	0.00E+00	1.74E-04	1.10E-03	0.00E+00	1.3E-03	--	--	--	--
Carbazole	--	9.70E-02	2.85E-02	--	1.21E-03	2.47E-02	2.6E-02	--	--	--	--
Benzo(a)pyrene	1.30E-04	--	--	3.44E-05	--	--	3.4E-05	9.20E+02	3.7E-08	9.20E+03	3.7E-09
N-Nitrosodi-n-propylamine	7.80E-07	--	--	2.06E-07	--	--	2.1E-07	--	--	--	--
Aluminum	6.76E-01	1.75E+04	1.50E+02	1.79E-01	2.19E+02	1.31E+02	3.5E+02	1.10E+02	3.2E+00	1.10E+03	3.2E-01
Arsenic	--	2.62E+01	3.33E+00	--	3.27E-01	2.89E+00	3.2E+00	5.14E+00	6.3E-01	1.28E+01	2.5E-01
Barium	4.56E-02	1.31E+02	2.39E+00	1.21E-02	1.64E+00	2.07E+00	3.7E+00	4.17E+01	8.9E-02	8.33E+01	4.5E-02
Beryllium	--	1.42E+00	1.28E-02	--	1.77E-02	1.11E-02	2.9E-02	3.70E-03	7.8E+00	3.70E-02	7.8E-01
Cadmium	--	2.92E+00	1.34E+00	--	3.64E-02	1.16E+00	1.2E+00	1.50E+00	8.0E-01	5.50E+00	2.2E-01
Copper	1.52E-02	5.33E+01	8.79E+01	4.02E-03	6.66E-01	7.62E+01	7.7E+01	1.85E+01	4.2E+00	3.70E+01	2.1E+00
Iron	9.94E+00	3.86E+04	2.78E+02	2.63E+00	4.81E+02	2.41E+02	7.2E+02	--	--	--	--
Lead	3.77E-02	2.04E+02	1.34E+01	9.97E-03	2.54E+00	1.17E+01	1.4E+01	4.70E+00	3.0E+00	8.28E+00	1.7E+00
Manganese	2.73E+00	1.27E+03	2.27E+00	7.21E-01	1.58E+01	1.97E+00	1.9E+01	9.77E+02	1.9E-02	9.77E+03	1.9E-03
Mercury	--	4.11E-01	1.17E+00	--	5.13E-03	1.01E+00	1.0E+00	4.50E-01	2.3E+00	9.00E-01	1.1E+00
Nickel	--	2.50E+01	2.04E+01	--	3.12E-01	1.77E+01	1.8E+01	7.74E+01	2.3E-01	1.07E+02	1.7E-01
Thallium	--	1.40E+00	--	--	1.75E-02	--	1.7E-02	6.10E-01	2.9E-02	6.10E+00	2.9E-03
Tin	--	1.01E+01	--	--	1.27E-01	--	1.3E-01	6.80E+00	1.9E-02	1.69E+01	7.5E-03
Vanadium	--	4.10E+01	3.44E-01	--	5.11E-01	2.98E-01	8.1E-01	1.10E+00	7.4E-01	1.10E+01	7.4E-02
Zinc	--	2.88E+02	7.48E+00	--	3.59E+00	6.48E+00	1.0E+01	1.45E+01	6.9E-01	1.31E+02	7.7E-02
Bromide	1.03E-01	--	--	2.72E-02	--	--	2.7E-02	--	--	--	--
Chloride	--	6.58E+02	--	--	8.22E+00	--	8.2E+00	--	--	--	--
Nitrogen, as Ammonia	--	7.71E+02	--	--	9.63E+00	--	9.6E+00	--	--	--	--
Sulfate	--	8.34E+02	--	--	1.04E+01	--	1.0E+01	--	--	--	--
Kempore (Azodicarbonamide)	--	--	--	--	--	--		--	--	--	--

Table - MMB Wetlands - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetland Reference - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
Acetone	--	2.00E+00	0.00E+00	0.00E+00
Benzaldehyde	--	3.30E-01	0.00E+00	0.00E+00
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	3.19E-01	8.30E-02
Caprolactam	5.60E-04	--	0.00E+00	--
Benzo(a)pyrene	--	9.60E-02	3.07E-01	2.95E-02
Aluminum	4.40E-01	5.50E+03	8.60E-03	4.73E+01
Arsenic	--	6.60E+00	1.27E-01	8.38E-01
Barium	5.00E-02	8.40E+01	1.82E-02	1.53E+00
Beryllium	--	7.00E-01	9.00E-03	6.30E-03
Cadmium	--	9.00E-01	4.59E-01	4.13E-01
Copper	3.90E-03	1.50E+01	1.65E+00	2.47E+01
Iron	2.00E+00	7.50E+03	7.20E-03	5.40E+01
Lead	1.30E-03	4.60E+01	6.60E-02	3.04E+00
Manganese	5.90E-01	5.00E+02	3.31E-03	1.65E+00
Nickel	2.10E-03	6.10E+00	8.18E-01	4.99E+00
Tin	--	7.30E+00	--	--
Vanadium	1.50E-03	1.10E+01	8.40E-03	9.24E-02
Zinc	2.40E-02	7.30E+01	2.60E-02	1.90E+00
Chloride	1.40E+02	4.20E+02	--	--
Nitrogen, as Ammonia	2.50E-01	8.30E+02	--	--
Sulfate	2.60E+01	4.20E+02	--	--

Notes:
RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - MMB Wetland Reference - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetone	--	2.00E+00	0.00E+00	--	2.50E-02	0.00E+00	2.5E-02	8.43E+03	3.0E-06	8.43E+04	3.0E-07
Benzaldehyde	--	3.30E-01	0.00E+00	--	4.12E-03	0.00E+00	4.1E-03	--	--	--	--
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	5.55E-04	6.74E-03	0.00E+00	7.3E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	8.30E-02	--	3.25E-03	7.19E-02	7.5E-02	1.10E+00	6.8E-02	1.10E+01	6.8E-03
Caprolactam	5.60E-04	--	--	1.48E-04	--	--	1.5E-04	--	--	--	--
Benzo(a)pyrene	--	9.60E-02	2.95E-02	--	1.20E-03	2.56E-02	2.7E-02	9.20E+02	2.9E-05	9.20E+03	2.9E-06
Aluminum	4.40E-01	5.50E+03	4.73E+01	1.16E-01	6.87E+01	4.10E+01	1.1E+02	1.10E+02	1.0E+00	1.10E+03	1.0E-01
Arsenic	--	6.60E+00	8.38E-01	--	8.24E-02	7.27E-01	8.1E-01	5.14E+00	1.6E-01	1.28E+01	6.3E-02
Barium	5.00E-02	8.40E+01	1.53E+00	1.32E-02	1.05E+00	1.33E+00	2.4E+00	4.17E+01	5.7E-02	8.33E+01	2.9E-02
Beryllium	--	7.00E-01	6.30E-03	--	8.74E-03	5.46E-03	1.4E-02	3.70E-03	3.8E+00	3.70E-02	3.8E-01
Cadmium	--	9.00E-01	4.13E-01	--	1.12E-02	3.58E-01	3.7E-01	1.50E+00	2.5E-01	5.50E+00	6.7E-02
Copper	3.90E-03	1.50E+01	2.47E+01	1.03E-03	1.87E-01	2.14E+01	2.2E+01	1.85E+01	1.2E+00	3.70E+01	5.8E-01
Iron	2.00E+00	7.50E+03	5.40E+01	5.29E-01	9.37E+01	4.68E+01	1.4E+02	--	--	--	--
Lead	1.30E-03	4.60E+01	3.04E+00	3.44E-04	5.74E-01	2.63E+00	3.2E+00	4.70E+00	6.8E-01	8.28E+00	3.9E-01
Manganese	5.90E-01	5.00E+02	1.65E+00	1.56E-01	6.24E+00	1.43E+00	7.8E+00	9.77E+02	8.0E-03	9.77E+03	8.0E-04
Nickel	2.10E-03	6.10E+00	4.99E+00	5.55E-04	7.62E-02	4.33E+00	4.4E+00	7.74E+01	5.7E-02	1.07E+02	4.1E-02
Tin	--	7.30E+00	--	--	9.12E-02	--	9.1E-02	6.80E+00	1.3E-02	1.69E+01	5.4E-03
Vanadium	1.50E-03	1.10E+01	9.24E-02	3.97E-04	1.37E-01	8.01E-02	2.2E-01	1.10E+00	2.0E-01	1.10E+01	2.0E-02
Zinc	2.40E-02	7.30E+01	1.90E+00	6.34E-03	9.12E-01	1.65E+00	2.6E+00	1.45E+01	1.8E-01	1.31E+02	2.0E-02
Chloride	1.40E+02	4.20E+02	--	3.70E+01	5.25E+00	--	4.2E+01	--	--	--	--
Nitrogen, as Ammonia	2.50E-01	8.30E+02	--	6.61E-02	1.04E+01	--	1.0E+01	--	--	--	--
Sulfate	2.60E+01	4.20E+02	--	6.87E+00	5.25E+00	--	1.2E+01	--	--	--	--

Table - MMB Wetland Reference - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	MMB Wetland Reference

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetlands - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetaldehyde		3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone		9.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde		2.8E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		3.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4-Nitrophenol		9.1E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid		7.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzyl alcohol		3.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		2.0E-01	3.1E-04	6.3E-05	1.1E+00	2.3E-01	1.0E+00	2.0E-01	1.0E+00	2.0E-01
Caprolactam	6.6E-04	8.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbazole		9.7E-02	5.5E-02	5.3E-03	1.0E+00	1.0E-01	5.6E-01	5.4E-02	5.6E-01	5.4E-02
Benzo(a)pyrene	1.3E-04		2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
N-Nitrosodi-n-propylamine	7.8E-07		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Aluminum	6.8E-01	1.7E+04	5.7E-04	1.0E+01	8.6E-03	1.5E+02	8.6E-03	1.5E+02	8.6E-03	1.5E+02
Arsenic		2.6E+01	2.8E-02	7.3E-01	1.3E-01	3.3E+00	1.3E-01	3.3E+00	1.3E-01	3.3E+00
Barium	4.6E-02	1.3E+02	3.1E-02	4.1E+00	1.8E-02	2.4E+00	1.8E-02	2.4E+00	1.8E-02	2.4E+00
Beryllium		1.4E+00	2.0E-03	2.8E-03	9.0E-03	1.3E-02	9.0E-03	1.3E-02	9.0E-03	1.3E-02
Cadmium		2.9E+00	5.6E-02	1.6E-01	4.6E-01	1.3E+00	4.6E-01	1.3E+00	4.6E-01	1.3E+00
Copper	1.5E-02	5.3E+01	4.1E-02	2.2E+00	1.6E+00	8.8E+01	1.6E+00	8.8E+01	1.6E+00	8.8E+01
Iron	9.9E+00	3.9E+04	8.5E-04	3.3E+01	7.2E-03	2.8E+02	7.2E-03	2.8E+02	7.2E-03	2.8E+02
Lead	3.8E-02	2.0E+02	3.5E-02	7.1E+00	6.6E-02	1.3E+01	6.6E-02	1.3E+01	6.6E-02	1.3E+01
Manganese	2.7E+00	1.3E+03	1.6E-02	2.0E+01	4.4E-02	5.5E+01	4.4E-02	5.5E+01	4.4E-02	5.5E+01
Mercury		4.1E-01	2.6E-02	1.1E-02	2.8E+00	1.2E+00	2.8E+00	1.2E+00	2.8E+00	1.2E+00
Nickel		2.5E+01	4.7E-02	1.2E+00	8.2E-01	2.0E+01	8.2E-01	2.0E+01	8.2E-01	2.0E+01
Thallium		1.4E+00	8.0E-04	1.1E-03	--	--	1.0E+00	1.4E+00	1.0E+00	1.4E+00
Tin		1.0E+01	6.0E-03	6.1E-02	--	--	--	--	--	--
Vanadium		4.1E+01	9.7E-04	4.0E-02	8.4E-03	3.4E-01	8.4E-03	3.4E-01	8.4E-03	3.4E-01
Zinc		2.9E+02	5.0E-02	1.5E+01	2.6E-02	7.5E+00	2.6E-02	7.5E+00	2.6E-02	7.5E+00
Bromide	1.0E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		6.6E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia		7.7E+02	--	--	--	--	--	--	--	--
Sulfate		8.3E+02	--	--	--	--	--	--	--	--
Kempore (Azodicarbonamide)			--	--	--	--	--	--	--	--

Table - MMB Wetlands - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - MMB Wetlands - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	--	3.3E-01	--	--	--	--	--	1.5E-04	--	--	--	--	1.5E-04	2.4E+01	6.4E-06	2.4E+02	6.4E-07
Acetone	--	9.6E-01	--	--	--	--	--	4.4E-04	--	--	--	--	4.4E-04	2.0E+01	2.2E-05	1.0E+02	4.4E-06
Formaldehyde	--	2.8E+00	--	--	--	--	--	1.3E-03	--	--	--	--	1.3E-03	1.0E-01	1.3E-02	1.0E+00	1.3E-03
3 & 4 Methylphenol	--	3.2E-01	--	--	--	--	--	1.5E-04	--	--	--	--	1.5E-04	1.0E+02	1.5E-06	1.0E+03	1.5E-07
4-Nitrophenol	--	9.1E-02	--	--	--	--	--	4.2E-05	--	--	--	--	4.2E-05	1.3E+00	3.4E-05	1.3E+01	3.4E-06
Benzaldehyde	--	2.0E-01	--	--	--	--	--	9.4E-05	--	--	--	--	9.4E-05	4.3E+01	2.2E-06	8.6E+01	1.1E-06
Benzoic Acid	--	7.6E-01	--	--	--	--	--	3.5E-04	--	--	--	--	3.5E-04	5.0E+01	7.1E-06	7.5E+02	4.7E-07
Benzyl alcohol	--	3.5E-01	--	--	--	--	--	1.6E-04	--	--	--	--	1.6E-04	1.4E+02	1.1E-06	1.4E+03	1.1E-07
Bis(2-Ethylhexyl)phthalate	--	2.0E-01	6.3E-05	2.3E-01	2.0E-01	2.0E-01	--	9.3E-05	7.0E-06	3.1E-03	1.4E-03	1.4E-03	6.0E-03	1.8E+01	3.3E-04	1.8E+02	3.3E-05
Caprolactam	6.6E-04	8.8E-02	--	--	--	--	6.4E-05	4.1E-05	--	--	--	--	1.0E-04	8.0E+02	1.3E-07	8.0E+03	1.3E-08
Carbazole	--	9.7E-02	5.3E-03	1.0E-01	5.4E-02	5.4E-02	--	4.5E-05	5.9E-04	1.4E-03	3.7E-04	3.7E-04	2.8E-03	5.0E+00	5.5E-04	5.0E+01	5.5E-05
Benzo(a)pyrene	1.3E-04	--	--	--	--	--	1.3E-05	--	--	--	--	--	1.3E-05	1.0E+00	1.3E-05	1.0E+01	1.3E-06
N-Nitrosodi-n-propylamine	7.8E-07	--	--	--	--	--	7.6E-08	--	--	--	--	--	7.6E-08	7.3E-02	1.0E-06	7.3E-01	1.0E-07
Aluminum	6.8E-01	1.7E+04	1.0E+01	1.5E+02	1.5E+02	1.5E+02	6.6E-02	8.1E+00	1.1E+00	2.1E+00	1.0E+00	1.0E+00	1.3E+01	1.9E+00	7.0E+00	1.9E+01	7.0E-01
Arsenic	--	2.6E+01	7.3E-01	3.3E+00	3.3E+00	3.3E+00	--	1.2E-02	8.1E-02	4.6E-02	2.3E-02	2.3E-02	1.9E-01	1.3E-01	1.5E+00	1.3E+00	1.5E-01
Barium	4.6E-02	1.3E+02	4.1E+00	2.4E+00	2.4E+00	2.4E+00	4.4E-03	6.1E-02	4.5E-01	3.3E-02	1.7E-02	1.7E-02	5.8E-01	5.2E+01	1.1E-02	1.2E+02	4.9E-03
Beryllium	--	1.4E+00	2.8E-03	1.3E-02	1.3E-02	1.3E-02	--	6.6E-04	3.1E-04	1.8E-04	8.8E-05	8.8E-05	1.3E-03	5.3E-01	2.5E-03	5.3E-01	2.5E-03
Cadmium	--	2.9E+00	1.6E-01	1.3E+00	1.3E+00	1.3E+00	--	1.3E-03	1.8E-02	1.8E-02	9.2E-03	9.2E-03	5.6E-02	1.9E+00	3.0E-02	7.1E+00	7.9E-03
Copper	1.5E-02	5.3E+01	2.2E+00	8.8E+01	8.8E+01	8.8E+01	1.5E-03	2.5E-02	2.4E-01	1.2E+00	6.1E-01	6.1E-01	2.7E+00	1.5E+01	1.8E-01	1.5E+02	1.8E-02
Iron	9.9E+00	3.9E+04	3.3E+01	2.8E+02	2.8E+02	2.8E+02	9.7E-01	1.8E+01	3.6E+00	3.8E+00	1.9E+00	1.9E+00	3.0E+01	--	--	--	--
Lead	3.8E-02	2.0E+02	7.1E+00	1.3E+01	1.3E+01	1.3E+01	3.7E-03	9.4E-02	7.9E-01	1.9E-01	9.3E-02	9.3E-02	1.3E+00	4.7E+00	2.7E-01	1.5E+02	8.2E-03
Manganese	2.7E+00	1.3E+03	2.0E+01	5.5E+01	5.5E+01	5.5E+01	2.7E-01	5.9E-01	2.2E+00	7.7E-01	3.8E-01	3.8E-01	4.6E+00	8.8E+01	5.2E-02	2.8E+02	1.6E-02
Mercury	--	4.1E-01	1.1E-02	1.2E+00	1.2E+00	1.2E+00	--	1.9E-04	1.2E-03	1.6E-02	8.1E-03	8.1E-03	3.4E-02	1.0E+00	3.3E-02	1.0E+01	3.3E-03
Nickel	--	2.5E+01	1.2E+00	2.0E+01	2.0E+01	2.0E+01	--	1.2E-02	1.3E-01	2.8E-01	1.4E-01	1.4E-01	7.1E-01	4.0E+01	1.8E-02	8.0E+01	8.8E-03
Thallium	--	1.4E+00	1.1E-03	--	1.4E+00	1.4E+00	--	6.5E-04	1.2E-04	--	9.7E-03	9.7E-03	2.0E-02	4.6E-02	4.4E-01	4.6E-01	4.4E-02
Tin	--	1.0E+01	6.1E-02	--	--	--	--	4.7E-03	6.7E-03	--	--	--	1.1E-02	2.3E+01	4.9E-04	3.5E+01	3.3E-04
Vanadium	--	4.1E+01	4.0E-02	3.4E-01	3.4E-01	3.4E-01	--	1.9E-02	4.4E-03	4.8E-03	2.4E-03	2.4E-03	3.3E-02	2.1E-01	1.6E-01	2.1E+00	1.6E-02
Zinc	--	2.9E+02	1.5E+01	7.5E+00	7.5E+00	7.5E+00	--	1.3E-01	1.6E+00	1.0E-01	5.2E-02	5.2E-02	1.9E+00	7.5E+01	2.6E-02	2.6E+02	7.6E-03
Bromide	1.0E-01	--	--	--	--	--	1.0E-02	--	--	--	--	--	1.0E-02	--	--	--	--
Chloride	--	6.6E+02	--	--	--	--	--	3.0E-01	--	--	--	--	3.0E-01	--	--	--	--
Nitrogen, as Ammonia	--	7.7E+02	--	--	--	--	--	3.6E-01	--	--	--	--	3.6E-01	--	--	--	--
Sulfate	--	8.3E+02	--	--	--	--	--	3.9E-01	--	--	--	--	3.9E-01	--	--	--	--
Kempore (Azodicarbonamid	--	--	--	--	--	--	--	--	--	--	--	--		--	--	--	--

Table - MMB Wetlands - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	MMB Wetlands

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - MMB Wetland Reference - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	--	2.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	--	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzoic Acid	2.1E-03	5.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	3.1E-04	8.2E-05	1.1E+00	2.9E-01	1.0E+00	2.6E-01	1.0E+00	2.6E-01
Caprolactam	5.6E-04	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)pyrene	--	9.6E-02	2.2E-03	2.1E-04	1.1E+00	1.0E-01	2.2E-01	2.1E-02	2.2E-01	2.1E-02
Aluminum	4.4E-01	5.5E+03	5.7E-04	3.2E+00	8.6E-03	4.7E+01	8.6E-03	4.7E+01	8.6E-03	4.7E+01
Arsenic	--	6.6E+00	2.8E-02	1.8E-01	1.3E-01	8.4E-01	1.3E-01	8.4E-01	1.3E-01	8.4E-01
Barium	5.0E-02	8.4E+01	3.1E-02	2.6E+00	1.8E-02	1.5E+00	1.8E-02	1.5E+00	1.8E-02	1.5E+00
Beryllium	--	7.0E-01	2.0E-03	1.4E-03	9.0E-03	6.3E-03	9.0E-03	6.3E-03	9.0E-03	6.3E-03
Cadmium	--	9.0E-01	5.6E-02	5.0E-02	4.6E-01	4.1E-01	4.6E-01	4.1E-01	4.6E-01	4.1E-01
Copper	3.9E-03	1.5E+01	4.1E-02	6.2E-01	1.6E+00	2.5E+01	1.6E+00	2.5E+01	1.6E+00	2.5E+01
Iron	2.0E+00	7.5E+03	8.5E-04	6.4E+00	7.2E-03	5.4E+01	7.2E-03	5.4E+01	7.2E-03	5.4E+01
Lead	1.3E-03	4.6E+01	3.5E-02	1.6E+00	6.6E-02	3.0E+00	6.6E-02	3.0E+00	6.6E-02	3.0E+00
Manganese	5.9E-01	5.0E+02	1.6E-02	7.9E+00	4.4E-02	2.2E+01	4.4E-02	2.2E+01	4.4E-02	2.2E+01
Nickel	2.1E-03	6.1E+00	4.7E-02	2.9E-01	8.2E-01	5.0E+00	8.2E-01	5.0E+00	8.2E-01	5.0E+00
Tin	--	7.3E+00	6.0E-03	4.4E-02	--	--	--	--	--	--
Vanadium	1.5E-03	1.1E+01	9.7E-04	1.1E-02	8.4E-03	9.2E-02	8.4E-03	9.2E-02	8.4E-03	9.2E-02
Zinc	2.4E-02	7.3E+01	5.0E-02	3.7E+00	2.6E-02	1.9E+00	2.6E-02	1.9E+00	2.6E-02	1.9E+00
Chloride	1.4E+02	4.2E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	2.5E-01	8.3E+02	--	--	--	--	--	--	--	--
Sulfate	2.6E+01	4.2E+02	--	--	--	--	--	--	--	--

Notes:

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - MMB Wetland Reference - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	MMB Wetland Reference

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	--	2.0E+00	--	--	--	--	--	9.2E-04	--	--	--	--	9.2E-04	2.0E+01	4.6E-05	1.0E+02	9.2E-06
Benzaldehyde	--	3.3E-01	--	--	--	--	--	1.5E-04	--	--	--	--	1.5E-04	4.3E+01	3.6E-06	8.6E+01	1.8E-06
Benzoic Acid	2.1E-03	5.4E-01	--	--	--	--	2.0E-04	2.5E-04	--	--	--	--	4.5E-04	5.0E+01	9.1E-06	7.5E+02	6.1E-07
Bis(2-Ethylhexyl)phthalate	--	2.6E-01	8.2E-05	2.9E-01	2.6E-01	2.6E-01	--	1.2E-04	9.0E-06	4.0E-03	1.8E-03	1.8E-03	7.7E-03	1.8E+01	4.2E-04	1.8E+02	4.2E-05
Caprolactam	5.6E-04	--	--	--	--	--	5.5E-05	--	--	--	--	--	5.5E-05	8.0E+02	6.8E-08	8.0E+03	6.8E-09
Benzo(a)pyrene	--	9.6E-02	2.1E-04	1.0E-01	2.1E-02	2.1E-02	--	4.4E-05	2.4E-05	1.4E-03	1.5E-04	1.5E-04	1.8E-03	1.0E+00	1.8E-03	1.0E+01	1.8E-04
Aluminum	4.4E-01	5.5E+03	3.2E+00	4.7E+01	4.7E+01	4.7E+01	4.3E-02	2.5E+00	3.5E-01	6.5E-01	3.3E-01	3.3E-01	4.2E+00	1.9E+00	2.2E+00	1.9E+01	2.2E-01
Arsenic	--	6.6E+00	1.8E-01	8.4E-01	8.4E-01	8.4E-01	--	3.1E-03	2.0E-02	1.2E-02	5.8E-03	5.8E-03	4.7E-02	1.3E-01	3.7E-01	1.3E+00	3.7E-02
Barium	5.0E-02	8.4E+01	2.6E+00	1.5E+00	1.5E+00	1.5E+00	4.9E-03	3.9E-02	2.9E-01	2.1E-02	1.1E-02	1.1E-02	3.8E-01	5.2E+01	7.3E-03	1.2E+02	3.2E-03
Beryllium	--	7.0E-01	1.4E-03	6.3E-03	6.3E-03	6.3E-03	--	3.2E-04	1.5E-04	8.7E-05	4.4E-05	4.4E-05	6.5E-04	5.3E-01	1.2E-03	5.3E-01	1.2E-03
Cadmium	--	9.0E-01	5.0E-02	4.1E-01	4.1E-01	4.1E-01	--	4.2E-04	5.6E-03	5.7E-03	2.9E-03	2.9E-03	1.7E-02	1.9E+00	9.4E-03	7.1E+00	2.5E-03
Copper	3.9E-03	1.5E+01	6.2E-01	2.5E+01	2.5E+01	2.5E+01	3.8E-04	6.9E-03	6.8E-02	3.4E-01	1.7E-01	1.7E-01	7.6E-01	1.5E+01	5.0E-02	1.5E+02	5.0E-03
Iron	2.0E+00	7.5E+03	6.4E+00	5.4E+01	5.4E+01	5.4E+01	1.9E-01	3.5E+00	7.0E-01	7.5E-01	3.7E-01	3.7E-01	5.9E+00	--	--	--	--
Lead	1.3E-03	4.6E+01	1.6E+00	3.0E+00	3.0E+00	3.0E+00	1.3E-04	2.1E-02	1.8E-01	4.2E-02	2.1E-02	2.1E-02	2.8E-01	4.7E+00	6.0E-02	1.5E+02	1.8E-03
Manganese	5.9E-01	5.0E+02	7.9E+00	2.2E+01	2.2E+01	2.2E+01	5.7E-02	2.3E-01	8.8E-01	3.0E-01	1.5E-01	1.5E-01	1.8E+00	8.8E+01	2.0E-02	2.8E+02	6.2E-03
Nickel	2.1E-03	6.1E+00	2.9E-01	5.0E+00	5.0E+00	5.0E+00	2.0E-04	2.8E-03	3.2E-02	6.9E-02	3.4E-02	3.4E-02	1.7E-01	4.0E+01	4.3E-03	8.0E+01	2.2E-03
Tin	--	7.3E+00	4.4E-02	--	--	--	--	3.4E-03	4.8E-03	--	--	--	8.2E-03	2.3E+01	3.5E-04	3.5E+01	2.3E-04
Vanadium	1.5E-03	1.1E+01	1.1E-02	9.2E-02	9.2E-02	9.2E-02	1.5E-04	5.1E-03	1.2E-03	1.3E-03	6.4E-04	6.4E-04	9.0E-03	2.1E-01	4.3E-02	2.1E+00	4.3E-03
Zinc	2.4E-02	7.3E+01	3.7E+00	1.9E+00	1.9E+00	1.9E+00	2.3E-03	3.4E-02	4.1E-01	2.6E-02	1.3E-02	1.3E-02	5.0E-01	7.5E+01	6.6E-03	2.6E+02	1.9E-03
Chloride	1.4E+02	4.2E+02	--	--	--	--	1.4E+01	1.9E-01	--	--	--	--	1.4E+01	--	--	--	--
Nitrogen, as Ammonia	2.5E-01	8.3E+02	--	--	--	--	2.4E-02	3.8E-01	--	--	--	--	4.1E-01	--	--	--	--
Sulfate	2.6E+01	4.2E+02	--	--	--	--	2.5E+00	1.9E-01	--	--	--	--	2.7E+00	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table MMB Wetlands - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-02	1.82E-02	3.63E-04	1.04E+00	2.07E-02	1.08E-01	2.15E-03
2,4,4-Trimethyl-2-pentene	--	3.50E-03	3.78E-02	1.32E-04	1.03E+00	3.60E-03	3.23E-01	1.13E-03
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	--	6.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Aniline	--	2.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)pyrene	1.50E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Bis(2-Ethylhexyl)phthalate	3.43E-03	6.02E+02	3.13E-04	1.89E-01	1.12E+00	6.72E+02	1.00E+00	6.02E+02
Di-n-octylphthalate	--	1.50E-01	1.61E-04	2.42E-05	1.13E+00	1.70E-01	1.00E+00	1.50E-01
Diphenyl ether	--	2.60E+00	2.86E-02	7.42E-02	1.03E+00	2.68E+00	2.13E-01	5.53E-01
Diphenylamine	--	9.50E-02	7.35E-02	6.98E-03	1.03E+00	9.82E-02	8.57E-01	8.14E-02
N-Nitrosodi-n-propylamine	6.56E-06	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
4,4`-DDT	--	6.20E-02	1.45E-03	8.98E-05	1.09E+00	6.73E-02	1.67E+00	1.04E-01
Hexachlorobenzene	--	3.70E-02	4.49E-03	1.66E-04	1.06E+00	3.93E-02	9.00E-02	3.33E-03
Aluminum	1.89E+01	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	2.67E-02	1.74E+01	3.12E-02	5.41E-01	1.82E-02	3.16E-01	1.82E-02	3.16E-01
Beryllium	8.41E-04	1.45E+00	2.00E-03	2.91E-03	9.00E-03	1.31E-02	9.00E-03	1.31E-02
Cadmium	--	1.03E+00	5.60E-02	5.75E-02	4.59E-01	4.71E-01	4.59E-01	4.71E-01
Chromium	3.32E+00	2.76E+03	8.20E-03	2.27E+01	6.32E-01	1.75E+03	6.32E-01	1.75E+03
Chromium, Hexavalent	--	2.56E+01	8.20E-03	2.10E-01	1.00E-01	2.56E+00	1.00E-01	2.56E+00
Cobalt	3.65E-02	--	1.49E-03	--	2.44E-02	--	2.44E-02	--
Copper	1.65E-02	--	4.12E-02	--	1.65E+00	--	1.65E+00	--
Iron	7.93E+00	--	8.50E-04	--	7.20E-03	--	7.20E-03	--
Lead	9.41E-04	--	3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	1.79E+00	--	1.58E-02	--	4.38E-02	--	4.38E-02	--
Mercury	--	2.90E-01	2.57E-02	7.45E-03	2.84E+00	8.23E-01	2.84E+00	8.23E-01
Nickel	--	1.96E+01	4.70E-02	9.21E-01	8.18E-01	1.60E+01	8.18E-01	1.60E+01
Silver	1.70E-05	6.20E+01	2.80E-03	1.74E-01	4.09E-01	2.54E+01	4.09E-01	2.54E+01
Tin	--	1.60E+00	6.00E-03	9.60E-03	--	--	--	--
Vanadium	--	1.11E+01	9.70E-04	1.08E-02	8.40E-03	9.32E-02	8.40E-03	9.32E-02
Bromide	4.01E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	1.72E+02	1.40E+02	--	--	--	--	--	--
Nitrite as N	2.05E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.52E+02	--	--	--	--	--	--
Sulfate	--	8.30E+02	--	--	--	--	--	--
Hydrazine	8.00E-05	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	9.60E-04	--	9.33E-02	--	1.04E+00	--	1.21E+00	--
4-Nonylphenol (Tech.)	1.39E-02	--	2.93E-03	--	1.07E+00	--	6.48E-03	--

Table MMB Wetlands - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Kempore (Azodicarbonamide)	1.21E+00	--	--	--	--	--	--	--
C11-C22 Aromatics	--	9.40E+03	--	--	--	--	--	--
C19-C36 Aliphatics	--	6.40E+03	--	--	--	--	--	--
C9-C18 Aliphatics	--	7.70E+02	--	--	--	--	--	--
EPH, Total	--	1.70E+04	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table MMB Wetlands - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-02	3.63E-04	2.07E-02	2.15E-03	--	7.02E-06	7.14E-06	5.09E-05	5.28E-06	7.0E-05	4.10E-01	1.7E-04	4.10E+00	1.7E-05
2,4,4-Trimethyl-2-pentene	--	3.50E-03	1.32E-04	3.60E-03	1.13E-03	--	1.23E-06	2.60E-06	8.84E-06	2.77E-06	1.5E-05	4.10E-01	3.8E-05	4.10E+00	3.8E-06
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00	0.00E+00	--	2.21E-05	0.00E+00	0.00E+00	0.00E+00	2.2E-05	2.40E+01	9.2E-07	2.40E+02	9.2E-08
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	4.21E-05	0.00E+00	0.00E+00	0.00E+00	4.2E-05	2.00E+01	2.1E-06	1.00E+02	4.2E-07
Formaldehyde	--	6.00E-01	0.00E+00	0.00E+00	0.00E+00	--	2.11E-04	0.00E+00	0.00E+00	0.00E+00	2.1E-04	1.00E-01	2.1E-03	1.00E+00	2.1E-04
Aniline	--	2.30E-01	0.00E+00	0.00E+00	0.00E+00	--	8.07E-05	0.00E+00	0.00E+00	0.00E+00	8.1E-05	2.00E+00	4.0E-05	2.00E+01	4.0E-06
Azobenzene	5.30E-04	--	--	--	--	1.31E-05	--	--	--	--	1.3E-05	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	4.21E-05	0.00E+00	0.00E+00	0.00E+00	4.2E-05	4.29E+01	9.8E-07	8.57E+01	4.9E-07
Benzo(a)pyrene	1.50E-04	--	--	--	--	3.69E-06	--	--	--	--	3.7E-06	1.00E+00	3.7E-06	1.00E+01	3.7E-07
Bis(2-Ethylhexyl)phthalate	3.43E-03	6.02E+02	1.89E-01	6.72E+02	6.02E+02	8.45E-05	2.11E-01	3.71E-03	1.65E+00	1.48E+00	3.3E+00	1.83E+01	1.8E-01	1.83E+02	1.8E-02
Di-n-octylphthalate	--	1.50E-01	2.42E-05	1.70E-01	1.50E-01	--	5.27E-05	4.75E-07	4.17E-04	3.69E-04	8.4E-04	1.00E+02	8.4E-06	4.00E+02	2.1E-06
Diphenyl ether	--	2.60E+00	7.42E-02	2.68E+00	5.53E-01	--	9.13E-04	1.46E-03	6.58E-03	1.36E-03	1.0E-02	3.00E+00	3.4E-03	3.00E+01	3.4E-04
Diphenylamine	--	9.50E-02	6.98E-03	9.82E-02	8.14E-02	--	3.34E-05	1.37E-04	2.41E-04	2.00E-04	6.1E-04	3.30E+01	1.9E-05	3.33E+02	1.8E-06
N-Nitrosodi-n-propylamine	6.56E-06	--	--	--	--	1.62E-07	--	--	--	--	1.6E-07	7.29E-02	2.2E-06	7.29E-01	2.2E-07
4,4`-DDT	--	6.20E-02	8.98E-05	6.73E-02	1.04E-01	--	2.18E-05	1.77E-06	1.65E-04	2.54E-04	4.4E-04	8.00E-01	5.5E-04	4.00E+00	1.1E-04
Hexachlorobenzene	--	3.70E-02	1.66E-04	3.93E-02	3.33E-03	--	1.30E-05	3.27E-06	9.66E-05	8.18E-06	1.2E-04	3.20E-01	3.8E-04	1.60E+00	7.6E-05
Aluminum	1.89E+01	--	--	--	--	4.64E-01	--	--	--	--	4.6E-01	1.93E+00	2.4E-01	1.93E+01	2.4E-02
Barium	2.67E-02	1.74E+01	5.41E-01	3.16E-01	3.16E-01	6.58E-04	6.09E-03	1.06E-02	7.76E-04	7.76E-04	1.9E-02	5.18E+01	3.7E-04	1.19E+02	1.6E-04
Beryllium	8.41E-04	1.45E+00	2.91E-03	1.31E-02	1.31E-02	2.07E-05	5.10E-04	5.71E-05	3.21E-05	3.21E-05	6.5E-04	5.32E-01	1.2E-03	5.32E-01	1.2E-03
Cadmium	--	1.03E+00	5.75E-02	4.71E-01	4.71E-01	--	3.61E-04	1.13E-03	1.16E-03	1.16E-03	3.8E-03	1.86E+00	2.0E-03	7.10E+00	5.4E-04
Chromium	3.32E+00	2.76E+03	2.27E+01	1.75E+03	1.75E+03	8.19E-02	9.70E-01	4.45E-01	4.29E+00	4.29E+00	1.0E+01	2.40E+00	4.2E+00	4.06E+01	2.5E-01
Chromium, Hexavalent	--	2.56E+01	2.10E-01	2.56E+00	2.56E+00	--	8.99E-03	4.13E-03	6.29E-03	6.29E-03	2.6E-02	2.20E+01	1.2E-03	2.20E+01	1.2E-03
Cobalt	3.65E-02	--	--	--	--	8.99E-04	--	--	--	--	9.0E-04	--	--	--	--
Copper	1.65E-02	--	--	--	--	4.06E-04	--	--	--	--	4.1E-04	1.52E+01	2.7E-05	1.52E+02	2.7E-06
Iron	7.93E+00	--	--	--	--	1.95E-01	--	--	--	--	2.0E-01	--	--	--	--
Lead	9.41E-04	--	--	--	--	2.32E-05	--	--	--	--	2.3E-05	4.70E+00	4.9E-06	1.54E+02	1.5E-07
Manganese	1.79E+00	--	--	--	--	4.40E-02	--	--	--	--	4.4E-02	8.80E+01	5.0E-04	2.84E+02	1.5E-04
Mercury	--	2.90E-01	7.45E-03	8.23E-01	8.23E-01	--	1.02E-04	1.47E-04	2.02E-03	2.02E-03	4.3E-03	1.01E+00	4.2E-03	1.01E+01	4.2E-04
Nickel	--	1.96E+01	9.21E-01	1.60E+01	1.60E+01	--	6.88E-03	1.81E-02	3.94E-02	3.94E-02	1.0E-01	4.00E+01	2.6E-03	8.00E+01	1.3E-03
Silver	1.70E-05	6.20E+01	1.74E-01	2.54E+01	2.54E+01	4.19E-07	2.18E-02	3.41E-03	6.23E-02	6.23E-02	1.5E-01	3.62E+01	4.1E-03	7.25E+01	2.1E-03
Tin	--	1.60E+00	9.60E-03	--	--	--	5.62E-04	1.89E-04	--	--	7.5E-04	2.34E+01	3.2E-05	3.50E+01	2.1E-05
Vanadium	--	1.11E+01	1.08E-02	9.32E-02	9.32E-02	--	3.90E-03	2.12E-04	2.29E-04	2.29E-04	4.6E-03	2.10E-01	2.2E-02	2.10E+00	2.2E-03
Bromide	4.01E-01	--	--	--	--	9.88E-03	--	--	--	--	9.9E-03	--	--	--	--
Chloride	1.72E+02	1.40E+02	--	--	--	4.23E+00	4.91E-02	--	--	--	4.3E+00	--	--	--	--
Nitrite as N	2.05E-02	--	--	--	--	5.05E-04	--	--	--	--	5.0E-04	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.52E+02	--	--	--	1.79E+00	8.86E-02	--	--	--	1.9E+00	--	--	--	--
Sulfate	--	8.30E+02	--	--	--	--	2.91E-01	--	--	--	2.9E-01	--	--	--	--
Hydrazine	8.00E-05	2.40E-03	0.00E+00	0.00E+00	0.00E+00	1.97E-06	8.43E-07	0.00E+00	0.00E+00	0.00E+00	2.8E-06	2.50E+00	1.1E-06	5.00E+00	5.6E-07
4,4'-Isopropylidenediphenol	9.60E-04	--	--	--	--	2.36E-05	--	--	--	--	2.4E-05	--	--	--	--
4-Nonylphenol (Tech.)	1.39E-02	--	--	--	--	3.42E-04	--	--	--	--	3.4E-04	5.00E+00	6.8E-05	5.00E+01	6.8E-06
Kempore (Azodicarbonamide)	1.21E+00	--	--	--	--	2.97E-02	--	--	--	--	3.0E-02	--	--	--	--
C11-C22 Aromatics	--	9.40E+03	--	--	--	--	3.30E+00	--	--	--	3.3E+00	--	--	--	--
C19-C36 Aliphatics	--	6.40E+03	--	--	--	--	2.25E+00	--	--	--	2.2E+00	--	--	--	--
C9-C18 Aliphatics	--	7.70E+02	--	--	--	--	2.70E-01	--	--	--	2.7E-01	--	--	--	--
EPH, Total	--	1.70E+04	--	--	--	--	5.97E+00	--	--	--	6.0E+00	--	--	--	--

Table MMB Wetlands - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	MMB Wetlands

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table MMB Wetland Reference - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	MMB Wetland Reference

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Acetone	--	2.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde	--	3.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	3.13E-04	8.15E-05	1.12E+00	2.90E-01	1.00E+00	2.60E-01
Caprolactam	5.60E-04	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Benzo(a)pyrene	--	9.60E-02	2.22E-03	2.13E-04	1.08E+00	1.03E-01	2.23E-01	2.14E-02
Aluminum	4.40E-01	5.50E+03	5.74E-04	3.16E+00	8.60E-03	4.73E+01	8.60E-03	4.73E+01
Arsenic	--	6.60E+00	2.79E-02	1.84E-01	1.27E-01	8.38E-01	1.27E-01	8.38E-01
Barium	5.00E-02	8.40E+01	3.12E-02	2.62E+00	1.82E-02	1.53E+00	1.82E-02	1.53E+00
Beryllium	--	7.00E-01	2.00E-03	1.40E-03	9.00E-03	6.30E-03	9.00E-03	6.30E-03
Cadmium	--	9.00E-01	5.60E-02	5.04E-02	4.59E-01	4.13E-01	4.59E-01	4.13E-01
Copper	3.90E-03	1.50E+01	4.12E-02	6.18E-01	1.65E+00	2.47E+01	1.65E+00	2.47E+01
Iron	2.00E+00	7.50E+03	8.50E-04	6.38E+00	7.20E-03	5.40E+01	7.20E-03	5.40E+01
Lead	1.30E-03	4.60E+01	3.50E-02	1.61E+00	6.60E-02	3.04E+00	6.60E-02	3.04E+00
Manganese	5.90E-01	5.00E+02	1.58E-02	7.92E+00	4.38E-02	2.19E+01	4.38E-02	2.19E+01
Nickel	2.10E-03	6.10E+00	4.70E-02	2.87E-01	8.18E-01	4.99E+00	8.18E-01	4.99E+00
Tin	--	7.30E+00	6.00E-03	4.38E-02	--	--	--	--
Vanadium	1.50E-03	1.10E+01	9.70E-04	1.07E-02	8.40E-03	9.24E-02	8.40E-03	9.24E-02
Zinc	2.40E-02	7.30E+01	5.05E-02	3.68E+00	2.60E-02	1.90E+00	2.60E-02	1.90E+00
Chloride	1.40E+02	4.20E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	2.50E-01	8.30E+02	--	--	--	--	--	--
Sulfate	2.60E+01	4.20E+02	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table MMB Wetland Reference - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	MMB Wetland Reference

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Acetone	--	2.00E+00	0.00E+00	0.00E+00	0.00E+00	--	7.02E-04	0.00E+00	0.00E+00	0.00E+00	7.0E-04	2.00E+01	3.5E-05	1.00E+02	7.0E-06
Benzaldehyde	--	3.30E-01	0.00E+00	0.00E+00	0.00E+00	--	1.16E-04	0.00E+00	0.00E+00	0.00E+00	1.2E-04	4.29E+01	2.7E-06	8.57E+01	1.4E-06
Benzoic Acid	2.10E-03	5.40E-01	0.00E+00	0.00E+00	0.00E+00	5.17E-05	1.90E-04	0.00E+00	0.00E+00	0.00E+00	2.4E-04	5.00E+01	4.8E-06	7.50E+02	3.2E-07
Bis(2-Ethylhexyl)phthalate	--	2.60E-01	8.15E-05	2.90E-01	2.60E-01	--	9.13E-05	1.60E-06	7.14E-04	6.39E-04	1.4E-03	1.83E+01	7.9E-05	1.83E+02	7.9E-06
Caprolactam	5.60E-04	--	--	--	--	1.38E-05	--	--	--	--	1.4E-05	8.00E+02	1.7E-08	8.00E+03	1.7E-09
Benzo(a)pyrene	--	9.60E-02	2.13E-04	1.03E-01	2.14E-02	--	3.37E-05	4.18E-06	2.54E-04	5.26E-05	3.4E-04	1.00E+00	3.4E-04	1.00E+01	3.4E-05
Aluminum	4.40E-01	5.50E+03	3.16E+00	4.73E+01	4.73E+01	1.08E-02	1.93E+00	6.21E-02	1.16E-01	1.16E-01	2.2E+00	1.93E+00	1.2E+00	1.93E+01	1.2E-01
Arsenic	--	6.60E+00	1.84E-01	8.38E-01	8.38E-01	--	2.32E-03	3.62E-03	2.06E-03	2.06E-03	1.0E-02	1.26E-01	8.0E-02	1.26E+00	8.0E-03
Barium	5.00E-02	8.40E+01	2.62E+00	1.53E+00	1.53E+00	1.23E-03	2.95E-02	5.15E-02	3.76E-03	3.76E-03	9.0E-02	5.18E+01	1.7E-03	1.19E+02	7.5E-04
Beryllium	--	7.00E-01	1.40E-03	6.30E-03	6.30E-03	--	2.46E-04	2.75E-05	1.55E-05	1.55E-05	3.0E-04	5.32E-01	5.7E-04	5.32E-01	5.7E-04
Cadmium	--	9.00E-01	5.04E-02	4.13E-01	4.13E-01	--	3.16E-04	9.90E-04	1.01E-03	1.01E-03	3.3E-03	1.86E+00	1.8E-03	7.10E+00	4.7E-04
Copper	3.90E-03	1.50E+01	6.18E-01	2.47E+01	2.47E+01	9.61E-05	5.27E-03	1.22E-02	6.07E-02	6.07E-02	1.4E-01	1.52E+01	9.1E-03	1.52E+02	9.1E-04
Iron	2.00E+00	7.50E+03	6.38E+00	5.40E+01	5.40E+01	4.93E-02	2.63E+00	1.25E-01	1.33E-01	1.33E-01	3.1E+00	--	--	--	--
Lead	1.30E-03	4.60E+01	1.61E+00	3.04E+00	3.04E+00	3.20E-05	1.61E-02	3.16E-02	7.46E-03	7.46E-03	6.3E-02	4.70E+00	1.3E-02	1.54E+02	4.1E-04
Manganese	5.90E-01	5.00E+02	7.92E+00	2.19E+01	2.19E+01	1.45E-02	1.76E-01	1.56E-01	5.38E-02	5.38E-02	4.5E-01	8.80E+01	5.2E-03	2.84E+02	1.6E-03
Nickel	2.10E-03	6.10E+00	2.87E-01	4.99E+00	4.99E+00	5.17E-05	2.14E-03	5.63E-03	1.23E-02	1.23E-02	3.2E-02	4.00E+01	8.1E-04	8.00E+01	4.0E-04
Tin	--	7.30E+00	4.38E-02	--	--	--	2.56E-03	8.61E-04	--	--	3.4E-03	2.34E+01	1.5E-04	3.50E+01	9.8E-05
Vanadium	1.50E-03	1.10E+01	1.07E-02	9.24E-02	9.24E-02	3.69E-05	3.86E-03	2.10E-04	2.27E-04	2.27E-04	4.6E-03	2.10E-01	2.2E-02	2.10E+00	2.2E-03
Zinc	2.40E-02	7.30E+01	3.68E+00	1.90E+00	1.90E+00	5.91E-04	2.56E-02	7.24E-02	4.66E-03	4.66E-03	1.1E-01	7.54E+01	1.4E-03	2.55E+02	4.2E-04
Chloride	1.40E+02	4.20E+02	--	--	--	3.45E+00	1.47E-01	--	--	--	3.6E+00	--	--	--	--
Nitrogen, as Ammonia	2.50E-01	8.30E+02	--	--	--	6.16E-03	2.91E-01	--	--	--	3.0E-01	--	--	--	--
Sulfate	2.60E+01	4.20E+02	--	--	--	6.40E-01	1.47E-01	--	--	--	7.9E-01	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.2E-02	2.0E+00	4.5E-02	2.0E+00	4.5E-02
Bis(2-Ethylhexyl)phthalate	3.1E-02	6.0E+01	1.9E+00	6.0E+01	1.9E+00
Fluoranthene	4.3E-02	2.2E-01	9.4E-03	2.2E-01	9.4E-03
Phenanthrene	3.5E-02	4.3E-02	1.5E-03	4.3E-02	1.5E-03
Pyrene	4.9E-02	1.1E-01	5.6E-03	1.1E-01	5.6E-03
Aluminum	1.3E+04	5.3E-03	6.8E+01	5.3E-03	6.8E+01
Arsenic	1.0E+01	1.0E-01	1.0E+00	1.0E-01	1.0E+00
Cadmium	2.6E-01	8.7E-02	2.3E-02	8.7E-02	2.3E-02
Chromium	1.0E+01	5.3E-02	5.3E-01	5.3E-02	5.3E-01
Cobalt	2.9E+00	4.1E-03	1.2E-02	4.1E-03	1.2E-02
Copper	5.8E+00	1.4E-01	7.8E-01	1.4E-01	7.8E-01
Iron	1.2E+04	1.1E-01	1.3E+03	1.1E-01	1.3E+03
Lead	2.6E+01	9.6E-02	2.5E+00	9.6E-02	2.5E+00
Manganese	6.9E+01	4.1E-03	2.8E-01	4.1E-03	2.8E-01
Mercury	1.1E-01	1.1E-02	1.2E-03	1.1E-02	1.2E-03
Nickel	7.3E+00	7.1E-02	5.2E-01	7.1E-02	5.2E-01
Selenium	6.0E-01	4.1E-02	2.5E-02	4.1E-02	2.5E-02
Tin	3.5E+00	4.0E+00	1.4E+01	4.0E+00	1.4E+01
Vanadium	2.1E+01	2.5E-03	5.2E-02	2.5E-03	5.2E-02
Zinc	1.8E+01	2.7E-02	4.9E-01	2.7E-02	4.9E-01
Nitrogen, as Ammonia	2.0E+02	--	--	--	--
Sulfate	6.3E+01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	3.6E-08	0.0E+00	0.0E+00	3.6E-08	--	--	--	--
Benzo(a)pyrene	2.2E-02	4.5E-02	4.5E-02	8.1E-09	5.1E-07	4.6E-06	5.1E-06	9.2E+02	5.6E-09	9.2E+03	5.6E-10
Bis(2-Ethylhexyl)phthalate	3.1E-02	1.9E+00	1.9E+00	1.1E-08	2.1E-05	1.9E-04	2.1E-04	1.1E+00	1.9E-04	1.1E+01	1.9E-05
Fluoranthene	4.3E-02	9.4E-03	9.4E-03	1.6E-08	1.1E-07	9.6E-07	1.1E-06	9.2E+02	1.2E-09	9.2E+03	1.2E-10
Phenanthrene	3.5E-02	1.5E-03	1.5E-03	1.3E-08	1.7E-08	1.6E-07	1.9E-07	9.2E+02	2.0E-10	9.2E+03	2.0E-11
Pyrene	4.9E-02	5.6E-03	5.6E-03	1.8E-08	6.4E-08	5.8E-07	6.6E-07	9.2E+02	7.2E-10	9.2E+03	7.2E-11
Aluminum	1.3E+04	6.8E+01	6.8E+01	4.8E-03	7.8E-04	7.0E-03	1.3E-02	1.1E+02	1.1E-04	1.1E+03	1.1E-05
Arsenic	1.0E+01	1.0E+00	1.0E+00	3.7E-06	1.2E-05	1.1E-04	1.2E-04	5.1E+00	2.4E-05	1.3E+01	9.6E-06
Cadmium	2.6E-01	2.3E-02	2.3E-02	9.5E-08	2.6E-07	2.3E-06	2.7E-06	1.5E+00	1.8E-06	5.5E+00	4.9E-07
Chromium	1.0E+01	5.3E-01	5.3E-01	3.7E-06	6.0E-06	5.4E-05	6.4E-05	2.7E+00	2.4E-05	1.1E+01	5.8E-06
Cobalt	2.9E+00	1.2E-02	1.2E-02	1.1E-06	1.4E-07	1.2E-06	2.4E-06	--	--	--	--
Copper	5.8E+00	7.8E-01	7.8E-01	2.1E-06	9.0E-06	8.1E-05	9.2E-05	1.9E+01	5.0E-06	3.7E+01	2.5E-06
Iron	1.2E+04	1.3E+03	1.3E+03	4.4E-03	1.5E-02	1.4E-01	1.6E-01	--	--	--	--
Lead	2.6E+01	2.5E+00	2.5E+00	9.5E-06	2.8E-05	2.6E-04	2.9E-04	4.7E+00	6.3E-05	8.3E+00	3.6E-05
Manganese	6.9E+01	2.8E-01	2.8E-01	2.5E-05	3.2E-06	2.9E-05	5.8E-05	9.8E+02	5.9E-08	9.8E+03	5.9E-09
Mercury	1.1E-01	1.2E-03	1.2E-03	4.0E-08	1.4E-08	1.2E-07	1.8E-07	4.5E-01	3.9E-07	9.0E-01	2.0E-07
Nickel	7.3E+00	5.2E-01	5.2E-01	2.7E-06	5.9E-06	5.3E-05	6.2E-05	7.7E+01	8.0E-07	1.1E+02	5.8E-07
Selenium	6.0E-01	2.5E-02	2.5E-02	2.2E-07	2.8E-07	2.5E-06	3.0E-06	4.4E-01	6.9E-06	5.2E-01	5.8E-06
Tin	3.5E+00	1.4E+01	1.4E+01	1.3E-06	1.6E-04	1.4E-03	1.6E-03	6.8E+00	2.4E-04	1.7E+01	9.5E-05
Vanadium	2.1E+01	5.2E-02	5.2E-02	7.7E-06	5.9E-07	5.3E-06	1.4E-05	1.1E+00	1.2E-05	1.1E+01	1.2E-06
Zinc	1.8E+01	4.9E-01	4.9E-01	6.6E-06	5.6E-06	5.0E-05	6.2E-05	1.5E+01	4.3E-06	1.3E+02	4.7E-07
Nitrogen, as Ammonia	2.0E+02	--	--	7.3E-05	--	--	7.3E-05	--	--	--	--
Sulfate	6.3E+01	--	--	2.3E-05	--	--	2.3E-05	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-2 - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.0E+00	3.0E-01	2.0E+00	3.0E-01
Bis(2-Ethylhexyl)phthalate	1.1E+02	6.0E+01	6.6E+03	6.0E+01	6.6E+03
Diphenyl ether	1.2E-01	2.4E-02	2.9E-03	2.4E-02	2.9E-03
Fluoranthene	4.0E-01	2.2E-01	8.6E-02	2.2E-01	8.6E-02
Phenanthrene	2.7E-01	4.3E-02	1.2E-02	4.3E-02	1.2E-02
Pyrene	3.1E-01	1.1E-01	3.5E-02	1.1E-01	3.5E-02
4,4'-DDD	3.9E-02	1.7E+00	6.7E-02	1.7E+00	6.7E-02
4,4'-DDE	4.9E-02	8.7E+00	4.2E-01	8.7E+00	4.2E-01
4,4'-DDT	6.8E-01	4.2E+00	2.9E+00	4.2E+00	2.9E+00
Aluminum	1.3E+04	5.3E-03	6.9E+01	5.3E-03	6.9E+01
Arsenic	8.8E+00	1.0E-01	9.3E-01	1.0E-01	9.3E-01
Cadmium	6.9E-01	8.7E-02	6.0E-02	8.7E-02	6.0E-02
Chromium	1.2E+02	5.3E-02	6.1E+00	5.3E-02	6.1E+00
Copper	2.2E+01	1.4E-01	3.0E+00	1.4E-01	3.0E+00
Iron	2.2E+04	1.1E-01	2.5E+03	1.1E-01	2.5E+03
Lead	5.3E+01	9.6E-02	5.0E+00	9.6E-02	5.0E+00
Mercury	1.6E-01	1.1E-02	1.8E-03	1.1E-02	1.8E-03
Selenium	2.4E+00	4.1E-02	9.7E-02	4.1E-02	9.7E-02
Vanadium	2.9E+01	2.5E-03	7.2E-02	2.5E-03	7.2E-02
Zinc	7.0E+01	2.7E-02	1.9E+00	2.7E-02	1.9E+00
Chloride	2.4E+02	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	--	--

Table - EA-2 - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-2 - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	2.0E-07	0.0E+00	0.0E+00	2.0E-07	--	--	--	--
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	8.0E-07	0.0E+00	0.0E+00	8.0E-07	--	--	--	--
Benzo(a)pyrene	1.5E-01	3.0E-01	3.0E-01	1.5E-07	9.6E-06	8.7E-05	9.7E-05	9.2E+02	1.0E-07	9.2E+03	1.0E-08
Bis(2-Ethylhexyl)phthalate	1.1E+02	6.6E+03	6.6E+03	1.1E-04	2.1E-01	1.9E+00	2.1E+00	1.1E+00	1.9E+00	1.1E+01	1.9E-01
Diphenyl ether	1.2E-01	2.9E-03	2.9E-03	1.2E-07	9.3E-08	8.3E-07	1.0E-06	--	--	--	--
Fluoranthene	4.0E-01	8.6E-02	8.6E-02	4.0E-07	2.7E-06	2.5E-05	2.8E-05	9.2E+02	3.0E-08	9.2E+03	3.0E-09
Phenanthrene	2.7E-01	1.2E-02	1.2E-02	2.8E-07	3.8E-07	3.4E-06	4.0E-06	9.2E+02	4.4E-09	9.2E+03	4.4E-10
Pyrene	3.1E-01	3.5E-02	3.5E-02	3.1E-07	1.1E-06	1.0E-05	1.1E-05	9.2E+02	1.2E-08	9.2E+03	1.2E-09
4,4'-DDD	3.9E-02	6.7E-02	6.7E-02	3.9E-08	2.1E-06	1.9E-05	2.1E-05	1.3E+01	1.6E-06	1.3E+02	1.6E-07
4,4'-DDE	4.9E-02	4.2E-01	4.2E-01	5.0E-08	1.3E-05	1.2E-04	1.3E-04	1.3E+01	1.0E-05	1.3E+02	1.0E-06
4,4'-DDT	6.8E-01	2.9E+00	2.9E+00	6.9E-07	9.1E-05	8.2E-04	9.1E-04	1.3E+01	7.0E-05	1.3E+02	7.0E-06
Aluminum	1.3E+04	6.9E+01	6.9E+01	1.3E-02	2.2E-03	2.0E-02	3.5E-02	1.1E+02	3.2E-04	1.1E+03	3.2E-05
Arsenic	8.8E+00	9.3E-01	9.3E-01	8.9E-06	2.9E-05	2.6E-04	3.0E-04	5.1E+00	5.9E-05	1.3E+01	2.3E-05
Cadmium	6.9E-01	6.0E-02	6.0E-02	7.0E-07	1.9E-06	1.7E-05	2.0E-05	1.5E+00	1.3E-05	5.5E+00	3.6E-06
Chromium	1.2E+02	6.1E+00	6.1E+00	1.2E-04	1.9E-04	1.7E-03	2.1E-03	2.7E+00	7.6E-04	1.1E+01	1.9E-04
Copper	2.2E+01	3.0E+00	3.0E+00	2.3E-05	9.5E-05	8.6E-04	9.8E-04	1.9E+01	5.3E-05	3.7E+01	2.6E-05
Iron	2.2E+04	2.5E+03	2.5E+03	2.3E-02	8.0E-02	7.2E-01	8.2E-01	--	--	--	--
Lead	5.3E+01	5.0E+00	5.0E+00	5.3E-05	1.6E-04	1.4E-03	1.6E-03	4.7E+00	3.5E-04	8.3E+00	2.0E-04
Mercury	1.6E-01	1.8E-03	1.8E-03	1.7E-07	5.6E-08	5.1E-07	7.3E-07	4.5E-01	1.6E-06	9.0E-01	8.1E-07
Selenium	2.4E+00	9.7E-02	9.7E-02	2.4E-06	3.1E-06	2.8E-05	3.3E-05	4.4E-01	7.6E-05	5.2E-01	6.4E-05
Vanadium	2.9E+01	7.2E-02	7.2E-02	3.0E-05	2.3E-06	2.1E-05	5.3E-05	1.1E+00	4.8E-05	1.1E+01	4.8E-06
Zinc	7.0E+01	1.9E+00	1.9E+00	7.1E-05	5.9E-05	5.4E-04	6.7E-04	1.5E+01	4.6E-05	1.3E+02	5.1E-06
Chloride	2.4E+02	--	--	2.4E-04	--	--	2.4E-04	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	6.3E-04	--	--	6.3E-04	--	--	--	--

Table - EA-2 - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-4 - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.5E-01	2.0E+00	7.2E-01	2.0E+00	7.2E-01
Bis(2-Ethylhexyl)phthalate	3.0E+01	6.0E+01	1.8E+03	6.0E+01	1.8E+03
Fluoranthene	4.1E-01	2.2E-01	8.9E-02	2.2E-01	8.9E-02
Naphthalene	6.5E-02	3.0E-03	1.9E-04	3.0E-03	1.9E-04
Phenanthrene	1.4E-01	4.3E-02	6.1E-03	4.3E-02	6.1E-03
Pyrene	2.2E-01	1.1E-01	2.6E-02	1.1E-01	2.6E-02
4,4'-DDD	1.6E-02	1.7E+00	2.8E-02	1.7E+00	2.8E-02
4,4'-DDE	3.8E-03	8.7E+00	3.3E-02	8.7E+00	3.3E-02
4,4'-DDT	6.8E-02	4.2E+00	2.9E-01	4.2E+00	2.9E-01
Alpha-BHC	2.0E-03	9.1E-03	1.9E-05	9.1E-03	1.9E-05
Gamma-BHC/Lindane	1.2E-02	7.0E-03	8.7E-05	7.0E-03	8.7E-05
Aluminum	8.8E+03	5.3E-03	4.6E+01	5.3E-03	4.6E+01
Arsenic	9.1E+00	1.0E-01	9.5E-01	1.0E-01	9.5E-01
Cadmium	4.8E-01	8.7E-02	4.2E-02	8.7E-02	4.2E-02
Chromium	5.8E+02	5.3E-02	3.1E+01	5.3E-02	3.1E+01
Chromium, Hexavalent	3.8E+01	5.3E-02	2.0E+00	5.3E-02	2.0E+00
Cobalt	1.6E+01	4.1E-03	6.6E-02	4.1E-03	6.6E-02
Copper	2.7E+01	1.4E-01	3.7E+00	1.4E-01	3.7E+00
Iron	1.9E+04	1.1E-01	2.2E+03	1.1E-01	2.2E+03
Lead	4.3E+01	9.6E-02	4.1E+00	9.6E-02	4.1E+00
Manganese	1.7E+02	4.1E-03	7.0E-01	4.1E-03	7.0E-01
Mercury	1.4E-01	1.1E-02	1.6E-03	1.1E-02	1.6E-03
Nickel	2.5E+01	7.1E-02	1.8E+00	7.1E-02	1.8E+00
Vanadium	2.0E+01	2.5E-03	5.0E-02	2.5E-03	5.0E-02
Zinc	4.8E+01	2.7E-02	1.3E+00	2.7E-02	1.3E+00
Chloride	1.2E+02	--	--	--	--
Cyanide, Total	7.9E+00	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	--	--
Sulfate	1.0E+04	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	--	--

Table - EA-4 - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-4 - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	3.3E-07	0.0E+00	0.0E+00	3.3E-07	--	--	--	--
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	4.3E-06	0.0E+00	0.0E+00	4.3E-06	--	--	--	--
Benzo(a)pyrene	3.5E-01	7.2E-01	7.2E-01	2.5E-06	1.6E-04	1.4E-03	1.6E-03	9.2E+02	1.7E-06	9.2E+03	1.7E-07
Bis(2-Ethylhexyl)phthalate	3.0E+01	1.8E+03	1.8E+03	2.1E-04	4.0E-01	3.6E+00	4.0E+00	1.1E+00	3.6E+00	1.1E+01	3.6E-01
Fluoranthene	4.1E-01	8.9E-02	8.9E-02	2.9E-06	2.0E-05	1.8E-04	2.0E-04	9.2E+02	2.2E-07	9.2E+03	2.2E-08
Naphthalene	6.5E-02	1.9E-04	1.9E-04	4.6E-07	4.3E-08	3.9E-07	8.9E-07	5.4E+00	1.7E-07	5.4E+01	1.7E-08
Phenanthrene	1.4E-01	6.1E-03	6.1E-03	1.0E-06	1.4E-06	1.2E-05	1.5E-05	9.2E+02	1.6E-08	9.2E+03	1.6E-09
Pyrene	2.2E-01	2.6E-02	2.6E-02	1.6E-06	5.7E-06	5.1E-05	5.8E-05	9.2E+02	6.4E-08	9.2E+03	6.4E-09
4,4'-DDD	1.6E-02	2.8E-02	2.8E-02	1.1E-07	6.2E-06	5.6E-05	6.2E-05	1.3E+01	4.8E-06	1.3E+02	4.8E-07
4,4'-DDE	3.8E-03	3.3E-02	3.3E-02	2.7E-08	7.2E-06	6.5E-05	7.2E-05	1.3E+01	5.6E-06	1.3E+02	5.6E-07
4,4'-DDT	6.8E-02	2.9E-01	2.9E-01	4.9E-07	6.4E-05	5.8E-04	6.4E-04	1.3E+01	5.0E-05	1.3E+02	5.0E-06
Alpha-BHC	2.0E-03	1.9E-05	1.9E-05	1.4E-08	4.1E-09	3.7E-08	5.6E-08	2.0E+00	2.8E-08	2.0E+01	2.8E-09
Gamma-BHC/Lindane	1.2E-02	8.7E-05	8.7E-05	8.7E-08	1.9E-08	1.7E-07	2.8E-07	2.0E+00	1.4E-07	2.0E+01	1.4E-08
Aluminum	8.8E+03	4.6E+01	4.6E+01	6.3E-02	1.0E-02	9.3E-02	1.7E-01	1.1E+02	1.5E-03	1.1E+03	1.5E-04
Arsenic	9.1E+00	9.5E-01	9.5E-01	6.5E-05	2.1E-04	1.9E-03	2.2E-03	5.1E+00	4.3E-04	1.3E+01	1.7E-04
Cadmium	4.8E-01	4.2E-02	4.2E-02	3.4E-06	9.3E-06	8.3E-05	9.6E-05	1.5E+00	6.4E-05	5.5E+00	1.7E-05
Chromium	5.8E+02	3.1E+01	3.1E+01	4.1E-03	6.8E-03	6.1E-02	7.2E-02	2.7E+00	2.7E-02	1.1E+01	6.6E-03
Chromium, Hexavalent	3.8E+01	2.0E+00	2.0E+00	2.7E-04	4.4E-04	4.0E-03	4.7E-03	1.6E+00	2.8E-03	1.6E+01	2.8E-04
Cobalt	1.6E+01	6.6E-02	6.6E-02	1.2E-04	1.5E-05	1.3E-04	2.6E-04	--	--	--	--
Copper	2.7E+01	3.7E+00	3.7E+00	1.9E-04	8.1E-04	7.3E-03	8.3E-03	1.9E+01	4.5E-04	3.7E+01	2.2E-04
Iron	1.9E+04	2.2E+03	2.2E+03	1.4E-01	4.8E-01	4.3E+00	4.9E+00	--	--	--	--
Lead	4.3E+01	4.1E+00	4.1E+00	3.0E-04	9.1E-04	8.2E-03	9.4E-03	4.7E+00	2.0E-03	8.3E+00	1.1E-03
Manganese	1.7E+02	7.0E-01	7.0E-01	1.2E-03	1.6E-04	1.4E-03	2.8E-03	9.8E+02	2.8E-06	9.8E+03	2.8E-07
Mercury	1.4E-01	1.6E-03	1.6E-03	1.0E-06	3.4E-07	3.1E-06	4.5E-06	4.5E-01	9.9E-06	9.0E-01	5.0E-06
Nickel	2.5E+01	1.8E+00	1.8E+00	1.8E-04	4.0E-04	3.6E-03	4.2E-03	7.7E+01	5.4E-05	1.1E+02	3.9E-05
Vanadium	2.0E+01	5.0E-02	5.0E-02	1.5E-04	1.1E-05	1.0E-04	2.6E-04	1.1E+00	2.3E-04	1.1E+01	2.3E-05
Zinc	4.8E+01	1.3E+00	1.3E+00	3.4E-04	2.9E-04	2.6E-03	3.2E-03	1.5E+01	2.2E-04	1.3E+02	2.5E-05
Chloride	1.2E+02	--	--	8.5E-04	--	--	8.5E-04	--	--	--	--
Cyanide, Total	7.9E+00	--	--	5.6E-05	--	--	5.6E-05	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	2.5E-03	--	--	2.5E-03	--	--	--	--
Sulfate	1.0E+04	--	--	7.1E-02	--	--	7.1E-02	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	4.0E-04	--	--	4.0E-04	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	5.7E-04	--	--	5.7E-04	--	--	--	--

Table - EA-4 - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-5 - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.0E+00	3.1E-01	2.0E+00	3.1E-01
Bis(2-Ethylhexyl)phthalate	1.0E+02	6.0E+01	6.2E+03	6.0E+01	6.2E+03
Diphenyl ether	1.9E+00	2.4E-02	4.6E-02	2.4E-02	4.6E-02
Fluoranthene	2.5E+00	2.2E-01	5.5E-01	2.2E-01	5.5E-01
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	1.5E-01	4.3E-02	6.3E-03	4.3E-02	6.3E-03
Pyrene	5.6E-01	1.1E-01	6.4E-02	1.1E-01	6.4E-02
4,4'-DDT	4.5E-02	4.2E+00	1.9E-01	4.2E+00	1.9E-01
Hexachlorobenzene	2.9E-02	6.0E-01	1.7E-02	6.0E-01	1.7E-02
Aluminum	2.0E+04	5.3E-03	1.1E+02	5.3E-03	1.1E+02
Antimony	3.4E-01	5.0E-02	1.7E-02	5.0E-02	1.7E-02
Arsenic	2.7E+01	1.0E-01	2.8E+00	1.0E-01	2.8E+00
Cadmium	4.2E-01	8.7E-02	3.7E-02	8.7E-02	3.7E-02
Chromium	2.6E+04	5.3E-02	1.4E+03	5.3E-02	1.4E+03
Chromium, Hexavalent	5.6E+02	5.3E-02	2.9E+01	5.3E-02	2.9E+01
Copper	9.7E+01	1.4E-01	1.3E+01	1.4E-01	1.3E+01
Iron	2.0E+04	1.1E-01	2.3E+03	1.1E-01	2.3E+03
Lead	9.3E+01	9.6E-02	8.9E+00	9.6E-02	8.9E+00
Mercury	1.9E+00	1.1E-02	2.1E-02	1.1E-02	2.1E-02
Silver	1.1E+03	8.0E-04	8.8E-01	8.0E-04	8.8E-01
Thallium	7.4E+00	2.2E-02	1.7E-01	2.2E-02	1.7E-01
Tin	2.6E+04	4.0E+00	1.0E+05	4.0E+00	1.0E+05
Vanadium	6.9E+01	2.5E-03	1.7E-01	2.5E-03	1.7E-01
Zinc	3.1E+01	2.7E-02	8.4E-01	2.7E-02	8.4E-01
Cyanide, Total	6.5E+00	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	--	--
Sulfate	2.3E+02	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	--	--

Table - EA-5 - RME - Red-Tailed Hawk - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-5 - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	4.8E-08	0.0E+00	0.0E+00	4.8E-08	--	--	--	--
Aniline	1.2E-01	0.0E+00	0.0E+00	4.4E-08	0.0E+00	0.0E+00	4.4E-08	--	--	--	--
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	7.7E-08	0.0E+00	0.0E+00	7.7E-08	--	--	--	--
Benzo(a)pyrene	1.5E-01	3.1E-01	3.1E-01	5.6E-08	3.5E-06	3.2E-05	3.5E-05	9.2E+02	3.8E-08	9.2E+03	3.8E-09
Bis(2-Ethylhexyl)phthalate	1.0E+02	6.2E+03	6.2E+03	3.8E-05	7.1E-02	6.4E-01	7.1E-01	1.1E+00	6.4E-01	1.1E+01	6.4E-02
Diphenyl ether	1.9E+00	4.6E-02	4.6E-02	7.0E-07	5.3E-07	4.8E-06	6.0E-06	--	--	--	--
Fluoranthene	2.5E+00	5.5E-01	5.5E-01	9.2E-07	6.3E-06	5.7E-05	6.4E-05	9.2E+02	6.9E-08	9.2E+03	6.9E-09
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	9.5E-08	0.0E+00	0.0E+00	9.5E-08	--	--	--	--
Phenanthrene	1.5E-01	6.3E-03	6.3E-03	5.3E-08	7.2E-08	6.5E-07	7.7E-07	9.2E+02	8.4E-10	9.2E+03	8.4E-11
Pyrene	5.6E-01	6.4E-02	6.4E-02	2.1E-07	7.3E-07	6.6E-06	7.6E-06	9.2E+02	8.2E-09	9.2E+03	8.2E-10
4,4'-DDT	4.5E-02	1.9E-01	1.9E-01	1.6E-08	2.2E-06	2.0E-05	2.2E-05	1.3E+01	1.7E-06	1.3E+02	1.7E-07
Hexachlorobenzene	2.9E-02	1.7E-02	1.7E-02	1.1E-08	2.0E-07	1.8E-06	2.0E-06	2.9E+00	6.9E-07	2.9E+01	6.9E-08
Aluminum	2.0E+04	1.1E+02	1.1E+02	7.3E-03	1.2E-03	1.1E-02	1.9E-02	1.1E+02	1.8E-04	1.1E+03	1.8E-05
Antimony	3.4E-01	1.7E-02	1.7E-02	1.2E-07	1.9E-07	1.7E-06	2.1E-06	--	--	--	--
Arsenic	2.7E+01	2.8E+00	2.8E+00	9.8E-06	3.2E-05	2.9E-04	3.3E-04	5.1E+00	6.4E-05	1.3E+01	2.6E-05
Cadmium	4.2E-01	3.7E-02	3.7E-02	1.5E-07	4.2E-07	3.8E-06	4.4E-06	1.5E+00	2.9E-06	5.5E+00	7.9E-07
Chromium	2.6E+04	1.4E+03	1.4E+03	9.6E-03	1.6E-02	1.4E-01	1.7E-01	2.7E+00	6.2E-02	1.1E+01	1.5E-02
Chromium, Hexavalent	5.6E+02	2.9E+01	2.9E+01	2.0E-04	3.4E-04	3.0E-03	3.6E-03	1.6E+00	2.2E-03	1.6E+01	2.2E-04
Copper	9.7E+01	1.3E+01	1.3E+01	3.6E-05	1.5E-04	1.4E-03	1.5E-03	1.9E+01	8.3E-05	3.7E+01	4.2E-05
Iron	2.0E+04	2.3E+03	2.3E+03	7.4E-03	2.6E-02	2.3E-01	2.7E-01	--	--	--	--
Lead	9.3E+01	8.9E+00	8.9E+00	3.4E-05	1.0E-04	9.2E-04	1.1E-03	4.7E+00	2.2E-04	8.3E+00	1.3E-04
Mercury	1.9E+00	2.1E-02	2.1E-02	7.1E-07	2.4E-07	2.2E-06	3.1E-06	4.5E-01	6.9E-06	9.0E-01	3.4E-06
Silver	1.1E+03	8.8E-01	8.8E-01	4.0E-04	1.0E-05	9.1E-05	5.0E-04	1.2E+01	4.2E-05	1.2E+02	4.2E-06
Thallium	7.4E+00	1.7E-01	1.7E-01	2.7E-06	1.9E-06	1.7E-05	2.2E-05	6.1E-01	3.6E-05	6.1E+00	3.6E-06
Tin	2.6E+04	1.0E+05	1.0E+05	9.5E-03	1.2E+00	1.1E+01	1.2E+01	6.8E+00	1.8E+00	1.7E+01	7.0E-01
Vanadium	6.9E+01	1.7E-01	1.7E-01	2.5E-05	1.9E-06	1.7E-05	4.5E-05	1.1E+00	4.1E-05	1.1E+01	4.1E-06
Zinc	3.1E+01	8.4E-01	8.4E-01	1.1E-05	9.6E-06	8.6E-05	1.1E-04	1.5E+01	7.4E-06	1.3E+02	8.2E-07
Cyanide, Total	6.5E+00	--	--	2.4E-06	--	--	2.4E-06	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	2.7E-04	--	--	2.7E-04	--	--	--	--
Sulfate	2.3E+02	--	--	8.4E-05	--	--	8.4E-05	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	2.7E-03	--	--	2.7E-03	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	1.8E-03	--	--	1.8E-03	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	2.9E-04	--	--	2.9E-04	--	--	--	--

Table - EA-5 - RME - Red-Tailed Hawk - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red-Tailed Hawk
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{mam} - Chemical concentration in mammal tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - CTE - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.9E-02	2.2E-03	4.2E-05	5.4E+00	1.0E-01
Bis(2-Ethylhexyl)phthalate	1.9E-02	3.1E-04	5.8E-06	5.6E+00	1.0E-01
Fluoranthene	2.6E-02	8.1E-03	2.1E-04	5.3E+00	1.4E-01
Phenanthrene	2.2E-02	2.0E-02	4.5E-04	5.2E+00	1.1E-01
Pyrene	2.8E-02	1.2E-02	3.3E-04	5.2E+00	1.5E-01
Aluminum	7.4E+03	5.7E-04	4.2E+00	8.6E-03	6.3E+01
Arsenic	5.0E+00	2.8E-02	1.4E-01	3.6E-02	1.8E-01
Cadmium	1.5E-01	5.7E-01	8.6E-02	3.7E-01	5.6E-02
Chromium	6.2E+00	8.2E-03	5.1E-02	--	4.0E+00
Cobalt	1.6E+00	1.5E-03	2.3E-03	2.4E-02	3.8E-02
Copper	4.1E+00	7.6E-02	3.1E-01	6.3E-02	2.6E-01
Iron	6.3E+03	8.5E-04	5.4E+00	7.2E-03	4.5E+01
Lead	1.6E+01	2.5E-02	3.9E-01	6.3E-02	9.9E-01
Manganese	2.8E+01	1.6E-02	4.4E-01	2.2E-02	6.2E-01
Mercury	7.7E-02	--	--	7.4E-01	5.7E-02
Nickel	4.0E+00	8.4E-02	3.3E-01	9.5E-01	3.8E+00
Selenium	4.1E-01	2.8E-01	1.1E-01	3.4E-01	1.4E-01
Tin	2.3E+00	6.0E-03	1.4E-02	--	--
Vanadium	1.2E+01	9.7E-04	1.2E-02	8.4E-03	1.0E-01
Zinc	8.5E+00	5.6E-02	4.7E-01	6.2E-02	5.3E-01
Nitrogen, as Ammonia	1.3E+02	--	--	--	--
Sulfate	2.8E+01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	2.9E-04	0.0E+00	0.0E+00	2.9E-04	--	--	--	--
Benzo(a)pyrene	1.9E-02	4.2E-05	1.0E-01	8.6E-05	4.2E-06	2.2E-02	2.2E-02	9.2E+02	2.4E-05	9.2E+03	2.4E-06
Bis(2-Ethylhexyl)phthalate	1.9E-02	5.8E-06	1.0E-01	8.4E-05	5.9E-07	2.2E-02	2.2E-02	1.1E+00	2.0E-02	1.1E+01	2.0E-03
Fluoranthene	2.6E-02	2.1E-04	1.4E-01	1.2E-04	2.1E-05	2.9E-02	2.9E-02	9.2E+02	3.2E-05	9.2E+03	3.2E-06
Phenanthrene	2.2E-02	4.5E-04	1.1E-01	1.0E-04	4.5E-05	2.4E-02	2.5E-02	9.2E+02	2.7E-05	9.2E+03	2.7E-06
Pyrene	2.8E-02	3.3E-04	1.5E-01	1.3E-04	3.3E-05	3.2E-02	3.2E-02	9.2E+02	3.4E-05	9.2E+03	3.4E-06
Aluminum	7.4E+03	4.2E+00	6.3E+01	3.4E+01	4.3E-01	1.4E+01	4.8E+01	1.1E+02	4.3E-01	1.1E+03	4.3E-02
Arsenic	5.0E+00	1.4E-01	1.8E-01	2.3E-02	1.4E-02	3.9E-02	7.5E-02	5.1E+00	1.5E-02	1.3E+01	5.9E-03
Cadmium	1.5E-01	8.6E-02	5.6E-02	6.9E-04	8.7E-03	1.2E-02	2.1E-02	1.5E+00	1.4E-02	5.5E+00	3.9E-03
Chromium	6.2E+00	5.1E-02	4.0E+00	2.8E-02	5.1E-03	8.6E-01	8.9E-01	2.7E+00	3.3E-01	1.1E+01	8.1E-02
Cobalt	1.6E+00	2.3E-03	3.8E-02	7.1E-03	2.3E-04	8.2E-03	1.5E-02	--	--	--	--
Copper	4.1E+00	3.1E-01	2.6E-01	1.9E-02	3.2E-02	5.6E-02	1.1E-01	1.9E+01	5.8E-03	3.7E+01	2.9E-03
Iron	6.3E+03	5.4E+00	4.5E+01	2.9E+01	5.4E-01	9.7E+00	3.9E+01	--	--	--	--
Lead	1.6E+01	3.9E-01	9.9E-01	7.1E-02	3.9E-02	2.1E-01	3.2E-01	4.7E+00	6.8E-02	8.3E+00	3.9E-02
Manganese	2.8E+01	4.4E-01	6.2E-01	1.3E-01	4.5E-02	1.3E-01	3.0E-01	9.8E+02	3.1E-04	9.8E+03	3.1E-05
Mercury	7.7E-02	--	5.7E-02	3.5E-04	--	1.2E-02	1.2E-02	4.5E-01	2.8E-02	9.0E-01	1.4E-02
Nickel	4.0E+00	3.3E-01	3.8E+00	1.8E-02	3.4E-02	8.1E-01	8.6E-01	7.7E+01	1.1E-02	1.1E+02	8.0E-03
Selenium	4.1E-01	1.1E-01	1.4E-01	1.9E-03	1.2E-02	3.0E-02	4.3E-02	4.4E-01	9.8E-02	5.2E-01	8.3E-02
Tin	2.3E+00	1.4E-02	--	1.0E-02	1.4E-03	--	1.2E-02	6.8E+00	1.7E-03	1.7E+01	6.9E-04
Vanadium	1.2E+01	1.2E-02	1.0E-01	5.4E-02	1.2E-03	2.1E-02	7.7E-02	1.1E+00	7.0E-02	1.1E+01	7.0E-03
Zinc	8.5E+00	4.7E-01	5.3E-01	3.9E-02	4.8E-02	1.1E-01	2.0E-01	1.5E+01	1.4E-02	1.3E+02	1.5E-03
Nitrogen, as Ammonia	1.3E+02	--	--	5.8E-01	--	--	5.8E-01	--	--	--	--
Sulfate	2.8E+01	--	--	1.3E-01	--	--	1.3E-01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-2 - CTE - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.4E-01	2.2E-03	5.3E-04	5.4E+00	1.3E+00
Bis(2-Ethylhexyl)phthalate	2.2E+01	3.1E-04	7.0E-03	5.6E+00	1.3E+02
Diphenyl ether	1.2E-01	2.9E-02	3.4E-03	5.2E+00	6.2E-01
Fluoranthene	9.4E-01	8.1E-03	7.6E-03	5.3E+00	4.9E+00
Phenanthrene	6.8E-01	2.0E-02	1.4E-02	5.2E+00	3.5E+00
Pyrene	6.6E-01	1.2E-02	7.7E-03	5.2E+00	3.4E+00
4,4'-DDD	3.9E-02	2.4E-03	9.5E-05	5.4E+00	2.1E-01
4,4'-DDE	4.9E-02	9.6E-04	4.7E-05	5.5E+00	2.7E-01
4,4'-DDT	2.7E-01	1.4E-03	3.9E-04	5.4E+00	1.5E+00
Aluminum	8.7E+03	5.7E-04	5.0E+00	8.6E-03	7.5E+01
Arsenic	6.7E+00	4.0E-02	2.7E-01	5.0E-02	3.3E-01
Cadmium	5.1E-01	2.9E-01	1.5E-01	2.5E-01	1.3E-01
Chromium	3.9E+01	8.2E-03	3.2E-01	--	4.0E+00
Copper	1.8E+01	2.8E-02	4.9E-01	1.9E-02	3.4E-01
Iron	1.1E+04	8.5E-04	9.3E+00	7.2E-03	7.9E+01
Lead	4.0E+01	1.3E-02	5.1E-01	4.3E-02	1.7E+00
Mercury	1.5E-01	--	--	3.5E-01	5.1E-02
Selenium	1.1E+00	2.0E-01	2.2E-01	1.9E-01	2.2E-01
Vanadium	2.4E+01	9.7E-04	2.3E-02	8.4E-03	2.0E-01
Zinc	4.9E+01	2.0E-02	9.6E-01	2.4E-02	1.2E+00
Chloride	7.9E+01	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-2 - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	1.3E-03	0.0E+00	0.0E+00	1.3E-03	--	--	--	--
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	1.2E-02	0.0E+00	0.0E+00	1.2E-02	--	--	--	--
Benzo(a)pyrene	2.4E-01	5.3E-04	1.3E+00	1.5E-03	7.6E-05	3.9E-01	3.9E-01	9.2E+02	4.3E-04	9.2E+03	4.3E-05
Bis(2-Ethylhexyl)phthalate	2.2E+01	7.0E-03	1.3E+02	1.4E-01	1.0E-03	3.8E+01	3.8E+01	1.1E+00	3.5E+01	1.1E+01	3.5E+00
Diphenyl ether	1.2E-01	3.4E-03	6.2E-01	7.7E-04	4.9E-04	1.9E-01	1.9E-01	--	--	--	--
Fluoranthene	9.4E-01	7.6E-03	4.9E+00	6.0E-03	1.1E-03	1.5E+00	1.5E+00	9.2E+02	1.6E-03	9.2E+03	1.6E-04
Phenanthrene	6.8E-01	1.4E-02	3.5E+00	4.4E-03	2.0E-03	1.1E+00	1.1E+00	9.2E+02	1.2E-03	9.2E+03	1.2E-04
Pyrene	6.6E-01	7.7E-03	3.4E+00	4.2E-03	1.1E-03	1.0E+00	1.0E+00	9.2E+02	1.1E-03	9.2E+03	1.1E-04
4,4'-DDD	3.9E-02	9.5E-05	2.1E-01	2.5E-04	1.4E-05	6.3E-02	6.4E-02	1.3E+01	4.9E-03	1.3E+02	4.9E-04
4,4'-DDE	4.9E-02	4.7E-05	2.7E-01	3.1E-04	6.7E-06	8.1E-02	8.1E-02	1.3E+01	6.3E-03	1.3E+02	6.3E-04
4,4'-DDT	2.7E-01	3.9E-04	1.5E+00	1.7E-03	5.6E-05	4.4E-01	4.4E-01	1.3E+01	3.4E-02	1.3E+02	3.4E-03
Aluminum	8.7E+03	5.0E+00	7.5E+01	5.6E+01	7.1E-01	2.3E+01	7.9E+01	1.1E+02	7.2E-01	1.1E+03	7.2E-02
Arsenic	6.7E+00	2.7E-01	3.3E-01	4.3E-02	3.8E-02	1.0E-01	1.8E-01	5.1E+00	3.5E-02	1.3E+01	1.4E-02
Cadmium	5.1E-01	1.5E-01	1.3E-01	3.3E-03	2.1E-02	3.9E-02	6.3E-02	1.5E+00	4.2E-02	5.5E+00	1.1E-02
Chromium	3.9E+01	3.2E-01	4.0E+00	2.5E-01	4.6E-02	1.2E+00	1.5E+00	2.7E+00	5.6E-01	1.1E+01	1.4E-01
Copper	1.8E+01	4.9E-01	3.4E-01	1.2E-01	7.0E-02	1.0E-01	2.9E-01	1.9E+01	1.6E-02	3.7E+01	7.8E-03
Iron	1.1E+04	9.3E+00	7.9E+01	7.0E+01	1.3E+00	2.4E+01	9.5E+01	--	--	--	--
Lead	4.0E+01	5.1E-01	1.7E+00	2.6E-01	7.2E-02	5.2E-01	8.5E-01	4.7E+00	1.8E-01	8.3E+00	1.0E-01
Mercury	1.5E-01	--	5.1E-02	9.4E-04	--	1.5E-02	1.6E-02	4.5E-01	3.6E-02	9.0E-01	1.8E-02
Selenium	1.1E+00	2.2E-01	2.2E-01	7.1E-03	3.1E-02	6.5E-02	1.0E-01	4.4E-01	2.4E-01	5.2E-01	2.0E-01
Vanadium	2.4E+01	2.3E-02	2.0E-01	1.5E-01	3.3E-03	6.0E-02	2.1E-01	1.1E+00	1.9E-01	1.1E+01	1.9E-02
Zinc	4.9E+01	9.6E-01	1.2E+00	3.1E-01	1.4E-01	3.5E-01	8.0E-01	1.5E+01	5.5E-02	1.3E+02	6.1E-03
Chloride	7.9E+01	--	--	5.1E-01	--	--	5.1E-01	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	2.8E+00	--	--	2.8E+00	--	--	--	--

Table - EA-2 - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-4 - CTE - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.3E-01	2.2E-03	7.4E-04	5.4E+00	1.8E+00
Bis(2-Ethylhexyl)phthalate	9.0E+00	3.1E-04	2.8E-03	5.6E+00	5.0E+01
Fluoranthene	8.5E-01	8.1E-03	6.9E-03	5.3E+00	4.5E+00
Naphthalene	2.1E-01	9.6E-02	2.0E-02	5.2E+00	1.1E+00
Phenanthrene	6.9E-01	2.0E-02	1.4E-02	5.2E+00	3.6E+00
Pyrene	8.2E-01	1.2E-02	9.6E-03	5.2E+00	4.3E+00
4,4'-DDD	2.1E-02	2.4E-03	5.2E-05	5.4E+00	1.1E-01
4,4'-DDE	1.1E-02	9.6E-04	1.1E-05	5.5E+00	6.0E-02
4,4'-DDT	2.5E-02	1.4E-03	3.7E-05	5.4E+00	1.4E-01
Alpha-BHC	5.8E-03	5.1E-02	2.9E-04	5.1E+00	3.0E-02
Gamma-BHC/Lindane	1.9E-02	5.9E-02	1.1E-03	5.1E+00	1.0E-01
Aluminum	7.0E+03	5.7E-04	4.0E+00	8.6E-03	6.0E+01
Arsenic	7.6E+00	3.5E-02	2.7E-01	4.4E-02	3.4E-01
Cadmium	4.2E-01	3.2E-01	1.3E-01	2.6E-01	1.1E-01
Chromium	2.7E+02	8.2E-03	2.2E+00	--	4.0E+00
Chromium, Hexavalent	1.1E+01	8.2E-03	8.6E-02	--	4.0E+00
Cobalt	5.0E+00	1.5E-03	7.5E-03	2.4E-02	1.2E-01
Copper	1.4E+01	3.2E-02	4.4E-01	2.2E-02	3.1E-01
Iron	9.0E+03	8.5E-04	7.6E+00	7.2E-03	6.5E+01
Lead	2.4E+01	1.8E-02	4.3E-01	5.2E-02	1.3E+00
Manganese	8.4E+01	1.6E-02	1.3E+00	1.0E-02	8.7E-01
Mercury	1.2E-01	--	--	5.6E-01	6.6E-02
Nickel	1.0E+01	3.6E-03	3.6E-02	9.5E-01	9.6E+00
Vanadium	1.7E+01	9.7E-04	1.6E-02	8.4E-03	1.4E-01
Zinc	2.3E+01	3.1E-02	6.9E-01	3.6E-02	8.1E-01
Chloride	5.4E+01	--	--	--	--
Cyanide, Total	5.8E+00	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	--	--
Sulfate	1.1E+03	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	--	--

Table - EA-4 - CTE - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-4 - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	3.0E-04	0.0E+00	0.0E+00	3.0E-04	--	--	--	--
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	1.5E-03	0.0E+00	0.0E+00	1.5E-03	--	--	--	--
Benzo(a)pyrene	3.3E-01	7.4E-04	1.8E+00	2.1E-03	1.1E-04	5.4E-01	5.5E-01	9.2E+02	5.9E-04	9.2E+03	5.9E-05
Bis(2-Ethylhexyl)phthalate	9.0E+00	2.8E-03	5.0E+01	5.8E-02	4.0E-04	1.5E+01	1.5E+01	1.1E+00	1.4E+01	1.1E+01	1.4E+00
Fluoranthene	8.5E-01	6.9E-03	4.5E+00	5.5E-03	9.8E-04	1.4E+00	1.4E+00	9.2E+02	1.5E-03	9.2E+03	1.5E-04
Naphthalene	2.1E-01	2.0E-02	1.1E+00	1.3E-03	2.9E-03	3.3E-01	3.4E-01	5.4E+00	6.2E-02	5.4E+01	6.2E-03
Phenanthrene	6.9E-01	1.4E-02	3.6E+00	4.4E-03	2.0E-03	1.1E+00	1.1E+00	9.2E+02	1.2E-03	9.2E+03	1.2E-04
Pyrene	8.2E-01	9.6E-03	4.3E+00	5.3E-03	1.4E-03	1.3E+00	1.3E+00	9.2E+02	1.4E-03	9.2E+03	1.4E-04
4,4'-DDD	2.1E-02	5.2E-05	1.1E-01	1.4E-04	7.4E-06	3.5E-02	3.5E-02	1.3E+01	2.7E-03	1.3E+02	2.7E-04
4,4'-DDE	1.1E-02	1.1E-05	6.0E-02	7.1E-05	1.5E-06	1.8E-02	1.8E-02	1.3E+01	1.4E-03	1.3E+02	1.4E-04
4,4'-DDT	2.5E-02	3.7E-05	1.4E-01	1.6E-04	5.2E-06	4.1E-02	4.2E-02	1.3E+01	3.2E-03	1.3E+02	3.2E-04
Alpha-BHC	5.8E-03	2.9E-04	3.0E-02	3.7E-05	4.2E-05	9.0E-03	9.1E-03	2.0E+00	4.6E-03	2.0E+01	4.6E-04
Gamma-BHC/Lindane	1.9E-02	1.1E-03	1.0E-01	1.2E-04	1.6E-04	3.0E-02	3.1E-02	2.0E+00	1.5E-02	2.0E+01	1.5E-03
Aluminum	7.0E+03	4.0E+00	6.0E+01	4.5E+01	5.7E-01	1.8E+01	6.4E+01	1.1E+02	5.8E-01	1.1E+03	5.8E-02
Arsenic	7.6E+00	2.7E-01	3.4E-01	4.9E-02	3.8E-02	1.0E-01	1.9E-01	5.1E+00	3.7E-02	1.3E+01	1.5E-02
Cadmium	4.2E-01	1.3E-01	1.1E-01	2.7E-03	1.9E-02	3.4E-02	5.5E-02	1.5E+00	3.7E-02	5.5E+00	1.0E-02
Chromium	2.7E+02	2.2E+00	4.0E+00	1.7E+00	3.2E-01	1.2E+00	3.3E+00	2.7E+00	1.2E+00	1.1E+01	3.0E-01
Chromium, Hexavalent	1.1E+01	8.6E-02	4.0E+00	6.8E-02	1.2E-02	1.2E+00	1.3E+00	1.6E+00	7.9E-01	1.6E+01	7.9E-02
Cobalt	5.0E+00	7.5E-03	1.2E-01	3.2E-02	1.1E-03	3.7E-02	7.0E-02	--	--	--	--
Copper	1.4E+01	4.4E-01	3.1E-01	8.9E-02	6.3E-02	9.4E-02	2.5E-01	1.9E+01	1.3E-02	3.7E+01	6.6E-03
Iron	9.0E+03	7.6E+00	6.5E+01	5.8E+01	1.1E+00	2.0E+01	7.8E+01	--	--	--	--
Lead	2.4E+01	4.3E-01	1.3E+00	1.6E-01	6.1E-02	3.8E-01	6.0E-01	4.7E+00	1.3E-01	8.3E+00	7.2E-02
Manganese	8.4E+01	1.3E+00	8.7E-01	5.4E-01	1.9E-01	2.6E-01	9.9E-01	9.8E+02	1.0E-03	9.8E+03	1.0E-04
Mercury	1.2E-01	--	6.6E-02	7.6E-04	--	2.0E-02	2.1E-02	4.5E-01	4.6E-02	9.0E-01	2.3E-02
Nickel	1.0E+01	3.6E-02	9.6E+00	6.5E-02	5.2E-03	2.9E+00	3.0E+00	7.7E+01	3.8E-02	1.1E+02	2.8E-02
Vanadium	1.7E+01	1.6E-02	1.4E-01	1.1E-01	2.3E-03	4.3E-02	1.5E-01	1.1E+00	1.4E-01	1.1E+01	1.4E-02
Zinc	2.3E+01	6.9E-01	8.1E-01	1.5E-01	9.9E-02	2.4E-01	4.9E-01	1.5E+01	3.4E-02	1.3E+02	3.7E-03
Chloride	5.4E+01	--	--	3.5E-01	--	--	3.5E-01	--	--	--	--
Cyanide, Total	5.8E+00	--	--	3.7E-02	--	--	3.7E-02	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	1.7E+00	--	--	1.7E+00	--	--	--	--
Sulfate	1.1E+03	--	--	7.0E+00	--	--	7.0E+00	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	2.0E-01	--	--	2.0E-01	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	2.7E-01	--	--	2.7E-01	--	--	--	--

Table - EA-4 - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-5 - CTE - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	7.2E-02	2.2E-03	1.6E-04	5.4E+00	3.9E-01
Bis(2-Ethylhexyl)phthalate	3.1E+01	3.1E-04	9.8E-03	5.6E+00	1.7E+02
Diphenyl ether	3.7E-01	2.9E-02	1.1E-02	5.2E+00	1.9E+00
Fluoranthene	4.4E-01	8.1E-03	3.6E-03	5.3E+00	2.3E+00
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	2.6E-01	2.0E-02	5.3E-03	5.2E+00	1.3E+00
Pyrene	2.8E-01	1.2E-02	3.3E-03	5.2E+00	1.5E+00
4,4'-DDT	4.5E-02	1.4E-03	6.5E-05	5.4E+00	2.4E-01
Hexachlorobenzene	2.9E-02	4.5E-03	1.3E-04	5.3E+00	1.5E-01
Aluminum	1.1E+04	5.7E-04	6.2E+00	8.6E-03	9.3E+01
Antimony	3.4E-01	2.0E-03	6.9E-04	2.0E-01	6.8E-02
Arsenic	1.9E+01	1.6E-02	3.1E-01	2.2E-02	4.3E-01
Cadmium	5.2E-01	2.9E-01	1.5E-01	2.5E-01	1.3E-01
Chromium	6.6E+03	8.2E-03	5.5E+01	--	4.0E+00
Chromium, Hexavalent	7.9E+01	8.2E-03	6.5E-01	--	4.0E+00
Copper	3.8E+01	1.6E-02	6.3E-01	1.0E-02	3.9E-01
Iron	1.4E+04	8.5E-04	1.2E+01	7.2E-03	1.0E+02
Lead	7.1E+01	8.0E-03	5.6E-01	3.3E-02	2.4E+00
Mercury	6.4E-01	--	--	2.5E-01	1.6E-01
Silver	1.0E+02	2.8E-03	2.9E-01	4.1E-01	4.2E+01
Thallium	1.9E+00	8.0E-04	1.5E-03	2.2E-02	4.2E-02
Tin	2.9E+03	6.0E-03	1.8E+01	--	--
Vanadium	3.9E+01	9.7E-04	3.8E-02	8.4E-03	3.3E-01
Zinc	1.7E+01	3.7E-02	6.2E-01	4.2E-02	7.2E-01
Cyanide, Total	6.5E+00	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	--	--
Sulfate	7.4E+01	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	--	--

Table - EA-5 - CTE - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-5 - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	3.7E-04	0.0E+00	0.0E+00	3.7E-04	--	--	--	--
Aniline	1.2E-01	0.0E+00	0.0E+00	5.5E-04	0.0E+00	0.0E+00	5.5E-04	--	--	--	--
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	5.4E-04	0.0E+00	0.0E+00	5.4E-04	--	--	--	--
Benzo(a)pyrene	7.2E-02	1.6E-04	3.9E-01	3.3E-04	1.6E-05	8.3E-02	8.4E-02	9.2E+02	9.1E-05	9.2E+03	9.1E-06
Bis(2-Ethylhexyl)phthalate	3.1E+01	9.8E-03	1.7E+02	1.4E-01	9.9E-04	3.7E+01	3.8E+01	1.1E+00	3.4E+01	1.1E+01	3.4E+00
Diphenyl ether	3.7E-01	1.1E-02	1.9E+00	1.7E-03	1.1E-03	4.1E-01	4.1E-01	--	--	--	--
Fluoranthene	4.4E-01	3.6E-03	2.3E+00	2.0E-03	3.6E-04	5.0E-01	5.0E-01	9.2E+02	5.4E-04	9.2E+03	5.4E-05
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	1.2E-03	0.0E+00	0.0E+00	1.2E-03	--	--	--	--
Phenanthrene	2.6E-01	5.3E-03	1.3E+00	1.2E-03	5.3E-04	2.8E-01	2.9E-01	9.2E+02	3.1E-04	9.2E+03	3.1E-05
Pyrene	2.8E-01	3.3E-03	1.5E+00	1.3E-03	3.4E-04	3.2E-01	3.2E-01	9.2E+02	3.5E-04	9.2E+03	3.5E-05
4,4'-DDT	4.5E-02	6.5E-05	2.4E-01	2.0E-04	6.6E-06	5.2E-02	5.3E-02	1.3E+01	4.0E-03	1.3E+02	4.0E-04
Hexachlorobenzene	2.9E-02	1.3E-04	1.5E-01	1.3E-04	1.3E-05	3.3E-02	3.3E-02	2.9E+00	1.1E-02	2.9E+01	1.1E-03
Aluminum	1.1E+04	6.2E+00	9.3E+01	4.9E+01	6.2E-01	2.0E+01	7.0E+01	1.1E+02	6.3E-01	1.1E+03	6.3E-02
Antimony	3.4E-01	6.9E-04	6.8E-02	1.5E-03	7.0E-05	1.5E-02	1.6E-02	--	--	--	--
Arsenic	1.9E+01	3.1E-01	4.3E-01	8.8E-02	3.1E-02	9.3E-02	2.1E-01	5.1E+00	4.1E-02	1.3E+01	1.7E-02
Cadmium	5.2E-01	1.5E-01	1.3E-01	2.4E-03	1.5E-02	2.8E-02	4.5E-02	1.5E+00	3.0E-02	5.5E+00	8.2E-03
Chromium	6.6E+03	5.5E+01	4.0E+00	3.0E+01	5.5E+00	8.6E-01	3.7E+01	2.7E+00	1.4E+01	1.1E+01	3.3E+00
Chromium, Hexavalent	7.9E+01	6.5E-01	4.0E+00	3.6E-01	6.5E-02	8.6E-01	1.3E+00	1.6E+00	7.8E-01	1.6E+01	7.8E-02
Copper	3.8E+01	6.3E-01	3.9E-01	1.7E-01	6.3E-02	8.3E-02	3.2E-01	1.9E+01	1.7E-02	3.7E+01	8.6E-03
Iron	1.4E+04	1.2E+01	1.0E+02	6.4E+01	1.2E+00	2.2E+01	8.7E+01	--	--	--	--
Lead	7.1E+01	5.6E-01	2.4E+00	3.2E-01	5.7E-02	5.1E-01	8.8E-01	4.7E+00	1.9E-01	8.3E+00	1.1E-01
Mercury	6.4E-01	--	1.6E-01	2.9E-03	--	3.4E-02	3.7E-02	4.5E-01	8.3E-02	9.0E-01	4.1E-02
Silver	1.0E+02	2.9E-01	4.2E+01	4.7E-01	2.9E-02	9.0E+00	9.5E+00	1.2E+01	8.0E-01	1.2E+02	8.0E-02
Thallium	1.9E+00	1.5E-03	4.2E-02	8.5E-03	1.5E-04	9.0E-03	1.8E-02	6.1E-01	2.9E-02	6.1E+00	2.9E-03
Tin	2.9E+03	1.8E+01	--	1.3E+01	1.8E+00	--	1.5E+01	6.8E+00	2.2E+00	1.7E+01	8.9E-01
Vanadium	3.9E+01	3.8E-02	3.3E-01	1.8E-01	3.8E-03	7.0E-02	2.5E-01	1.1E+00	2.3E-01	1.1E+01	2.3E-02
Zinc	1.7E+01	6.2E-01	7.2E-01	7.7E-02	6.3E-02	1.5E-01	2.9E-01	1.5E+01	2.0E-02	1.3E+02	2.2E-03
Cyanide, Total	6.5E+00	--	--	3.0E-02	--	--	3.0E-02	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	1.8E+00	--	--	1.8E+00	--	--	--	--
Sulfate	7.4E+01	--	--	3.4E-01	--	--	3.4E-01	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	2.0E+01	--	--	2.0E+01	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	1.5E+01	--	--	1.5E+01	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	2.2E+00	--	--	2.2E+00	--	--	--	--

Table - EA-5 - CTE - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - Central Pond - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.8E-03	6.1E+02	4.1E+00	1.1E-01	7.3E-04	1.1E-01	7.3E-04
2,4,4-Trimethyl-2-pentene		5.7E-03	6.0E+02	3.4E+00	3.2E-01	1.8E-03	3.2E-01	1.8E-03
Acetone		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Methyl Tertbutyl Ether		1.6E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		5.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.7E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenol		2.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene		1.4E-01	6.3E+02	8.8E+01	4.2E-01	5.8E-02	4.2E-01	5.8E-02
Fluoranthene		2.5E-01	6.2E+02	1.5E+02	8.0E-01	2.0E-01	8.0E-01	2.0E-01
Phenanthrene		2.1E-01	6.1E+02	1.3E+02	3.0E-01	6.4E-02	3.0E-01	6.4E-02
Pyrene		2.1E-01	6.1E+02	1.3E+02	5.1E-01	1.1E-01	5.1E-01	1.1E-01
Aluminum	2.1E-01		8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	4.9E-02	4.6E+01	1.8E-02	8.3E-01	1.8E-02	8.3E-01	1.8E-02	8.3E-01
Beryllium		9.2E-02	9.0E-03	8.3E-04	9.0E-03	8.3E-04	9.0E-03	8.3E-04
Chromium		3.8E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent		2.4E-01	1.0E-01	2.4E-02	1.0E-01	2.4E-02	1.0E-01	2.4E-02
Lead		5.1E+01	6.6E-02	3.3E+00	6.6E-02	3.3E+00	6.6E-02	3.3E+00
Manganese	7.0E-01	5.2E+02	3.2E-03	1.7E+00	3.2E-03	1.7E+00	3.2E-03	1.7E+00
Tin		2.2E+00	--	--	--	--	--	--
Silver	1.5E-05		4.1E-01	--	4.1E-01	--	4.1E-01	--
Vanadium		1.7E+01	8.4E-03	1.4E-01	8.4E-03	1.4E-01	8.4E-03	1.4E-01
Bromide	1.3E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		2.1E+01	--	--	--	--	--	--
Nitrite as N	7.5E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	2.6E+01	--	--	--	--	--	--
Sulfate		8.6E+02	--	--	--	--	--	--

Table - Central Pond - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Central Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Central Pond - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	6.8E-03	4.1E+00	7.3E-04	7.3E-04	--	9.1E-07	5.3E-02	4.7E-06	4.7E-06	5.3E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	5.7E-03	3.4E+00	1.8E-03	1.8E-03	--	7.7E-07	4.4E-02	1.2E-05	1.2E-05	4.4E-02	--	--	--	--
Acetone	--	1.2E-01	--	--	--	--	1.6E-05	--	--	--	1.6E-05	8.4E+03	1.8E-09	8.4E+04	1.8E-10
Methyl Tertbutyl Ether	--	1.6E-03	--	--	--	--	2.1E-07	--	--	--	2.1E-07	--	--	--	--
3 & 4 Methylphenol	--	5.2E+00	--	--	--	--	7.0E-04	--	--	--	7.0E-04	--	--	--	--
Acetophenone	--	2.1E-01	--	--	--	--	2.8E-05	--	--	--	2.8E-05	--	--	--	--
Benzaldehyde	--	1.7E+00	--	--	--	--	2.2E-04	--	--	--	2.2E-04	--	--	--	--
Phenol	--	2.0E+00	--	--	--	--	2.6E-04	--	--	--	2.6E-04	--	--	--	--
Benzo(b)fluoranthene	--	1.4E-01	8.8E+01	5.8E-02	5.8E-02	--	1.9E-05	1.1E+00	3.7E-04	3.7E-04	1.1E+00	9.2E+02	1.2E-03	9.2E+03	1.2E-04
Fluoranthene	--	2.5E-01	1.5E+02	2.0E-01	2.0E-01	--	3.4E-05	2.0E+00	1.3E-03	1.3E-03	2.0E+00	9.2E+02	2.1E-03	9.2E+03	2.1E-04
Phenanthrene	--	2.1E-01	1.3E+02	6.4E-02	6.4E-02	--	2.8E-05	1.6E+00	4.1E-04	4.1E-04	1.6E+00	9.2E+02	1.8E-03	9.2E+03	1.8E-04
Pyrene	--	2.1E-01	1.3E+02	1.1E-01	1.1E-01	--	2.8E-05	1.6E+00	6.7E-04	6.7E-04	1.6E+00	9.2E+02	1.8E-03	9.2E+03	1.8E-04
Aluminum	2.1E-01	--	--	--	--	1.9E-03	--	--	--	--	1.9E-03	1.1E+02	1.7E-05	1.1E+03	1.7E-06
Barium	4.9E-02	4.6E+01	8.3E-01	8.3E-01	8.3E-01	4.3E-04	6.1E-03	1.1E-02	5.3E-03	5.3E-03	2.8E-02	4.2E+01	6.7E-04	8.3E+01	3.3E-04
Beryllium	--	9.2E-02	8.3E-04	8.3E-04	8.3E-04	--	1.2E-05	1.1E-05	5.3E-06	5.3E-06	3.4E-05	3.7E-03	9.1E-03	3.7E-02	9.1E-04
Chromium	--	3.8E+01	4.0E+00	4.0E+00	4.0E+00	--	5.2E-03	5.1E-02	2.6E-02	2.6E-02	1.1E-01	2.7E+00	4.0E-02	1.1E+01	9.8E-03
Chromium, Hexavalent	--	2.4E-01	2.4E-02	2.4E-02	2.4E-02	--	3.2E-05	3.1E-04	1.5E-04	1.5E-04	6.5E-04	1.6E+00	3.9E-04	1.6E+01	3.9E-05
Lead	--	5.1E+01	3.3E+00	3.3E+00	3.3E+00	--	6.8E-03	4.3E-02	2.1E-02	2.1E-02	9.2E-02	4.7E+00	2.0E-02	8.3E+00	1.1E-02
Manganese	7.0E-01	5.2E+02	1.7E+00	1.7E+00	1.7E+00	6.2E-03	6.9E-02	2.1E-02	1.1E-02	1.1E-02	1.2E-01	9.8E+02	1.2E-04	9.8E+03	1.2E-05
Tin	--	2.2E+00	--	--	--	--	2.9E-04	--	--	--	2.9E-04	6.8E+00	4.3E-05	1.7E+01	1.7E-05
Silver	1.5E-05	--	--	--	--	1.3E-07	--	--	--	--	1.3E-07	1.2E+01	1.1E-08	1.2E+02	1.1E-09
Vanadium	--	1.7E+01	1.4E-01	1.4E-01	1.4E-01	--	2.2E-03	1.8E-03	8.9E-04	8.9E-04	5.8E-03	1.1E+00	5.2E-03	1.1E+01	5.2E-04
Bromide	1.3E-01	--	--	--	--	1.2E-03	--	--	--	--	1.2E-03	--	--	--	--
Chloride	--	2.1E+01	--	--	--	--	2.8E-03	--	--	--	2.8E-03	--	--	--	--
Nitrite as N	7.5E-02	--	--	--	--	6.6E-04	--	--	--	--	6.6E-04	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	2.6E+01	--	--	--	2.5E-01	3.5E-03	--	--	--	2.5E-01	--	--	--	--
Sulfate	--	8.6E+02	--	--	--	--	1.2E-01	--	--	--	1.2E-01	--	--	--	--

Table - Central Pond - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Central Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Lower South Ditch - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.1E-02	1.1E+00	1.2E-02	1.1E-01	1.2E-03	1.1E-01	1.2E-03
2,4,4-Trimethyl-2-pentene	--	3.5E-03	1.1E+00	3.7E-03	3.2E-01	1.1E-03	3.2E-01	1.1E-03
Acetaldehyde	--	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	4.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	--	2.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--
Benzaldehyde	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-04	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	2.4E-03	3.2E+02	1.2E+00	3.7E+02	1.0E+00	3.2E+02	1.0E+00	3.2E+02
Di-n-octylphthalate	--	1.5E-01	1.2E+00	1.8E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenyl ether	--	1.8E+00	1.1E+00	2.0E+00	2.1E-01	3.9E-01	2.1E-01	3.9E-01
Diphenylamine	--	6.2E-02	1.1E+00	6.7E-02	8.6E-01	5.3E-02	8.6E-01	5.3E-02
N-Nitrosodi-n-propylamine	3.5E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
4,4`-DDT	--	2.5E-02	1.1E+00	2.8E-02	1.7E+00	4.1E-02	1.7E+00	4.1E-02
Hexachlorobenzene	--	1.6E-02	1.1E+00	1.8E-02	9.0E-02	1.5E-03	9.0E-02	1.5E-03
Aluminum	4.9E+00	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	2.4E-02	1.3E+01	1.8E-02	2.3E-01	1.8E-02	2.3E-01	1.8E-02	2.3E-01
Beryllium	6.1E-04	9.6E-01	9.0E-03	8.6E-03	9.0E-03	8.6E-03	9.0E-03	8.6E-03
Cadmium	--	5.6E-01	4.6E-01	2.5E-01	4.6E-01	2.5E-01	4.6E-01	2.5E-01
Chromium	1.1E+00	1.9E+03	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	1.4E+01	1.0E-01	1.4E+00	1.0E-01	1.4E+00	1.0E-01	1.4E+00
Cobalt	2.8E-02	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	9.0E-03	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	5.9E+00	--	7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	6.3E-04	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.5E+00	--	1.1E-02	--	1.1E-02	--	1.1E-02	--
Mercury	--	1.8E-01	2.8E+00	5.0E-01	2.8E+00	5.0E-01	2.8E+00	5.0E-01
Nickel	--	1.4E+01	8.2E-01	1.2E+01	8.2E-01	1.2E+01	8.2E-01	1.2E+01
Silver	1.7E-05	2.5E+01	4.1E-01	1.0E+01	4.1E-01	1.0E+01	4.1E-01	1.0E+01
Tin	--	1.6E+00	--	--	--	--	--	--
Vanadium	--	8.7E+00	8.4E-03	7.3E-02	8.4E-03	7.3E-02	8.4E-03	7.3E-02
Bromide	3.2E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.6E+02	1.3E+02	--	--	--	--	--	--

Table - Lower South Ditch - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Nitrite as N	3.1E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.7E+02	--	--	--	--	--	--
Sulfate	--	6.9E+02	--	--	--	--	--	--
Hydrazine	5.6E-05	1.9E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4,4'-Isopropylidenediphenol	5.9E-04	--	1.1E+00	--	1.2E+00	--	1.2E+00	--
4-Nonylphenol (Tech.)	9.8E-03	--	1.1E+00	--	6.5E-03	--	6.5E-03	--
Kempore (Azodicarbonamide)	7.3E-01	--	--	--	--	--	--	--
C11-C22 Aromatics	--	5.3E+03	--	--	--	--	--	--
C19-C36 Aliphatics	--	3.5E+03	--	--	--	--	--	--
C9-C18 Aliphatics	--	4.3E+02	--	--	--	--	--	--
EPH, Total	--	9.5E+03	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Lower South Ditch - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	1.1E-02	1.2E-02	1.2E-03	1.2E-03	--	3.3E-07	3.4E-05	1.7E-06	1.7E-06	3.8E-05	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.5E-03	3.7E-03	1.1E-03	1.1E-03	--	1.0E-07	1.1E-05	1.6E-06	1.6E-06	1.4E-05	--	--	--	--
Acetaldehyde	--	6.3E-02	--	--	--	--	1.9E-06	--	--	--	1.9E-06	--	--	--	--
Acetone	--	1.2E-01	--	--	--	--	3.6E-06	--	--	--	3.6E-06	8.4E+03	4.3E-10	8.4E+04	4.3E-11
Formaldehyde	--	4.4E-01	--	--	--	--	1.3E-05	--	--	--	1.3E-05	--	--	--	--
Aniline	--	2.3E-01	--	--	--	--	6.9E-06	--	--	--	6.9E-06	--	--	--	--
Azobenzene	5.3E-04	--	--	--	--	1.0E-06	--	--	--	--	1.0E-06	--	--	--	--
Benzaldehyde	--	1.2E-01	--	--	--	--	3.6E-06	--	--	--	3.6E-06	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	--	--	--	3.0E-07	--	--	--	--	3.0E-07	9.2E+02	3.2E-10	9.2E+03	3.2E-11
Bis(2-Ethylhexyl)phthalate	2.4E-03	3.2E+02	3.7E+02	3.2E+02	3.2E+02	4.8E-06	9.7E-03	1.1E+00	4.6E-01	4.6E-01	2.0E+00	1.1E+00	1.8E+00	1.1E+01	1.8E-01
Di-n-octylphthalate	--	1.5E-01	1.8E-01	1.5E-01	1.5E-01	--	4.5E-06	5.0E-04	2.1E-04	2.1E-04	9.3E-04	1.1E+00	8.4E-04	1.1E+01	8.4E-05
Diphenyl ether	--	1.8E+00	2.0E+00	3.9E-01	3.9E-01	--	5.5E-05	5.6E-03	5.6E-04	5.6E-04	6.8E-03	--	--	--	--
Diphenylamine	--	6.2E-02	6.7E-02	5.3E-02	5.3E-02	--	1.9E-06	1.9E-04	7.5E-05	7.5E-05	3.4E-04	--	--	--	--
N-Nitrosodi-n-propylamine	3.5E-06	--	--	--	--	6.9E-09	--	--	--	--	6.9E-09	--	--	--	--
4,4`-DDT	--	2.5E-02	2.8E-02	4.1E-02	4.1E-02	--	7.4E-07	7.9E-05	5.8E-05	5.8E-05	2.0E-04	1.3E+01	1.5E-05	1.3E+02	1.5E-06
Hexachlorobenzene	--	1.6E-02	1.8E-02	1.5E-03	1.5E-03	--	4.9E-07	5.1E-05	2.1E-06	2.1E-06	5.6E-05	2.9E+00	1.9E-05	2.9E+01	1.9E-06
Aluminum	4.9E+00	--	--	--	--	9.6E-03	--	--	--	--	9.6E-03	1.1E+02	8.8E-05	1.1E+03	8.8E-06
Barium	2.4E-02	1.3E+01	2.3E-01	2.3E-01	2.3E-01	4.8E-05	3.8E-04	6.6E-04	3.3E-04	3.3E-04	1.8E-03	4.2E+01	4.2E-05	8.3E+01	2.1E-05
Beryllium	6.1E-04	9.6E-01	8.6E-03	8.6E-03	8.6E-03	1.2E-06	2.9E-05	2.5E-05	1.2E-05	1.2E-05	7.9E-05	3.7E-03	2.1E-02	3.7E-02	2.1E-03
Cadmium	--	5.6E-01	2.5E-01	2.5E-01	2.5E-01	--	1.7E-05	7.2E-04	3.6E-04	3.6E-04	1.5E-03	1.5E+00	9.8E-04	5.5E+00	2.7E-04
Chromium	1.1E+00	1.9E+03	4.0E+00	4.0E+00	4.0E+00	2.2E-03	5.8E-02	1.1E-02	5.7E-03	5.7E-03	8.3E-02	2.7E+00	3.1E-02	1.1E+01	7.5E-03
Chromium, Hexavalent	--	1.4E+01	1.4E+00	1.4E+00	1.4E+00	--	4.3E-04	4.1E-03	2.1E-03	2.1E-03	8.7E-03	1.6E+00	5.3E-03	1.6E+01	5.3E-04
Cobalt	2.8E-02	--	--	--	--	5.6E-05	--	--	--	--	5.6E-05	--	--	--	--
Copper	9.0E-03	--	--	--	--	1.8E-05	--	--	--	--	1.8E-05	1.9E+01	9.6E-07	3.7E+01	4.8E-07
Iron	5.9E+00	--	--	--	--	1.2E-02	--	--	--	--	1.2E-02	--	--	--	--
Lead	6.3E-04	--	--	--	--	1.2E-06	--	--	--	--	1.2E-06	4.7E+00	2.6E-07	8.3E+00	1.5E-07
Manganese	1.5E+00	--	--	--	--	2.9E-03	--	--	--	--	2.9E-03	9.8E+02	3.0E-06	9.8E+03	3.0E-07
Mercury	--	1.8E-01	5.0E-01	5.0E-01	5.0E-01	--	5.3E-06	1.4E-03	7.1E-04	7.1E-04	2.9E-03	4.5E-01	6.4E-03	9.0E-01	3.2E-03
Nickel	--	1.4E+01	1.2E+01	1.2E+01	1.2E+01	--	4.2E-04	3.3E-02	1.6E-02	1.6E-02	6.6E-02	7.7E+01	8.5E-04	1.1E+02	6.2E-04
Silver	1.7E-05	2.5E+01	1.0E+01	1.0E+01	1.0E+01	3.3E-08	7.5E-04	2.9E-02	1.5E-02	1.5E-02	5.9E-02	1.2E+01	5.0E-03	1.2E+02	5.0E-04
Tin	--	1.6E+00	--	--	--	--	4.8E-05	--	--	--	4.8E-05	6.8E+00	7.1E-06	1.7E+01	2.8E-06
Vanadium	--	8.7E+00	7.3E-02	7.3E-02	7.3E-02	--	2.6E-04	2.1E-04	1.0E-04	1.0E-04	6.7E-04	1.1E+00	6.1E-04	1.1E+01	6.1E-05
Bromide	3.2E-01	--	--	--	--	6.2E-04	--	--	--	--	6.2E-04	--	--	--	--
Chloride	1.6E+02	1.3E+02	--	--	--	3.2E-01	4.0E-03	--	--	--	3.3E-01	--	--	--	--
Nitrite as N	3.1E-02	--	--	--	--	6.1E-05	--	--	--	--	6.1E-05	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.7E+02	--	--	--	1.1E-01	5.2E-03	--	--	--	1.2E-01	--	--	--	--
Sulfate	--	6.9E+02	--	--	--	--	2.1E-02	--	--	--	2.1E-02	--	--	--	--

Table - Lower South Ditch - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Hydrazine	5.6E-05	1.9E-03	--	--	--	1.1E-07	5.5E-08	--	--	--	1.6E-07	--	--	--	--
4,4'-Isopropylidenediphenol	5.9E-04	--	--	--	--	1.2E-06	--	--	--	--	1.2E-06	--	--	--	--
4-Nonylphenol (Tech.)	9.8E-03	--	--	--	--	1.9E-05	--	--	--	--	1.9E-05	--	--	--	--
Kempore (Azodicarbonamide)	7.3E-01	--	--	--	--	1.4E-03	--	--	--	--	1.4E-03	--	--	--	--
C11-C22 Aromatics	--	5.3E+03	--	--	--	--	1.6E-01	--	--	--	1.6E-01	--	--	--	--
C19-C36 Aliphatics	--	3.5E+03	--	--	--	--	1.1E-01	--	--	--	1.1E-01	--	--	--	--
C9-C18 Aliphatics	--	4.3E+02	--	--	--	--	1.3E-02	--	--	--	1.3E-02	--	--	--	--
EPH, Total	--	9.5E+03	--	--	--	--	2.8E-01	--	--	--	2.8E-01	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - North Pond - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.0E-03	2.3E+00	4.6E-03	1.1E-01	2.2E-04	1.1E-01	2.2E-04
Acetone	--	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	--	3.6E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)anthracene	1.2E-04	--	2.4E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	1.2E-04	--	2.4E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	--	1.8E+00	2.5E+00	4.5E+00	1.0E+00	1.8E+00	1.0E+00	1.8E+00
Carbazole	--	1.6E-01	2.3E+00	3.7E-01	5.6E-01	8.9E-02	5.6E-01	8.9E-02
Caprolactam	3.3E-04	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Pyrene	3.9E-04	--	2.3E+00	--	5.1E-01	--	5.1E-01	--
Aluminum	1.5E-01	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	8.3E+00	1.3E-01	1.0E+00	1.3E-01	1.0E+00	1.3E-01	1.0E+00
Barium	3.4E-02	4.1E+01	1.8E-02	7.4E-01	1.8E-02	7.4E-01	1.8E-02	7.4E-01
Beryllium	--	4.8E-01	9.0E-03	4.3E-03	9.0E-03	4.3E-03	9.0E-03	4.3E-03
Cadmium	--	1.4E+00	4.6E-01	6.5E-01	4.6E-01	6.5E-01	4.6E-01	6.5E-01
Chromium	--	2.8E+02	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	5.9E-01	1.0E-01	5.9E-02	1.0E-01	5.9E-02	1.0E-01	5.9E-02
Copper	--	4.5E+01	1.6E+00	7.5E+01	1.6E+00	7.5E+01	1.6E+00	7.5E+01
Iron	1.9E+00	1.6E+04	7.2E-03	1.1E+02	7.2E-03	1.1E+02	7.2E-03	1.1E+02
Lead	9.3E-04	6.9E+01	6.6E-02	4.5E+00	6.6E-02	4.5E+00	6.6E-02	4.5E+00
Manganese	3.9E-01	4.2E+02	1.1E-02	4.5E+00	1.1E-02	4.5E+00	1.1E-02	4.5E+00
Silver	2.2E-05	--	4.1E-01	--	4.1E-01	--	4.1E-01	--
Thallium	--	7.6E-01	--	--	1.0E+00	7.6E-01	1.0E+00	7.6E-01
Tin	--	5.9E+00	--	--	--	--	--	--
Vanadium	--	2.3E+01	8.4E-03	2.0E-01	8.4E-03	2.0E-01	8.4E-03	2.0E-01
Zinc	--	2.9E+02	2.6E-02	7.5E+00	2.6E-02	7.5E+00	2.6E-02	7.5E+00

Table - North Pond - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Bromide	2.8E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.9E+02	1.8E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	--	1.2E+01	--	--	--	--	--	--
Sulfate	--	1.8E+02	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - North Pond - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.0E-03	4.6E-03	2.2E-04	2.2E-04	--	2.4E-06	5.2E-04	1.2E-05	1.2E-05	5.5E-04	--	--	--	--
Acetone	--	2.1E-01	--	--	--	--	2.5E-04	--	--	--	2.5E-04	8.4E+03	3.0E-08	8.4E+04	3.0E-09
Carbon disulfide	--	3.6E-03	--	--	--	--	4.3E-06	--	--	--	4.3E-06	--	--	--	--
Benzo(a)anthracene	1.2E-04	--	--	--	--	9.4E-06	--	--	--	--	9.4E-06	9.2E+02	1.0E-08	9.2E+03	1.0E-09
Benzo(a)pyrene	1.2E-04	--	--	--	--	9.6E-06	--	--	--	--	9.6E-06	9.2E+02	1.0E-08	9.2E+03	1.0E-09
Bis(2-Ethylhexyl)phthalate	--	1.8E+00	4.5E+00	1.8E+00	1.8E+00	--	2.2E-03	5.1E-01	1.0E-01	1.0E-01	7.2E-01	1.1E+00	6.6E-01	1.1E+01	6.6E-02
Carbazole	--	1.6E-01	3.7E-01	8.9E-02	8.9E-02	--	1.9E-04	4.2E-02	5.1E-03	5.1E-03	5.2E-02	--	--	--	--
Caprolactam	3.3E-04	--	--	--	--	2.6E-05	--	--	--	--	2.6E-05	--	--	--	--
Pyrene	3.9E-04	--	--	--	--	3.1E-05	--	--	--	--	3.1E-05	9.2E+02	3.3E-08	9.2E+03	3.3E-09
Aluminum	1.5E-01	--	--	--	--	1.2E-02	--	--	--	--	1.2E-02	1.1E+02	1.1E-04	1.1E+03	1.1E-05
Arsenic	--	8.3E+00	1.0E+00	1.0E+00	1.0E+00	--	9.9E-03	1.2E-01	6.0E-02	6.0E-02	2.5E-01	5.1E+00	4.8E-02	1.3E+01	1.9E-02
Barium	3.4E-02	4.1E+01	7.4E-01	7.4E-01	7.4E-01	2.7E-03	4.9E-02	8.4E-02	4.2E-02	4.2E-02	2.2E-01	4.2E+01	5.3E-03	8.3E+01	2.6E-03
Beryllium	--	4.8E-01	4.3E-03	4.3E-03	4.3E-03	--	5.7E-04	4.9E-04	2.4E-04	2.4E-04	1.5E-03	3.7E-03	4.2E-01	3.7E-02	4.2E-02
Cadmium	--	1.4E+00	6.5E-01	6.5E-01	6.5E-01	--	1.7E-03	7.4E-02	3.7E-02	3.7E-02	1.5E-01	1.5E+00	9.9E-02	5.5E+00	2.7E-02
Chromium	--	2.8E+02	4.0E+00	4.0E+00	4.0E+00	--	3.3E-01	4.5E-01	2.3E-01	2.3E-01	1.2E+00	2.7E+00	4.6E-01	1.1E+01	1.1E-01
Chromium, Hexavalent	--	5.9E-01	5.9E-02	5.9E-02	5.9E-02	--	7.0E-04	6.7E-03	3.3E-03	3.3E-03	1.4E-02	1.6E+00	8.5E-03	1.6E+01	8.5E-04
Copper	--	4.5E+01	7.5E+01	7.5E+01	7.5E+01	--	5.4E-02	8.5E+00	4.2E+00	4.2E+00	1.7E+01	1.9E+01	9.2E-01	3.7E+01	4.6E-01
Iron	1.9E+00	1.6E+04	1.1E+02	1.1E+02	1.1E+02	1.5E-01	1.9E+01	1.3E+01	6.3E+00	6.3E+00	4.4E+01	--	--	--	--
Lead	9.3E-04	6.9E+01	4.5E+00	4.5E+00	4.5E+00	7.3E-05	8.2E-02	5.1E-01	2.6E-01	2.6E-01	1.1E+00	4.7E+00	2.4E-01	8.3E+00	1.3E-01
Manganese	3.9E-01	4.2E+02	4.5E+00	4.5E+00	4.5E+00	3.1E-02	5.0E-01	5.2E-01	2.6E-01	2.6E-01	1.6E+00	9.8E+02	1.6E-03	9.8E+03	1.6E-04
Silver	2.2E-05	--	--	--	--	1.7E-06	--	--	--	--	1.7E-06	1.2E+01	1.5E-07	1.2E+02	1.5E-08
Thallium	--	7.6E-01	--	7.6E-01	7.6E-01	--	9.1E-04	--	4.3E-02	4.3E-02	8.7E-02	6.1E-01	1.4E-01	6.1E+00	1.4E-02
Tin	--	5.9E+00	--	--	--	--	7.0E-03	--	--	--	7.0E-03	6.8E+00	1.0E-03	1.7E+01	4.2E-04
Vanadium	--	2.3E+01	2.0E-01	2.0E-01	2.0E-01	--	2.8E-02	2.2E-02	1.1E-02	1.1E-02	7.2E-02	1.1E+00	6.6E-02	1.1E+01	6.6E-03
Zinc	--	2.9E+02	7.5E+00	7.5E+00	7.5E+00	--	3.4E-01	8.5E-01	4.2E-01	4.2E-01	2.0E+00	1.5E+01	1.4E-01	1.3E+02	1.6E-02
Bromide	2.8E-01	--	--	--	--	2.2E-02	--	--	--	--	2.2E-02	--	--	--	--
Chloride	1.9E+02	1.8E+02	--	--	--	1.5E+01	2.2E-01	--	--	--	1.5E+01	--	--	--	--
Nitrogen, as Ammonia	--	1.2E+01	--	--	--	--	1.5E-02	--	--	--	1.5E-02	--	--	--	--
Sulfate	--	1.8E+02	--	--	--	--	2.2E-01	--	--	--	2.2E-01	--	--	--	--

Table - North Pond - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	North Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Off-PWD - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		2.3E-02	2.1E+00	4.8E-02	1.1E-01	2.5E-03	1.1E-01	2.5E-03
2,4,4-Trimethyl-2-pentene		6.0E-03	2.1E+00	1.2E-02	3.2E-01	1.9E-03	3.2E-01	1.9E-03
Formaldehyde		5.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	2.5E-03		0.0E+00	--	0.0E+00	--	0.0E+00	--
3 & 4 Methylphenol	7.6E-04		0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)anthracene	4.7E-04		2.1E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	8.9E-04		2.2E+00	--	2.2E-01	--	2.2E-01	--
Benzo(b)fluoranthene	1.6E-03		2.1E+00	--	4.2E-01	--	4.2E-01	--
Benzo(ghi)perylene	9.9E-04		2.2E+00	--	4.7E-02	--	4.7E-02	--
Benzo(k)fluoranthene	6.1E-04		2.2E+00	--	2.9E-01	--	2.9E-01	--
Chrysene	1.2E-03		2.1E+00	--	4.4E-01	--	4.4E-01	--
Dibenz(a,h)anthracene	3.9E-04		2.2E+00	--	3.8E-01	--	3.8E-01	--
Indeno(1,2,3-cd)pyrene	8.8E-04		2.2E+00	--	2.8E-01	--	2.8E-01	--
Phenanthrene	5.3E-04		2.1E+00	--	3.0E-01	--	3.0E-01	--
Pyrene	3.1E-03		2.1E+00	--	5.1E-01	--	5.1E-01	--
4-Chlorophenyl phenyl ether		4.4E-02	2.1E+00	9.2E-02	7.9E-02	3.5E-03	7.9E-02	3.5E-03
Carbazole		4.5E-02	2.1E+00	9.2E-02	5.6E-01	2.5E-02	5.6E-01	2.5E-02
Diphenyl ether		3.3E-01	2.1E+00	6.9E-01	2.1E-01	7.1E-02	2.1E-01	7.1E-02
Diphenylmethanone		9.1E-02	2.1E+00	1.9E-01	1.6E+00	1.4E-01	1.6E+00	1.4E-01
Aluminum	8.2E-01		8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	3.5E-02	1.2E+01	1.8E-02	2.1E-01	1.8E-02	2.1E-01	1.8E-02	2.1E-01
Chromium	5.0E-02	1.4E+03	--	4.0E+00	--	4.0E+00	--	4.0E+00
Iron	1.6E+01		7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	2.7E-03		6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	8.5E-01		1.1E-02	--	1.1E-02	--	1.1E-02	--
Zinc	3.8E-02		2.6E-02	--	2.6E-02	--	2.6E-02	--
Arsenic		1.0E+01	1.3E-01	1.3E+00	1.3E-01	1.3E+00	1.3E-01	1.3E+00
Beryllium		1.2E+00	9.0E-03	1.1E-02	9.0E-03	1.1E-02	9.0E-03	1.1E-02
Copper		2.5E+01	1.6E+00	4.1E+01	1.6E+00	4.1E+01	1.6E+00	4.1E+01
Silver		2.4E+01	4.1E-01	9.6E+00	4.1E-01	9.6E+00	4.1E-01	9.6E+00
Vanadium		1.2E+01	8.4E-03	9.9E-02	8.4E-03	9.9E-02	8.4E-03	9.9E-02
Bromide	1.5E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--
Nitrite as N	2.0E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	4.5E+01	2.5E+02	--	--	--	--	--	--

Table - Off-PWD - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Chloride		1.5E+02	--	--	--	--	--	--
Sulfate		7.0E+02	--	--	--	--	--	--
Hydrazine		1.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Off-PWD - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.3E-02	4.8E-02	2.5E-03	2.5E-03	--	2.4E-06	4.7E-04	1.2E-05	1.2E-05	5.0E-04	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	6.0E-03	1.2E-02	1.9E-03	1.9E-03	--	6.2E-07	1.2E-04	9.5E-06	9.5E-06	1.4E-04	--	--	--	--
Formaldehyde	--	5.1E-01	--	--	--	--	5.2E-05	--	--	--	5.2E-05	--	--	--	--
Carbon disulfide	2.5E-03	--	--	--	--	1.7E-05	--	--	--	--	1.7E-05	--	--	--	--
3 & 4 Methylphenol	7.6E-04	--	--	--	--	5.2E-06	--	--	--	--	5.2E-06	--	--	--	--
Benzo(a)anthracene	4.7E-04	--	--	--	--	3.2E-06	--	--	--	--	3.2E-06	9.2E+02	3.4E-09	9.2E+03	3.4E-10
Benzo(a)pyrene	8.9E-04	--	--	--	--	6.0E-06	--	--	--	--	6.0E-06	9.2E+02	6.5E-09	9.2E+03	6.5E-10
Benzo(b)fluoranthene	1.6E-03	--	--	--	--	1.1E-05	--	--	--	--	1.1E-05	9.2E+02	1.2E-08	9.2E+03	1.2E-09
Benzo(ghi)perylene	9.9E-04	--	--	--	--	6.7E-06	--	--	--	--	6.7E-06	9.2E+02	7.3E-09	9.2E+03	7.3E-10
Benzo(k)fluoranthene	6.1E-04	--	--	--	--	4.1E-06	--	--	--	--	4.1E-06	9.2E+02	4.5E-09	9.2E+03	4.5E-10
Chrysene	1.2E-03	--	--	--	--	8.2E-06	--	--	--	--	8.2E-06	9.2E+02	9.0E-09	9.2E+03	9.0E-10
Dibenz(a,h)anthracene	3.9E-04	--	--	--	--	2.7E-06	--	--	--	--	2.7E-06	9.2E+02	2.9E-09	9.2E+03	2.9E-10
Indeno(1,2,3-cd)pyrene	8.8E-04	--	--	--	--	6.0E-06	--	--	--	--	6.0E-06	9.2E+02	6.5E-09	9.2E+03	6.5E-10
Phenanthrene	5.3E-04	--	--	--	--	3.6E-06	--	--	--	--	3.6E-06	9.2E+02	3.9E-09	9.2E+03	3.9E-10
Pyrene	3.1E-03	--	--	--	--	2.1E-05	--	--	--	--	2.1E-05	9.2E+02	2.3E-08	9.2E+03	2.3E-09
4-Chlorophenyl phenyl ether	--	4.4E-02	9.2E-02	3.5E-03	3.5E-03	--	4.6E-06	9.0E-04	1.7E-05	1.7E-05	9.4E-04	--	--	--	--
Carbazole	--	4.5E-02	9.2E-02	2.5E-02	2.5E-02	--	4.6E-06	9.0E-04	1.2E-04	1.2E-04	1.1E-03	--	--	--	--
Diphenyl ether	--	3.3E-01	6.9E-01	7.1E-02	7.1E-02	--	3.4E-05	6.7E-03	3.5E-04	3.5E-04	7.4E-03	--	--	--	--
Diphenylmethanone	--	9.1E-02	1.9E-01	1.4E-01	1.4E-01	--	9.4E-06	1.9E-03	7.0E-04	7.0E-04	3.3E-03	--	--	--	--
Aluminum	8.2E-01	--	--	--	--	5.6E-03	--	--	--	--	5.6E-03	1.1E+02	5.1E-05	1.1E+03	5.1E-06
Barium	3.5E-02	1.2E+01	2.1E-01	2.1E-01	2.1E-01	2.3E-04	1.2E-03	2.1E-03	1.0E-03	1.0E-03	5.6E-03	4.2E+01	1.3E-04	8.3E+01	6.7E-05
Chromium	5.0E-02	1.4E+03	4.0E+00	4.0E+00	4.0E+00	3.4E-04	1.4E-01	3.9E-02	2.0E-02	2.0E-02	2.2E-01	2.7E+00	8.1E-02	1.1E+01	2.0E-02
Iron	1.6E+01	--	--	--	--	1.1E-01	--	--	--	--	1.1E-01	--	--	--	--
Lead	2.7E-03	--	--	--	--	1.8E-05	--	--	--	--	1.8E-05	4.7E+00	3.9E-06	8.3E+00	2.2E-06
Manganese	8.5E-01	--	--	--	--	5.8E-03	--	--	--	--	5.8E-03	9.8E+02	5.9E-06	9.8E+03	5.9E-07
Zinc	3.8E-02	--	--	--	--	2.5E-04	--	--	--	--	2.5E-04	1.5E+01	1.8E-05	1.3E+02	1.9E-06
Arsenic	--	1.0E+01	1.3E+00	1.3E+00	1.3E+00	--	1.0E-03	1.2E-02	6.2E-03	6.2E-03	2.6E-02	5.1E+00	5.0E-03	1.3E+01	2.0E-03
Beryllium	--	1.2E+00	1.1E-02	1.1E-02	1.1E-02	--	1.2E-04	1.1E-04	5.3E-05	5.3E-05	3.4E-04	3.7E-03	9.1E-02	3.7E-02	9.1E-03
Copper	--	2.5E+01	4.1E+01	4.1E+01	4.1E+01	--	2.6E-03	4.0E-01	2.0E-01	2.0E-01	8.0E-01	1.9E+01	4.3E-02	3.7E+01	2.2E-02
Silver	--	2.4E+01	9.6E+00	9.6E+00	9.6E+00	--	2.4E-03	9.4E-02	4.7E-02	4.7E-02	1.9E-01	1.2E+01	1.6E-02	1.2E+02	1.6E-03
Vanadium	--	1.2E+01	9.9E-02	9.9E-02	9.9E-02	--	1.2E-03	9.7E-04	4.8E-04	4.8E-04	3.1E-03	1.1E+00	2.9E-03	1.1E+01	2.9E-04
Bromide	1.5E-01	--	--	--	--	1.0E-03	--	--	--	--	1.0E-03	--	--	--	--
Nitrite as N	2.0E-02	--	--	--	--	1.4E-04	--	--	--	--	1.4E-04	--	--	--	--
Nitrogen, as Ammonia	4.5E+01	2.5E+02	--	--	--	3.0E-01	2.6E-02	--	--	--	3.3E-01	--	--	--	--
Chloride	--	1.5E+02	--	--	--	--	1.5E-02	--	--	--	1.5E-02	--	--	--	--
Sulfate	--	7.0E+02	--	--	--	--	7.2E-02	--	--	--	7.2E-02	--	--	--	--
Hydrazine	--	1.3E-03	--	--	--	--	1.3E-07	--	--	--	1.3E-07	--	--	--	--

Table - Off-PWD - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - On PWD/WDW - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	3.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	4.2E+00	3.5E+00	1.5E+01	1.0E+00	4.2E+00	1.0E+00	4.2E+00
Benzene	9.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Barium	1.8E+01	1.8E-02	3.3E-01	1.8E-02	3.3E-01	1.8E-02	3.3E-01
Beryllium	2.5E-01	9.0E-03	2.2E-03	9.0E-03	2.2E-03	9.0E-03	2.2E-03
Cadmium	5.7E-01	4.6E-01	2.6E-01	4.6E-01	2.6E-01	4.6E-01	2.6E-01
Chromium	2.4E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Lead	5.0E+01	6.6E-02	3.3E+00	6.6E-02	3.3E+00	6.6E-02	3.3E+00
Mercury	2.3E-01	2.8E+00	6.6E-01	2.8E+00	6.6E-01	2.8E+00	6.6E-01
Vanadium	1.6E+01	8.4E-03	1.3E-01	8.4E-03	1.3E-01	8.4E-03	1.3E-01

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - On PWD/WDW - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	3.4E-01	--	--	--	2.0E-04	--	--	--	2.0E-04	8.4E+03	2.4E-08	8.4E+04	2.4E-09
Bis(2-Ethylhexyl)phthalate	4.2E+00	1.5E+01	4.2E+00	4.2E+00	2.5E-03	8.3E-01	1.2E-01	1.2E-01	1.1E+00	1.1E+00	9.8E-01	1.1E+01	9.8E-02
Benzene	9.3E-01	--	--	--	5.6E-04	--	--	--	5.6E-04	--	--	--	--
Barium	1.8E+01	3.3E-01	3.3E-01	3.3E-01	1.1E-02	1.9E-02	9.3E-03	9.3E-03	4.8E-02	4.2E+01	1.2E-03	8.3E+01	5.8E-04
Beryllium	2.5E-01	2.2E-03	2.2E-03	2.2E-03	1.5E-04	1.3E-04	6.3E-05	6.3E-05	4.0E-04	3.7E-03	1.1E-01	3.7E-02	1.1E-02
Cadmium	5.7E-01	2.6E-01	2.6E-01	2.6E-01	3.4E-04	1.5E-02	7.5E-03	7.5E-03	3.0E-02	1.5E+00	2.0E-02	5.5E+00	5.5E-03
Chromium	2.4E+01	4.0E+00	4.0E+00	4.0E+00	1.5E-02	2.3E-01	1.1E-01	1.1E-01	4.7E-01	2.7E+00	1.7E-01	1.1E+01	4.3E-02
Lead	5.0E+01	3.3E+00	3.3E+00	3.3E+00	3.0E-02	1.9E-01	9.3E-02	9.3E-02	4.0E-01	4.7E+00	8.6E-02	8.3E+00	4.9E-02
Mercury	2.3E-01	6.6E-01	6.6E-01	6.6E-01	1.4E-04	3.7E-02	1.9E-02	1.9E-02	7.5E-02	4.5E-01	1.7E-01	9.0E-01	8.3E-02
Vanadium	1.6E+01	1.3E-01	1.3E-01	1.3E-01	9.4E-03	7.5E-03	3.7E-03	3.7E-03	2.4E-02	1.1E+00	2.2E-02	1.1E+01	2.2E-03

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Storm Water Detention Basin - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		5.1E-03	6.1E+02	3.1E+00	1.1E-01	5.5E-04	1.1E-01	5.5E-04
2,4,4-Trimethyl-2-pentene		2.7E-03	6.0E+02	1.6E+00	3.2E-01	8.5E-04	3.2E-01	8.5E-04
Acetone		1.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		2.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		9.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		2.3E+00	6.6E+02	1.5E+03	1.0E+00	2.3E+00	1.0E+00	2.3E+00
Phenol		1.7E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
N-Nitrosodiphenylamine	7.4E-06		6.2E+02	--	1.7E+00	--	1.7E+00	--
Benzo(a)pyrene		2.2E-01	6.3E+02	1.4E+02	2.2E-01	4.9E-02	2.2E-01	4.9E-02
Arsenic		1.1E+01	1.3E-01	1.4E+00	1.3E-01	1.4E+00	1.3E-01	1.4E+00
Barium	2.6E-02	5.0E+01	1.8E-02	9.0E-01	1.8E-02	9.0E-01	1.8E-02	9.0E-01
Beryllium		1.0E-01	9.0E-03	9.4E-04	9.0E-03	9.4E-04	9.0E-03	9.4E-04
Chromium		4.2E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Vanadium		2.1E+01	8.4E-03	1.7E-01	8.4E-03	1.7E-01	8.4E-03	1.7E-01
Chloride		9.7E+00	--	--	--	--	--	--
Nitrite as N	2.6E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	1.8E+01	--	--	--	--	--	--
Sulfate		1.4E+03	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Storm Water Detention Basin - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	5.1E-03	3.1E+00	5.5E-04	5.5E-04	--	8.4E-07	4.9E-02	4.3E-06	4.3E-06	4.9E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	2.7E-03	1.6E+00	8.5E-04	8.5E-04	--	4.4E-07	2.5E-02	6.7E-06	6.7E-06	2.5E-02	--	--	--	--
Acetone	--	1.4E-01	--	--	--	--	2.3E-05	--	--	--	2.3E-05	8.4E+03	2.7E-09	8.4E+04	2.7E-10
3 & 4 Methylphenol	--	2.9E+00	--	--	--	--	4.8E-04	--	--	--	4.8E-04	--	--	--	--
Acetophenone	--	1.6E-01	--	--	--	--	2.6E-05	--	--	--	2.6E-05	--	--	--	--
Benzaldehyde	--	9.6E-01	--	--	--	--	1.6E-04	--	--	--	1.6E-04	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.3E+00	1.5E+03	2.3E+00	2.3E+00	--	3.8E-04	2.3E+01	1.8E-02	1.8E-02	2.3E+01	1.1E+00	2.1E+01	1.1E+01	2.1E+00
Phenol	--	1.7E+00	--	--	--	--	2.7E-04	--	--	--	2.7E-04	--	--	--	--
N-Nitrosodiphenylamine	7.4E-06	--	--	--	--	8.0E-08	--	--	--	--	8.0E-08	--	--	--	--
Benzo(a)pyrene	--	2.2E-01	1.4E+02	4.9E-02	4.9E-02	--	3.6E-05	2.2E+00	3.8E-04	3.8E-04	2.2E+00	9.2E+02	2.4E-03	9.2E+03	2.4E-04
Arsenic	--	1.1E+01	1.4E+00	1.4E+00	1.4E+00	--	1.8E-03	2.1E-02	1.1E-02	1.1E-02	4.4E-02	5.1E+00	8.6E-03	1.3E+01	3.4E-03
Barium	2.6E-02	5.0E+01	9.0E-01	9.0E-01	9.0E-01	2.8E-04	8.2E-03	1.4E-02	7.0E-03	7.0E-03	3.7E-02	4.2E+01	8.8E-04	8.3E+01	4.4E-04
Beryllium	--	1.0E-01	9.4E-04	9.4E-04	9.4E-04	--	1.7E-05	1.5E-05	7.3E-06	7.3E-06	4.7E-05	3.7E-03	1.3E-02	3.7E-02	1.3E-03
Chromium	--	4.2E+01	4.0E+00	4.0E+00	4.0E+00	--	6.8E-03	6.2E-02	3.1E-02	3.1E-02	1.3E-01	2.7E+00	4.9E-02	1.1E+01	1.2E-02
Vanadium	--	2.1E+01	1.7E-01	1.7E-01	1.7E-01	--	3.4E-03	2.7E-03	1.3E-03	1.3E-03	8.8E-03	1.1E+00	8.0E-03	1.1E+01	8.0E-04
Chloride	--	9.7E+00	--	--	--	--	1.6E-03	--	--	--	1.6E-03	--	--	--	--
Nitrite as N	2.6E-02	--	--	--	--	2.8E-04	--	--	--	--	2.8E-04	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	1.8E+01	--	--	--	8.1E-02	3.0E-03	--	--	--	8.4E-02	--	--	--	--
Sulfate	--	1.4E+03	--	--	--	--	2.3E-01	--	--	--	2.3E-01	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Upper South Ditch - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.8E-02	2.3E+00	4.2E-02	1.1E-01	2.0E-03	1.1E-01	2.0E-03
2,4,4-Trimethyl-2-pentene	--	2.9E-03	2.3E+00	6.5E-03	3.2E-01	9.2E-04	3.2E-01	9.2E-04
4-iso-Propyltoluene	--	1.8E-03	2.3E+00	4.1E-03	2.6E-01	4.7E-04	2.6E-01	4.7E-04
Acetaldehyde	--	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	7.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol	--	1.3E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone	--	9.0E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	2.4E+00	--	2.2E-01	--	2.2E-01	--
Benzaldehyde	--	3.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	2.4E-03	4.2E+01	2.5E+00	1.0E+02	1.0E+00	4.2E+01	1.0E+00	4.2E+01
Caprolactam	--	5.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Diphenyl ether	--	1.5E-01	2.3E+00	3.5E-01	2.1E-01	3.2E-02	2.1E-01	3.2E-02
Di-n-octylphthalate	--	1.5E-01	2.5E+00	3.8E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenylmethanone	--	3.1E-02	2.3E+00	7.1E-02	1.6E+00	4.8E-02	1.6E+00	4.8E-02
N-Nitrosodi-n-propylamine	3.5E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Phenol	--	7.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aluminum	4.9E+00	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	5.3E+00	1.3E-01	6.8E-01	1.3E-01	6.8E-01	1.3E-01	6.8E-01
Barium	2.4E-02	2.7E+01	1.8E-02	4.9E-01	1.8E-02	4.9E-01	1.8E-02	4.9E-01
Beryllium	6.1E-04	4.4E-01	9.0E-03	4.0E-03	9.0E-03	4.0E-03	9.0E-03	4.0E-03
Chromium	1.1E+00	4.0E+02	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	7.0E+00	1.0E-01	7.0E-01	1.0E-01	7.0E-01	1.0E-01	7.0E-01
Cobalt	2.8E-02	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	9.0E-03	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	5.9E+00	1.2E+04	7.2E-03	9.0E+01	7.2E-03	9.0E+01	7.2E-03	9.0E+01
Lead	6.3E-04	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.5E+00	--	1.1E-02	--	1.1E-02	--	1.1E-02	--
Silver	1.7E-05	7.5E+00	4.1E-01	3.1E+00	4.1E-01	3.1E+00	4.1E-01	3.1E+00
Vanadium	--	1.0E+01	8.4E-03	8.8E-02	8.4E-03	8.8E-02	8.4E-03	8.8E-02
Bromide	3.2E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.6E+02	7.4E+01	--	--	--	--	--	--
Nitrite as N	3.1E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.5E+02	--	--	--	--	--	--

Table - Upper South Ditch - CTE - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Sulfate	--	4.7E+02	--	--	--	--	--	--
Hydrazine	5.6E-05	9.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Upper South Ditch - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	1.8E-02	4.2E-02	2.0E-03	2.0E-03	--	6.8E-07	1.5E-04	3.5E-06	3.5E-06	1.6E-04	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	2.9E-03	6.5E-03	9.2E-04	9.2E-04	--	1.1E-07	2.3E-05	1.6E-06	1.6E-06	2.6E-05	--	--	--	--
4-iso-Propyltoluene	--	1.8E-03	4.1E-03	4.7E-04	4.7E-04	--	6.7E-08	1.5E-05	8.4E-07	8.4E-07	1.6E-05	--	--	--	--
Acetaldehyde	--	8.3E-02	--	--	--	--	3.1E-06	--	--	--	3.1E-06	--	--	--	--
Formaldehyde	--	7.5E-01	--	--	--	--	2.8E-05	--	--	--	2.8E-05	--	--	--	--
3 & 4 Methylphenol	--	1.3E+00	--	--	--	--	4.8E-05	--	--	--	4.8E-05	--	--	--	--
Acetophenone	--	9.0E-02	--	--	--	--	3.4E-06	--	--	--	3.4E-06	--	--	--	--
Azobenzene	5.3E-04	--	--	--	--	1.3E-06	--	--	--	--	1.3E-06	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	--	--	--	3.7E-07	--	--	--	--	3.7E-07	9.2E+02	4.0E-10	9.2E+03	4.0E-11
Benzaldehyde	--	3.5E-01	--	--	--	--	1.3E-05	--	--	--	1.3E-05	--	--	--	--
Bis(2-Ethylhexyl)phthalate	2.4E-03	4.2E+01	1.0E+02	4.2E+01	4.2E+01	6.0E-06	1.6E-03	3.7E-01	7.5E-02	7.5E-02	5.2E-01	1.1E+00	4.8E-01	1.1E+01	4.8E-02
Caprolactam	--	5.3E-02	--	--	--	--	2.0E-06	--	--	--	2.0E-06	--	--	--	--
Diphenyl ether	--	1.5E-01	3.5E-01	3.2E-02	3.2E-02	--	5.7E-06	1.2E-03	5.7E-05	5.7E-05	1.3E-03	--	--	--	--
Di-n-octylphthalate	--	1.5E-01	3.8E-01	1.5E-01	1.5E-01	--	5.6E-06	1.3E-03	2.7E-04	2.7E-04	1.9E-03	1.1E+00	1.7E-03	1.1E+01	1.7E-04
Diphenylmethanone	--	3.1E-02	7.1E-02	4.8E-02	4.8E-02	--	1.1E-06	2.5E-04	8.5E-05	8.5E-05	4.3E-04	--	--	--	--
N-Nitrosodi-n-propylamine	3.5E-06	--	--	--	--	8.6E-09	--	--	--	--	8.6E-09	--	--	--	--
Phenol	--	7.2E-01	--	--	--	--	2.7E-05	--	--	--	2.7E-05	--	--	--	--
Aluminum	4.9E+00	--	--	--	--	1.2E-02	--	--	--	--	1.2E-02	1.1E+02	1.1E-04	1.1E+03	1.1E-05
Arsenic	--	5.3E+00	6.8E-01	6.8E-01	6.8E-01	--	2.0E-04	2.4E-03	1.2E-03	1.2E-03	5.0E-03	5.1E+00	9.8E-04	1.3E+01	3.9E-04
Barium	2.4E-02	2.7E+01	4.9E-01	4.9E-01	4.9E-01	6.0E-05	1.0E-03	1.7E-03	8.7E-04	8.7E-04	4.6E-03	4.2E+01	1.1E-04	8.3E+01	5.5E-05
Beryllium	6.1E-04	4.4E-01	4.0E-03	4.0E-03	4.0E-03	1.5E-06	1.6E-05	1.4E-05	7.0E-06	7.0E-06	4.6E-05	3.7E-03	1.2E-02	3.7E-02	1.2E-03
Chromium	1.1E+00	4.0E+02	4.0E+00	4.0E+00	4.0E+00	2.7E-03	1.5E-02	1.4E-02	7.1E-03	7.1E-03	4.6E-02	2.7E+00	1.7E-02	1.1E+01	4.2E-03
Chromium, Hexavalent	--	7.0E+00	7.0E-01	7.0E-01	7.0E-01	--	2.6E-04	2.5E-03	1.2E-03	1.2E-03	5.2E-03	1.6E+00	3.2E-03	1.6E+01	3.2E-04
Cobalt	2.8E-02	--	--	--	--	7.0E-05	--	--	--	--	7.0E-05	--	--	--	--
Copper	9.0E-03	--	--	--	--	2.2E-05	--	--	--	--	2.2E-05	1.9E+01	1.2E-06	3.7E+01	6.0E-07
Iron	5.9E+00	1.2E+04	9.0E+01	9.0E+01	9.0E+01	1.5E-02	4.7E-01	3.2E-01	1.6E-01	1.6E-01	1.1E+00	--	--	--	--
Lead	6.3E-04	--	--	--	--	1.6E-06	--	--	--	--	1.6E-06	4.7E+00	3.3E-07	8.3E+00	1.9E-07
Manganese	1.5E+00	--	--	--	--	3.7E-03	--	--	--	--	3.7E-03	9.8E+02	3.8E-06	9.8E+03	3.8E-07
Silver	1.7E-05	7.5E+00	3.1E+00	3.1E+00	3.1E+00	4.2E-08	2.8E-04	1.1E-02	5.4E-03	5.4E-03	2.2E-02	1.2E+01	1.9E-03	1.2E+02	1.9E-04
Vanadium	--	1.0E+01	8.8E-02	8.8E-02	8.8E-02	--	3.9E-04	3.1E-04	1.6E-04	1.6E-04	1.0E-03	1.1E+00	9.2E-04	1.1E+01	9.2E-05
Bromide	3.2E-01	--	--	--	--	7.8E-04	--	--	--	--	7.8E-04	--	--	--	--
Chloride	1.6E+02	7.4E+01	--	--	--	4.0E-01	2.8E-03	--	--	--	4.1E-01	--	--	--	--
Nitrite as N	3.1E-02	--	--	--	--	7.6E-05	--	--	--	--	7.6E-05	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.5E+02	--	--	--	1.4E-01	5.6E-03	--	--	--	1.4E-01	--	--	--	--
Sulfate	--	4.7E+02	--	--	--	--	1.8E-02	--	--	--	1.8E-02	--	--	--	--
Hydrazine	5.6E-05	9.1E-04	--	--	--	1.4E-07	3.4E-08	--	--	--	1.7E-07	--	--	--	--

Table - Upper South Ditch - CTE - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Central Pond - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.78E-03	6.10E+02	4.13E+00
2,4,4-Trimethyl-2-pentene		5.68E-03	6.05E+02	3.43E+00
Acetone		1.15E-01	0.00E+00	0.00E+00
Methyl Tertbutyl Ether		1.58E-03	0.00E+00	0.00E+00
3 & 4 Methylphenol		5.20E+00	0.00E+00	0.00E+00
Acetophenone		2.05E-01	0.00E+00	0.00E+00
Benzaldehyde		1.65E+00	0.00E+00	0.00E+00
Phenol		1.95E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene		1.40E-01	6.28E+02	8.79E+01
Fluoranthene		2.50E-01	6.18E+02	1.55E+02
Phenanthrene		2.10E-01	6.09E+02	1.28E+02
Pyrene		2.05E-01	6.14E+02	1.26E+02
Aluminum	2.10E-01		8.60E-03	--
Barium	4.90E-02	4.55E+01	1.82E-02	8.28E-01
Beryllium		9.20E-02	9.00E-03	8.28E-04
Chromium		3.83E+01	--	4.00E+00
Chromium, Hexavalent		2.40E-01	1.00E-01	2.40E-02
Lead		5.05E+01	6.60E-02	3.33E+00
Manganese	7.00E-01	5.15E+02	3.25E-03	1.67E+00
Tin		2.15E+00	--	--
Silver	1.50E-05		4.09E-01	--
Vanadium		1.65E+01	8.40E-03	1.39E-01
Bromide	1.30E-01		0.00E+00	--
Chloride		2.10E+01	--	--
Nitrite as N	7.50E-02		--	--
Nitrogen, as Ammonia	2.80E+01	2.60E+01	--	--
Sulfate		8.55E+02	--	--

Table - Central Pond - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Central Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in sediment
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table - Central Pond - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	6.78E-03	4.13E+00	--	6.35E-05	2.69E+00	2.7E+00	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	5.68E-03	3.43E+00	--	5.32E-05	2.23E+00	2.2E+00	--	--	--	--
Acetone	--	1.15E-01	0.00E+00	--	1.08E-03	0.00E+00	1.1E-03	8.43E+03	1.3E-07	8.43E+04	1.3E-08
Methyl Tertbutyl Ether	--	1.58E-03	0.00E+00	--	1.48E-05	0.00E+00	1.5E-05	--	--	--	--
3 & 4 Methylphenol	--	5.20E+00	0.00E+00	--	4.87E-02	0.00E+00	4.9E-02	--	--	--	--
Acetophenone	--	2.05E-01	0.00E+00	--	1.92E-03	0.00E+00	1.9E-03	--	--	--	--
Benzaldehyde	--	1.65E+00	0.00E+00	--	1.55E-02	0.00E+00	1.5E-02	--	--	--	--
Phenol	--	1.95E+00	0.00E+00	--	1.83E-02	0.00E+00	1.8E-02	--	--	--	--
Benzo(b)fluoranthene	--	1.40E-01	8.79E+01	--	1.31E-03	5.72E+01	5.7E+01	9.20E+02	6.2E-02	9.20E+03	6.2E-03
Fluoranthene	--	2.50E-01	1.55E+02	--	2.34E-03	1.01E+02	1.0E+02	9.20E+02	1.1E-01	9.20E+03	1.1E-02
Phenanthrene	--	2.10E-01	1.28E+02	--	1.97E-03	8.31E+01	8.3E+01	9.20E+02	9.0E-02	9.20E+03	9.0E-03
Pyrene	--	2.05E-01	1.26E+02	--	1.92E-03	8.19E+01	8.2E+01	9.20E+02	8.9E-02	9.20E+03	8.9E-03
Aluminum	2.10E-01	--	--	4.16E-02	--	--	4.2E-02	1.10E+02	3.8E-04	1.10E+03	3.8E-05
Barium	4.90E-02	4.55E+01	8.28E-01	9.71E-03	4.26E-01	5.39E-01	9.7E-01	4.17E+01	2.3E-02	8.33E+01	1.2E-02
Beryllium	--	9.20E-02	8.28E-04	--	8.62E-04	5.39E-04	1.4E-03	3.70E-03	3.8E-01	3.70E-02	3.8E-02
Chromium	--	3.83E+01	4.00E+00	--	3.59E-01	2.60E+00	3.0E+00	2.70E+00	1.1E+00	1.10E+01	2.7E-01
Chromium, Hexavalent	--	2.40E-01	2.40E-02	--	2.25E-03	1.56E-02	1.8E-02	1.64E+00	1.1E-02	1.64E+01	1.1E-03
Lead	--	5.05E+01	3.33E+00	--	4.73E-01	2.17E+00	2.6E+00	4.70E+00	5.6E-01	8.28E+00	3.2E-01
Manganese	7.00E-01	5.15E+02	1.67E+00	1.39E-01	4.82E+00	1.09E+00	6.0E+00	9.77E+02	6.2E-03	9.77E+03	6.2E-04
Tin	--	2.15E+00	--	--	2.01E-02	--	2.0E-02	6.80E+00	3.0E-03	1.69E+01	1.2E-03
Silver	1.50E-05	--	--	2.97E-06	--	--	3.0E-06	1.18E+01	2.5E-07	1.18E+02	2.5E-08
Vanadium	--	1.65E+01	1.39E-01	--	1.55E-01	9.02E-02	2.4E-01	1.10E+00	2.2E-01	1.10E+01	2.2E-02
Bromide	1.30E-01	--	--	2.58E-02	--	--	2.6E-02	--	--	--	--
Chloride	--	2.10E+01	--	--	1.97E-01	--	2.0E-01	--	--	--	--
Nitrite as N	7.50E-02	--	--	1.49E-02	--	--	1.5E-02	--	--	--	--
Nitrogen, as Ammonia	2.80E+01	2.60E+01	--	5.55E+00	2.44E-01	--	5.8E+00	--	--	--	--
Sulfate	--	8.55E+02	--	--	8.01E+00	--	8.0E+00	--	--	--	--

Table - Central Pond - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Central Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

[a] - Doses for surface water (sw), sediment, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in sediment
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{inv} - Chemical concentration in fish tissue
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
mg/L - milligrams per liter
mg/kg - milligrams per kilogram
BW - body weight
TRV - Toxicity Reference Value
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
HQ - Hazard Quotient

Table - Lower South Ditch - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.11E-02	1.08E+00	1.20E-02
2,4,4-Trimethyl-2-pentene	--	3.50E-03	1.07E+00	3.75E-03
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00
Acetone	--	1.20E-01	0.00E+00	0.00E+00
Formaldehyde	--	4.35E-01	0.00E+00	0.00E+00
Aniline	--	2.30E-01	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00
Benzo(a)pyrene	1.50E-04	--	1.12E+00	--
Bis(2-Ethylhexyl)phthalate	2.44E-03	3.22E+02	1.16E+00	3.75E+02
Di-n-octylphthalate	--	1.50E-01	1.18E+00	1.77E-01
Diphenyl ether	--	1.84E+00	1.07E+00	1.98E+00
Diphenylamine	--	6.20E-02	1.08E+00	6.68E-02
N-Nitrosodi-n-propylamine	3.51E-06	--	0.00E+00	--
4,4`-DDT	--	2.47E-02	1.13E+00	2.79E-02
Hexachlorobenzene	--	1.63E-02	1.11E+00	1.81E-02
Aluminum	4.90E+00	--	8.60E-03	--
Barium	2.43E-02	1.28E+01	1.82E-02	2.34E-01
Beryllium	6.08E-04	9.60E-01	9.00E-03	8.64E-03
Cadmium	--	5.55E-01	4.59E-01	2.55E-01
Chromium	1.10E+00	1.92E+03	--	4.00E+00
Chromium, Hexavalent	--	1.45E+01	1.00E-01	1.45E+00
Cobalt	2.85E-02	--	2.44E-02	--
Copper	9.02E-03	--	1.65E+00	--
Iron	5.91E+00	--	7.20E-03	--
Lead	6.30E-04	--	6.60E-02	--
Manganese	1.49E+00	--	1.08E-02	--
Mercury	--	1.78E-01	2.84E+00	5.04E-01
Nickel	--	1.41E+01	8.18E-01	1.16E+01
Silver	1.70E-05	2.51E+01	4.09E-01	1.03E+01
Tin	--	1.60E+00	--	--
Vanadium	--	8.65E+00	8.40E-03	7.27E-02
Bromide	3.16E-01	--	0.00E+00	--
Chloride	1.64E+02	1.33E+02	--	--

Table - Lower South Ditch - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Nitrite as N	3.10E-02	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.72E+02	--	--
Sulfate	--	6.90E+02	--	--
Hydrazine	5.56E-05	1.85E-03	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	5.93E-04	--	1.09E+00	--
4-Nonylphenol (Tech.)	9.81E-03	--	1.12E+00	--
Kempore (Azodicarbonamide)	7.25E-01	--	--	--
C11-C22 Aromatics	--	5.25E+03	--	--
C19-C36 Aliphatics	--	3.55E+03	--	--
C9-C18 Aliphatics	--	4.33E+02	--	--
EPH, Total	--	9.45E+03	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Lower South Ditch - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	1.11E-02	1.20E-02	--	2.31E-05	1.74E-03	1.8E-03	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.50E-03	3.75E-03	--	7.29E-06	5.42E-04	5.5E-04	--	--	--	--
Acetaldehyde	--	6.30E-02	0.00E+00	--	1.31E-04	0.00E+00	1.3E-04	--	--	--	--
Acetone	--	1.20E-01	0.00E+00	--	2.50E-04	0.00E+00	2.5E-04	8.43E+03	3.0E-08	8.43E+04	3.0E-09
Formaldehyde	--	4.35E-01	0.00E+00	--	9.05E-04	0.00E+00	9.1E-04	--	--	--	--
Aniline	--	2.30E-01	0.00E+00	--	4.79E-04	0.00E+00	4.8E-04	--	--	--	--
Azobenzene	5.30E-04	--	--	2.34E-05	--	--	2.3E-05	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	--	2.50E-04	0.00E+00	2.5E-04	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	--	6.61E-06	--	--	6.6E-06	9.20E+02	7.2E-09	9.20E+03	7.2E-10
Bis(2-Ethylhexyl)phthalate	2.44E-03	3.22E+02	3.75E+02	1.08E-04	6.70E-01	5.42E+01	5.5E+01	1.10E+00	5.0E+01	1.10E+01	5.0E+00
Di-n-octylphthalate	--	1.50E-01	1.77E-01	--	3.12E-04	2.56E-02	2.6E-02	1.11E+00	2.3E-02	1.11E+01	2.3E-03
Diphenyl ether	--	1.84E+00	1.98E+00	--	3.83E-03	2.86E-01	2.9E-01	--	--	--	--
Diphenylamine	--	6.20E-02	6.68E-02	--	1.29E-04	9.65E-03	9.8E-03	--	--	--	--
N-Nitrosodi-n-propylamine	3.51E-06	--	--	1.55E-07	--	--	1.5E-07	--	--	--	--
4,4`-DDT	--	2.47E-02	2.79E-02	--	5.13E-05	4.03E-03	4.1E-03	1.30E+01	3.1E-04	1.30E+02	3.1E-05
Hexachlorobenzene	--	1.63E-02	1.81E-02	--	3.40E-05	2.61E-03	2.6E-03	2.90E+00	9.1E-04	2.90E+01	9.1E-05
Aluminum	4.90E+00	--	--	2.16E-01	--	--	2.2E-01	1.10E+02	2.0E-03	1.10E+03	2.0E-04
Barium	2.43E-02	1.28E+01	2.34E-01	1.07E-03	2.67E-02	3.38E-02	6.2E-02	4.17E+01	1.5E-03	8.33E+01	7.4E-04
Beryllium	6.08E-04	9.60E-01	8.64E-03	2.68E-05	2.00E-03	1.25E-03	3.3E-03	3.70E-03	8.8E-01	3.70E-02	8.8E-02
Cadmium	--	5.55E-01	2.55E-01	--	1.16E-03	3.68E-02	3.8E-02	1.50E+00	2.5E-02	5.50E+00	6.9E-03
Chromium	1.10E+00	1.92E+03	4.00E+00	4.85E-02	4.00E+00	5.78E-01	4.6E+00	2.70E+00	1.7E+00	1.10E+01	4.2E-01
Chromium, Hexavalent	--	1.45E+01	1.45E+00	--	3.01E-02	2.09E-01	2.4E-01	1.64E+00	1.5E-01	1.64E+01	1.5E-02
Cobalt	2.85E-02	--	--	1.26E-03	--	--	1.3E-03	--	--	--	--
Copper	9.02E-03	--	--	3.97E-04	--	--	4.0E-04	1.85E+01	2.1E-05	3.70E+01	1.1E-05
Iron	5.91E+00	--	--	2.60E-01	--	--	2.6E-01	--	--	--	--
Lead	6.30E-04	--	--	2.78E-05	--	--	2.8E-05	4.70E+00	5.9E-06	8.28E+00	3.4E-06
Manganese	1.49E+00	--	--	6.58E-02	--	--	6.6E-02	9.77E+02	6.7E-05	9.77E+03	6.7E-06
Mercury	--	1.78E-01	5.04E-01	--	3.69E-04	7.28E-02	7.3E-02	4.50E-01	1.6E-01	9.00E-01	8.1E-02
Nickel	--	1.41E+01	1.16E+01	--	2.94E-02	1.67E+00	1.7E+00	7.74E+01	2.2E-02	1.07E+02	1.6E-02
Silver	1.70E-05	2.51E+01	1.03E+01	7.49E-07	5.23E-02	1.49E+00	1.5E+00	1.18E+01	1.3E-01	1.18E+02	1.3E-02
Tin	--	1.60E+00	--	--	3.33E-03	--	3.3E-03	6.80E+00	4.9E-04	1.69E+01	2.0E-04
Vanadium	--	8.65E+00	7.27E-02	--	1.80E-02	1.05E-02	2.9E-02	1.10E+00	2.6E-02	1.10E+01	2.6E-03
Bromide	3.16E-01	--	--	1.39E-02	--	--	1.4E-02	--	--	--	--
Chloride	1.64E+02	1.33E+02	--	7.23E+00	2.78E-01	--	7.5E+00	--	--	--	--
Nitrite as N	3.10E-02	--	--	1.37E-03	--	--	1.4E-03	--	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.72E+02	--	2.47E+00	3.59E-01	--	2.8E+00	--	--	--	--
Sulfate	--	6.90E+02	--	--	1.44E+00	--	1.4E+00	--	--	--	--

Table - Lower South Ditch - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Hydrazine	5.56E-05	1.85E-03	0.00E+00	2.45E-06	3.85E-06	0.00E+00	6.3E-06	--	--	--	--
4,4'-Isopropylidenediphenol	5.93E-04	--	--	2.61E-05	--	--	2.6E-05	--	--	--	--
4-Nonylphenol (Tech.)	9.81E-03	--	--	4.32E-04	--	--	4.3E-04	--	--	--	--
Kempore (Azodicarbonamide)	7.25E-01	--	--	3.19E-02	--	--	3.2E-02	--	--	--	--
C11-C22 Aromatics	--	5.25E+03	--	--	1.09E+01	--	1.1E+01	--	--	--	--
C19-C36 Aliphatics	--	3.55E+03	--	--	7.38E+00	--	7.4E+00	--	--	--	--
C9-C18 Aliphatics	--	4.33E+02	--	--	9.01E-01	--	9.0E-01	--	--	--	--
EPH, Total	--	9.45E+03	--	--	1.97E+01	--	2.0E+01	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] - Doses for surface water (sw), sediment and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - North Pond - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-03	2.30E+00	4.61E-03
Acetone	--	2.09E-01	0.00E+00	0.00E+00
Carbon disulfide	--	3.61E-03	0.00E+00	0.00E+00
Benzo(a)anthracene	1.19E-04	--	2.37E+00	--
Benzo(a)pyrene	1.23E-04	--	2.39E+00	--
Bis(2-Ethylhexyl)phthalate	--	1.83E+00	2.48E+00	4.53E+00
Carbazole	--	1.60E-01	2.29E+00	3.66E-01
Caprolactam	3.30E-04	--	0.00E+00	--
Pyrene	3.90E-04	--	2.32E+00	--
Aluminum	1.53E-01	--	8.60E-03	--
Arsenic	--	8.25E+00	1.27E-01	1.05E+00
Barium	3.38E-02	4.08E+01	1.82E-02	7.42E-01
Beryllium	--	4.78E-01	9.00E-03	4.30E-03
Cadmium	--	1.41E+00	4.59E-01	6.48E-01
Chromium	--	2.78E+02	--	4.00E+00
Chromium, Hexavalent	--	5.86E-01	1.00E-01	5.86E-02
Copper	--	4.54E+01	1.65E+00	7.48E+01
Iron	1.87E+00	1.55E+04	7.20E-03	1.12E+02
Lead	9.30E-04	6.85E+01	6.60E-02	4.52E+00
Manganese	3.90E-01	4.20E+02	1.08E-02	4.54E+00
Silver	2.20E-05	--	4.09E-01	--
Thallium	--	7.55E-01	--	--
Tin	--	5.85E+00	--	--
Vanadium	--	2.33E+01	8.40E-03	1.95E-01
Zinc	--	2.88E+02	2.60E-02	7.48E+00
Bromide	2.80E-01	--	0.00E+00	--
Chloride	1.90E+02	1.84E+02	--	--
Nitrogen, as Ammonia	--	1.22E+01	--	--
Sulfate	--	1.83E+02	--	--

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - North Pond - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-03	4.61E-03	--	2.50E-05	4.00E-03	4.0E-03	--	--	--	--
Acetone	--	2.09E-01	0.00E+00	--	2.61E-03	0.00E+00	2.6E-03	8.43E+03	3.1E-07	8.43E+04	3.1E-08
Carbon disulfide	--	3.61E-03	0.00E+00	--	4.51E-05	0.00E+00	4.5E-05	--	--	--	--
Benzo(a)anthracene	1.19E-04	--	--	3.15E-05	--	--	3.1E-05	9.20E+02	3.4E-08	9.20E+03	3.4E-09
Benzo(a)pyrene	1.23E-04	--	--	3.24E-05	--	--	3.2E-05	9.20E+02	3.5E-08	9.20E+03	3.5E-09
Bis(2-Ethylhexyl)phthalate	--	1.83E+00	4.53E+00	--	2.28E-02	3.93E+00	4.0E+00	1.10E+00	3.6E+00	1.10E+01	3.6E-01
Carbazole	--	1.60E-01	3.66E-01	--	2.00E-03	3.17E-01	3.2E-01	--	--	--	--
Caprolactam	3.30E-04	--	--	8.72E-05	--	--	8.7E-05	--	--	--	--
Pyrene	3.90E-04	--	--	1.03E-04	--	--	1.0E-04	9.20E+02	1.1E-07	9.20E+03	1.1E-08
Aluminum	1.53E-01	--	--	4.03E-02	--	--	4.0E-02	1.10E+02	3.7E-04	1.10E+03	3.7E-05
Arsenic	--	8.25E+00	1.05E+00	--	1.03E-01	9.09E-01	1.0E+00	5.14E+00	2.0E-01	1.28E+01	7.9E-02
Barium	3.38E-02	4.08E+01	7.42E-01	8.92E-03	5.09E-01	6.43E-01	1.2E+00	4.17E+01	2.8E-02	8.33E+01	1.4E-02
Beryllium	--	4.78E-01	4.30E-03	--	5.96E-03	3.73E-03	9.7E-03	3.70E-03	2.6E+00	3.70E-02	2.6E-01
Cadmium	--	1.41E+00	6.48E-01	--	1.76E-02	5.62E-01	5.8E-01	1.50E+00	3.9E-01	5.50E+00	1.1E-01
Chromium	--	2.78E+02	4.00E+00	--	3.47E+00	3.47E+00	6.9E+00	2.70E+00	2.6E+00	1.10E+01	6.3E-01
Chromium, Hexavalent	--	5.86E-01	5.86E-02	--	7.32E-03	5.08E-02	5.8E-02	1.64E+00	3.5E-02	1.64E+01	3.5E-03
Copper	--	4.54E+01	7.48E+01	--	5.67E-01	6.48E+01	6.5E+01	1.85E+01	3.5E+00	3.70E+01	1.8E+00
Iron	1.87E+00	1.55E+04	1.12E+02	4.94E-01	1.94E+02	9.68E+01	2.9E+02	--	--	--	--
Lead	9.30E-04	6.85E+01	4.52E+00	2.46E-04	8.55E-01	3.92E+00	4.8E+00	4.70E+00	1.0E+00	8.28E+00	5.8E-01
Manganese	3.90E-01	4.20E+02	4.54E+00	1.03E-01	5.25E+00	3.93E+00	9.3E+00	9.77E+02	9.5E-03	9.77E+03	9.5E-04
Silver	2.20E-05	--	--	5.82E-06	--	--	5.8E-06	1.18E+01	4.9E-07	1.18E+02	4.9E-08
Thallium	--	7.55E-01	--	--	9.43E-03	--	9.4E-03	6.10E-01	1.5E-02	6.10E+00	1.5E-03
Tin	--	5.85E+00	--	--	7.31E-02	--	7.3E-02	6.80E+00	1.1E-02	1.69E+01	4.3E-03
Vanadium	--	2.33E+01	1.95E-01	--	2.90E-01	1.69E-01	4.6E-01	1.10E+00	4.2E-01	1.10E+01	4.2E-02
Zinc	--	2.88E+02	7.48E+00	--	3.59E+00	6.48E+00	1.0E+01	1.45E+01	6.9E-01	1.31E+02	7.7E-02
Bromide	2.80E-01	--	--	7.40E-02	--	--	7.4E-02	--	--	--	--
Chloride	1.90E+02	1.84E+02	--	5.02E+01	2.29E+00	--	5.3E+01	--	--	--	--
Nitrogen, as Ammonia	--	1.22E+01	--	--	1.52E-01	--	1.5E-01	--	--	--	--
Sulfate	--	1.83E+02	--	--	2.28E+00	--	2.3E+00	--	--	--	--

Table - North Pond - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	North Pond

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Off-PWD - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene		2.33E-02	2.07E+00	4.84E-02
2,4,4-Trimethyl-2-pentene		6.00E-03	2.06E+00	1.23E-02
Formaldehyde		5.05E-01	0.00E+00	0.00E+00
Carbon disulfide	2.50E-03		0.00E+00	--
3 & 4 Methylphenol	7.60E-04		0.00E+00	--
Benzo(a)anthracene	4.66E-04		2.13E+00	--
Benzo(a)pyrene	8.87E-04		2.15E+00	--
Benzo(b)fluoranthene	1.59E-03		2.13E+00	--
Benzo(ghi)perylene	9.92E-04		2.18E+00	--
Benzo(k)fluoranthene	6.09E-04		2.15E+00	--
Chrysene	1.21E-03		2.14E+00	--
Dibenz(a,h)anthracene	3.92E-04		2.19E+00	--
Indeno(1,2,3-cd)pyrene	8.81E-04		2.18E+00	--
Phenanthrene	5.32E-04		2.07E+00	--
Pyrene	3.06E-03		2.09E+00	--
4-Chlorophenyl phenyl ether		4.42E-02	2.08E+00	9.18E-02
Carbazole		4.47E-02	2.06E+00	9.19E-02
Diphenyl ether		3.33E-01	2.06E+00	6.85E-01
Diphenylmethanone		9.05E-02	2.11E+00	1.91E-01
Aluminum	8.20E-01		8.60E-03	--
Barium	3.45E-02	1.17E+01	1.82E-02	2.13E-01
Chromium	4.95E-02	1.35E+03	--	4.00E+00
Iron	1.64E+01		7.20E-03	--
Lead	2.68E-03		6.60E-02	--
Manganese	8.53E-01		1.08E-02	--
Zinc	3.75E-02		2.60E-02	--
Arsenic		1.00E+01	1.27E-01	1.27E+00
Beryllium		1.20E+00	9.00E-03	1.08E-02
Copper		2.47E+01	1.65E+00	4.06E+01
Silver		2.36E+01	4.09E-01	9.64E+00
Vanadium		1.17E+01	8.40E-03	9.86E-02
Bromide	1.48E-01		0.00E+00	--
Nitrite as N	2.00E-02		--	--
Nitrogen, as Ammonia	4.45E+01	2.54E+02	--	--

Table - Off-PWD - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Off-PWD

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Chloride		1.47E+02	--	--
Sulfate		6.97E+02	--	--
Hydrazine		1.30E-03	0.00E+00	0.00E+00

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - Off-PWD - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.33E-02	4.84E-02	--	1.68E-04	2.41E-02	2.4E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	6.00E-03	1.23E-02	--	4.31E-05	6.15E-03	6.2E-03	--	--	--	--
Formaldehyde	--	5.05E-01	0.00E+00	--	3.63E-03	0.00E+00	3.6E-03	--	--	--	--
Carbon disulfide	2.50E-03	--	--	3.80E-04	--	--	3.8E-04	--	--	--	--
3 & 4 Methylphenol	7.60E-04	--	--	1.16E-04	--	--	1.2E-04	--	--	--	--
Benzo(a)anthracene	4.66E-04	--	--	7.08E-05	--	--	7.1E-05	9.20E+02	7.7E-08	9.20E+03	7.7E-09
Benzo(a)pyrene	8.87E-04	--	--	1.35E-04	--	--	1.3E-04	9.20E+02	1.5E-07	9.20E+03	1.5E-08
Benzo(b)fluoranthene	1.59E-03	--	--	2.42E-04	--	--	2.4E-04	9.20E+02	2.6E-07	9.20E+03	2.6E-08
Benzo(ghi)perylene	9.92E-04	--	--	1.51E-04	--	--	1.5E-04	9.20E+02	1.6E-07	9.20E+03	1.6E-08
Benzo(k)fluoranthene	6.09E-04	--	--	9.26E-05	--	--	9.3E-05	9.20E+02	1.0E-07	9.20E+03	1.0E-08
Chrysene	1.21E-03	--	--	1.85E-04	--	--	1.8E-04	9.20E+02	2.0E-07	9.20E+03	2.0E-08
Dibenz(a,h)anthracene	3.92E-04	--	--	5.95E-05	--	--	6.0E-05	9.20E+02	6.5E-08	9.20E+03	6.5E-09
Indeno(1,2,3-cd)pyrene	8.81E-04	--	--	1.34E-04	--	--	1.3E-04	9.20E+02	1.5E-07	9.20E+03	1.5E-08
Phenanthrene	5.32E-04	--	--	8.08E-05	--	--	8.1E-05	9.20E+02	8.8E-08	9.20E+03	8.8E-09
Pyrene	3.06E-03	--	--	4.65E-04	--	--	4.6E-04	9.20E+02	5.1E-07	9.20E+03	5.1E-08
4-Chlorophenyl phenyl ether	--	4.42E-02	9.18E-02	--	3.17E-04	4.58E-02	4.6E-02	--	--	--	--
Carbazole	--	4.47E-02	9.19E-02	--	3.21E-04	4.58E-02	4.6E-02	--	--	--	--
Diphenyl ether	--	3.33E-01	6.85E-01	--	2.39E-03	3.42E-01	3.4E-01	--	--	--	--
Diphenylmethanone	--	9.05E-02	1.91E-01	--	6.50E-04	9.52E-02	9.6E-02	--	--	--	--
Aluminum	8.20E-01	--	--	1.25E-01	--	--	1.2E-01	1.10E+02	1.1E-03	1.10E+03	1.1E-04
Barium	3.45E-02	1.17E+01	2.13E-01	5.24E-03	8.40E-02	1.06E-01	2.0E-01	4.17E+01	4.7E-03	8.33E+01	2.3E-03
Chromium	4.95E-02	1.35E+03	4.00E+00	7.53E-03	9.69E+00	1.99E+00	1.2E+01	2.70E+00	4.3E+00	1.10E+01	1.1E+00
Iron	1.64E+01	--	--	2.49E+00	--	--	2.5E+00	--	--	--	--
Lead	2.68E-03	--	--	4.07E-04	--	--	4.1E-04	4.70E+00	8.7E-05	8.28E+00	4.9E-05
Manganese	8.53E-01	--	--	1.30E-01	--	--	1.3E-01	9.77E+02	1.3E-04	9.77E+03	1.3E-05
Zinc	3.75E-02	--	--	5.70E-03	--	--	5.7E-03	1.45E+01	3.9E-04	1.31E+02	4.4E-05
Arsenic	--	1.00E+01	1.27E+00	--	7.18E-02	6.33E-01	7.1E-01	5.14E+00	1.4E-01	1.28E+01	5.5E-02
Beryllium	--	1.20E+00	1.08E-02	--	8.62E-03	5.39E-03	1.4E-02	3.70E-03	3.8E+00	3.70E-02	3.8E-01
Copper	--	2.47E+01	4.06E+01	--	1.77E-01	2.03E+01	2.0E+01	1.85E+01	1.1E+00	3.70E+01	5.5E-01
Silver	--	2.36E+01	9.64E+00	--	1.69E-01	4.81E+00	5.0E+00	1.18E+01	4.2E-01	1.18E+02	4.2E-02
Vanadium	--	1.17E+01	9.86E-02	--	8.43E-02	4.92E-02	1.3E-01	1.10E+00	1.2E-01	1.10E+01	1.2E-02
Bromide	1.48E-01	--	--	2.25E-02	--	--	2.3E-02	--	--	--	--
Nitrite as N	2.00E-02	--	--	3.04E-03	--	--	3.0E-03	--	--	--	--
Nitrogen, as Ammonia	4.45E+01	2.54E+02	--	6.76E+00	1.83E+00	--	8.6E+00	--	--	--	--
Chloride	--	1.47E+02	--	--	1.06E+00	--	1.1E+00	--	--	--	--
Sulfate	--	6.97E+02	--	--	5.00E+00	--	5.0E+00	--	--	--	--
Hydrazine	--	1.30E-03	0.00E+00	--	9.34E-06	0.00E+00	9.3E-06	--	--	--	--

Table - Off-PWD - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Off-PWD

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - On PWD/WDW - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	On PWD/WDW

Chemical	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Acetone	3.40E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	4.20E+00	3.49E+00	1.47E+01
Benzene	9.29E-01	0.00E+00	0.00E+00
Barium	1.80E+01	1.82E-02	3.28E-01
Beryllium	2.47E-01	9.00E-03	2.23E-03
Cadmium	5.74E-01	4.59E-01	2.64E-01
Chromium	2.43E+01	--	4.00E+00
Lead	4.97E+01	6.60E-02	3.28E+00
Mercury	2.31E-01	2.84E+00	6.56E-01
Vanadium	1.57E+01	8.40E-03	1.32E-01

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - On PWD/WDW - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetone	3.40E-01	0.00E+00	4.25E-03	0.00E+00	4.2E-03	8.43E+03	5.0E-07	8.43E+04	5.0E-08
Bis(2-Ethylhexyl)phthalate	4.20E+00	1.47E+01	5.25E-02	1.27E+01	1.3E+01	1.10E+00	1.2E+01	1.10E+01	1.2E+00
Benzene	9.29E-01	0.00E+00	1.16E-02	0.00E+00	1.2E-02	--	--	--	--
Barium	1.80E+01	3.28E-01	2.25E-01	2.84E-01	5.1E-01	4.17E+01	1.2E-02	8.33E+01	6.1E-03
Beryllium	2.47E-01	2.23E-03	3.09E-03	1.93E-03	5.0E-03	3.70E-03	1.4E+00	3.70E-02	1.4E-01
Cadmium	5.74E-01	2.64E-01	7.17E-03	2.29E-01	2.4E-01	1.50E+00	1.6E-01	5.50E+00	4.3E-02
Chromium	2.43E+01	4.00E+00	3.03E-01	3.47E+00	3.8E+00	2.70E+00	1.4E+00	1.10E+01	3.4E-01
Lead	4.97E+01	3.28E+00	6.21E-01	2.84E+00	3.5E+00	4.70E+00	7.4E-01	8.28E+00	4.2E-01
Mercury	2.31E-01	6.56E-01	2.89E-03	5.69E-01	5.7E-01	4.50E-01	1.3E+00	9.00E-01	6.4E-01
Vanadium	1.57E+01	1.32E-01	1.96E-01	1.14E-01	3.1E-01	1.10E+00	2.8E-01	1.10E+01	2.8E-02

Notes:
[a] - Doses for surface water (sw), sediment and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Storm Water Detention Basin - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene		5.10E-03	6.10E+02	3.11E+00
2,4,4-Trimethyl-2-pentene		2.65E-03	6.05E+02	1.60E+00
Acetone		1.40E-01	0.00E+00	0.00E+00
3 & 4 Methylphenol		2.90E+00	0.00E+00	0.00E+00
Acetophenone		1.60E-01	0.00E+00	0.00E+00
Benzaldehyde		9.60E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		2.28E+00	6.57E+02	1.50E+03
Phenol		1.65E+00	0.00E+00	0.00E+00
N-Nitrosodiphenylamine	7.40E-06		6.23E+02	--
Benzo(a)pyrene		2.20E-01	6.33E+02	1.39E+02
Arsenic		1.07E+01	1.27E-01	1.36E+00
Barium	2.60E-02	4.95E+01	1.82E-02	9.01E-01
Beryllium		1.05E-01	9.00E-03	9.41E-04
Chromium		4.15E+01	--	4.00E+00
Vanadium		2.05E+01	8.40E-03	1.72E-01
Chloride		9.65E+00	--	--
Nitrite as N	2.60E-02		--	--
Nitrogen, as Ammonia	7.50E+00	1.80E+01	--	--
Sulfate		1.40E+03	--	--

Notes:

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure

C_{sw} - Chemical concentration in surface water

C_{sed} - Chemical concentration in sediment

C_{plant} - Chemical concentration in plant

C_{inv} - Chemical concentration in invertebrates

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

BAF - Bioaccumulation Factor

mg/L - milligrams per liter

mg/kg - milligrams per kilogram

Table - Storm Water Detention Basin - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	5.10E-03	3.11E+00	--	5.84E-05	2.47E+00	2.5E+00	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	2.65E-03	1.60E+00	--	3.03E-05	1.27E+00	1.3E+00	--	--	--	--
Acetone	--	1.40E-01	0.00E+00	--	1.60E-03	0.00E+00	1.6E-03	8.43E+03	1.9E-07	8.43E+04	1.9E-08
3 & 4 Methylphenol	--	2.90E+00	0.00E+00	--	3.32E-02	0.00E+00	3.3E-02	--	--	--	--
Acetophenone	--	1.60E-01	0.00E+00	--	1.83E-03	0.00E+00	1.8E-03	--	--	--	--
Benzaldehyde	--	9.60E-01	0.00E+00	--	1.10E-02	0.00E+00	1.1E-02	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	2.28E+00	1.50E+03	--	2.60E-02	1.19E+03	1.2E+03	1.10E+00	1.1E+03	1.10E+01	1.1E+02
Phenol	--	1.65E+00	0.00E+00	--	1.89E-02	0.00E+00	1.9E-02	--	--	--	--
N-Nitrosodiphenylamine	7.40E-06	--	--	1.79E-06	--	--	1.8E-06	--	--	--	--
Benzo(a)pyrene	--	2.20E-01	1.39E+02	--	2.52E-03	1.11E+02	1.1E+02	9.20E+02	1.2E-01	9.20E+03	1.2E-02
Arsenic	--	1.07E+01	1.36E+00	--	1.22E-01	1.08E+00	1.2E+00	5.14E+00	2.3E-01	1.28E+01	9.4E-02
Barium	2.60E-02	4.95E+01	9.01E-01	6.30E-03	5.67E-01	7.16E-01	1.3E+00	4.17E+01	3.1E-02	8.33E+01	1.5E-02
Beryllium	--	1.05E-01	9.41E-04	--	1.20E-03	7.48E-04	1.9E-03	3.70E-03	5.3E-01	3.70E-02	5.3E-02
Chromium	--	4.15E+01	4.00E+00	--	4.75E-01	3.18E+00	3.7E+00	2.70E+00	1.4E+00	1.10E+01	3.3E-01
Vanadium	--	2.05E+01	1.72E-01	--	2.35E-01	1.37E-01	3.7E-01	1.10E+00	3.4E-01	1.10E+01	3.4E-02
Chloride	--	9.65E+00	--	--	1.10E-01	--	1.1E-01	--	--	--	--
Nitrite as N	2.60E-02	--	--	6.30E-03	--	--	6.3E-03	--	--	--	--
Nitrogen, as Ammonia	7.50E+00	1.80E+01	--	1.82E+00	2.06E-01	--	2.0E+00	--	--	--	--
Sulfate	--	1.40E+03	--	--	1.60E+01	--	1.6E+01	--	--	--	--

Notes:

[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.

[b] - Total Dose is the sum of all doses.

[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.

[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Upper South Ditch - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.82E-02	2.30E+00	4.18E-02
2,4,4-Trimethyl-2-pentene	--	2.85E-03	2.29E+00	6.51E-03
4-iso-Propyltoluene	--	1.79E-03	2.29E+00	4.09E-03
Acetaldehyde	--	8.30E-02	0.00E+00	0.00E+00
Formaldehyde	--	7.45E-01	0.00E+00	0.00E+00
3 & 4 Methylphenol	--	1.29E+00	0.00E+00	0.00E+00
Acetophenone	--	9.00E-02	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--
Benzo(a)pyrene	1.50E-04	--	2.39E+00	--
Benzaldehyde	--	3.53E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	2.44E-03	4.22E+01	2.48E+00	1.05E+02
Caprolactam	--	5.30E-02	0.00E+00	0.00E+00
Diphenyl ether	--	1.51E-01	2.29E+00	3.46E-01
Di-n-octylphthalate	--	1.50E-01	2.51E+00	3.77E-01
Diphenylmethanone	--	3.05E-02	2.34E+00	7.15E-02
N-Nitrosodi-n-propylamine	3.51E-06	--	0.00E+00	--
Phenol	--	7.24E-01	0.00E+00	0.00E+00
Aluminum	4.90E+00	--	8.60E-03	--
Arsenic	--	5.33E+00	1.27E-01	6.77E-01
Barium	2.43E-02	2.70E+01	1.82E-02	4.91E-01
Beryllium	6.08E-04	4.39E-01	9.00E-03	3.95E-03
Chromium	1.10E+00	4.05E+02	--	4.00E+00
Chromium, Hexavalent	--	6.98E+00	1.00E-01	6.98E-01
Cobalt	2.85E-02	--	2.44E-02	--
Copper	9.02E-03	--	1.65E+00	--
Iron	5.91E+00	1.24E+04	7.20E-03	8.96E+01
Lead	6.30E-04	--	6.60E-02	--
Manganese	1.49E+00	--	1.08E-02	--
Silver	1.70E-05	7.46E+00	4.09E-01	3.05E+00
Vanadium	--	1.05E+01	8.40E-03	8.78E-02
Bromide	3.16E-01	--	0.00E+00	--
Chloride	1.64E+02	7.44E+01	--	--
Nitrite as N	3.10E-02	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.48E+02	--	--

Table - Upper South Ditch - CTE - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Sulfate	--	4.69E+02	--	--
Hydrazine	5.56E-05	9.10E-04	0.00E+00	0.00E+00

Notes:
Central Tendency Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - Upper South Ditch - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	1.82E-02	4.18E-02	--	4.72E-05	7.55E-03	7.6E-03	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	2.85E-03	6.51E-03	--	7.42E-06	1.18E-03	1.2E-03	--	--	--	--
4-iso-Propyltoluene	--	1.79E-03	4.09E-03	--	4.65E-06	7.39E-04	7.4E-04	--	--	--	--
Acetaldehyde	--	8.30E-02	0.00E+00	--	2.16E-04	0.00E+00	2.2E-04	--	--	--	--
Formaldehyde	--	7.45E-01	0.00E+00	--	1.94E-03	0.00E+00	1.9E-03	--	--	--	--
3 & 4 Methylphenol	--	1.29E+00	0.00E+00	--	3.36E-03	0.00E+00	3.4E-03	--	--	--	--
Acetophenone	--	9.00E-02	0.00E+00	--	2.34E-04	0.00E+00	2.3E-04	--	--	--	--
Azobenzene	5.30E-04	--	--	2.92E-05	--	--	2.9E-05	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	--	8.26E-06	--	--	8.3E-06	9.20E+02	9.0E-09	9.20E+03	9.0E-10
Benzaldehyde	--	3.53E-01	0.00E+00	--	9.17E-04	0.00E+00	9.2E-04	--	--	--	--
Bis(2-Ethylhexyl)phthalate	2.44E-03	4.22E+01	1.05E+02	1.34E-04	1.10E-01	1.89E+01	1.9E+01	1.10E+00	1.7E+01	1.10E+01	1.7E+00
Caprolactam	--	5.30E-02	0.00E+00	--	1.38E-04	0.00E+00	1.4E-04	--	--	--	--
Diphenyl ether	--	1.51E-01	3.46E-01	--	3.94E-04	6.26E-02	6.3E-02	--	--	--	--
Di-n-octylphthalate	--	1.50E-01	3.77E-01	--	3.90E-04	6.81E-02	6.9E-02	1.11E+00	6.2E-02	1.11E+01	6.2E-03
Diphenylmethanone	--	3.05E-02	7.15E-02	--	7.94E-05	1.29E-02	1.3E-02	--	--	--	--
N-Nitrosodi-n-propylamine	3.51E-06	--	--	1.93E-07	--	--	1.9E-07	--	--	--	--
Phenol	--	7.24E-01	0.00E+00	--	1.88E-03	0.00E+00	1.9E-03	--	--	--	--
Aluminum	4.90E+00	--	--	2.70E-01	--	--	2.7E-01	1.10E+02	2.5E-03	1.10E+03	2.5E-04
Arsenic	--	5.33E+00	6.77E-01	--	1.39E-02	1.22E-01	1.4E-01	5.14E+00	2.7E-02	1.28E+01	1.1E-02
Barium	2.43E-02	2.70E+01	4.91E-01	1.34E-03	7.02E-02	8.88E-02	1.6E-01	4.17E+01	3.9E-03	8.33E+01	1.9E-03
Beryllium	6.08E-04	4.39E-01	3.95E-03	3.35E-05	1.14E-03	7.14E-04	1.9E-03	3.70E-03	5.1E-01	3.70E-02	5.1E-02
Chromium	1.10E+00	4.05E+02	4.00E+00	6.06E-02	1.05E+00	7.23E-01	1.8E+00	2.70E+00	6.8E-01	1.10E+01	1.7E-01
Chromium, Hexavalent	--	6.98E+00	6.98E-01	--	1.82E-02	1.26E-01	1.4E-01	1.64E+00	8.8E-02	1.64E+01	8.8E-03
Cobalt	2.85E-02	--	--	1.57E-03	--	--	1.6E-03	--	--	--	--
Copper	9.02E-03	--	--	4.97E-04	--	--	5.0E-04	1.85E+01	2.7E-05	3.70E+01	1.3E-05
Iron	5.91E+00	1.24E+04	8.96E+01	3.26E-01	3.24E+01	1.62E+01	4.9E+01	--	--	--	--
Lead	6.30E-04	--	--	3.47E-05	--	--	3.5E-05	4.70E+00	7.4E-06	8.28E+00	4.2E-06
Manganese	1.49E+00	--	--	8.22E-02	--	--	8.2E-02	9.77E+02	8.4E-05	9.77E+03	8.4E-06
Silver	1.70E-05	7.46E+00	3.05E+00	9.36E-07	1.94E-02	5.51E-01	5.7E-01	1.18E+01	4.8E-02	1.18E+02	4.8E-03
Vanadium	--	1.05E+01	8.78E-02	--	2.72E-02	1.59E-02	4.3E-02	1.10E+00	3.9E-02	1.10E+01	3.9E-03
Bromide	3.16E-01	--	--	1.74E-02	--	--	1.7E-02	--	--	--	--
Chloride	1.64E+02	7.44E+01	--	9.03E+00	1.94E-01	--	9.2E+00	--	--	--	--
Nitrite as N	3.10E-02	--	--	1.71E-03	--	--	1.7E-03	--	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.48E+02	--	3.08E+00	3.86E-01	--	3.5E+00	--	--	--	--
Sulfate	--	4.69E+02	--	--	1.22E+00	--	1.2E+00	--	--	--	--
Hydrazine	5.56E-05	9.10E-04	0.00E+00	3.06E-06	2.37E-06	0.00E+00	5.4E-06	--	--	--	--
4,4'-Isopropylidenediphenol	5.93E-04	--	--	3.27E-05	--	--	3.3E-05	--	--	--	--
4-Nonylphenol (Tech.)	9.81E-03	--	--	5.40E-04	--	--	5.4E-04	--	--	--	--
Dimethylformamide	--	1.79E-01	0.00E+00	--	4.65E-04	0.00E+00	4.7E-04	--	--	--	--

Table - Upper South Ditch - CTE - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Kempore (Azodicarbonamide)	7.25E-01	--	--	3.99E-02	--	--	4.0E-02	--	--	--	--
C11-C22 Aromatics	--	1.71E+01	--	--	4.46E-02	--	4.5E-02	--	--	--	--
C19-C36 Aliphatics	--	2.90E+01	--	--	7.55E-02	--	7.5E-02	--	--	--	--
C9-C18 Aliphatics	--	2.60E+01	--	--	6.76E-02	--	6.8E-02	--	--	--	--

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Central Tendency Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Central Pond - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.8E-03	1.8E-02	1.2E-04	1.0E+00	7.0E-03	1.1E-01	7.3E-04	1.1E-01	7.3E-04
2,4,4-Trimethyl-2-pentene		5.7E-03	3.8E-02	2.1E-04	1.0E+00	5.8E-03	3.2E-01	1.8E-03	3.2E-01	1.8E-03
Acetone		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Methyl Tertbutyl Ether		1.6E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		5.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.7E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenol		2.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene		1.4E-01	3.5E-03	4.9E-04	1.1E+00	1.5E-01	4.2E-01	5.8E-02	4.2E-01	5.8E-02
Fluoranthene		2.5E-01	8.1E-03	2.0E-03	1.1E+00	2.6E-01	8.0E-01	2.0E-01	8.0E-01	2.0E-01
Phenanthrene		2.1E-01	2.0E-02	4.3E-03	1.0E+00	2.2E-01	3.0E-01	6.4E-02	3.0E-01	6.4E-02
Pyrene		2.1E-01	1.2E-02	2.4E-03	1.0E+00	2.1E-01	5.1E-01	1.1E-01	5.1E-01	1.1E-01
Aluminum	2.1E-01		5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	4.9E-02	4.6E+01	3.1E-02	1.4E+00	1.8E-02	8.3E-01	1.8E-02	8.3E-01	1.8E-02	8.3E-01
Beryllium		9.2E-02	2.0E-03	1.8E-04	9.0E-03	8.3E-04	9.0E-03	8.3E-04	9.0E-03	8.3E-04
Chromium		3.8E+01	8.2E-03	3.1E-01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent		2.4E-01	8.2E-03	2.0E-03	1.0E-01	2.4E-02	1.0E-01	2.4E-02	1.0E-01	2.4E-02
Lead		5.1E+01	3.5E-02	1.8E+00	6.6E-02	3.3E+00	6.6E-02	3.3E+00	6.6E-02	3.3E+00
Manganese	7.0E-01	5.2E+02	1.6E-02	8.2E+00	4.4E-02	2.3E+01	4.4E-02	2.3E+01	4.4E-02	2.3E+01
Tin		2.2E+00	6.0E-03	1.3E-02	--	--	--	--	--	--
Silver	1.5E-05		2.8E-03	--	4.1E-01	--	4.1E-01	--	4.1E-01	--
Vanadium		1.7E+01	9.7E-04	1.6E-02	8.4E-03	1.4E-01	8.4E-03	1.4E-01	8.4E-03	1.4E-01
Bromide	1.3E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		2.1E+01	--	--	--	--	--	--	--	--
Nitrite as N	7.5E-02		--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	2.6E+01	--	--	--	--	--	--	--	--
Sulfate		8.6E+02	--	--	--	--	--	--	--	--

Table - Environmental Protection Agency
Industrial Engineering Work Assessment Form
Environmental Protection Agency, Region 1
5 Post Office Square, Suite 100
Boston, Massachusetts

Date:	
Employee:	

Prepared by: [illegible]
Reviewed by: [illegible]

Step 1
Step 1 — Identify the Work Element
Step 2 — Determine the work element is a repetitive or non-repetitive task
Step 3 — Determine the work element is a recurring or non-recurring task
Step 4 — Determine the work element is a mandatory or discretionary task
Step 5 — Determine the work element is a priority or non-priority task
Step 6 — Determine the work element is a core or non-core task
Step 7 — Determine the work element is a service delivery or non-service delivery task
STEP 8 - Identify Training Requirements
STEP 9 - Identify Work Load Data
STEP 10 - Finding Analysis Data

Table - Central Pond - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	6.8E-03	1.2E-04	7.0E-03	7.3E-04	7.3E-04	--	2.1E-06	9.2E-06	6.5E-05	3.4E-06	3.4E-06	8.3E-05	4.1E-01	2.0E-04	4.1E+00	2.0E-05
2,4,4-Trimethyl-2-pentene	--	5.7E-03	2.1E-04	5.8E-03	1.8E-03	1.8E-03	--	1.8E-06	1.6E-05	5.4E-05	8.5E-06	8.5E-06	8.9E-05	4.1E-01	2.2E-04	4.1E+00	2.2E-05
Acetone	--	1.2E-01	--	--	--	--	--	3.6E-05	--	--	--	--	3.6E-05	2.0E+01	1.8E-06	1.0E+02	3.6E-07
Methyl Tertbutyl Ether	--	1.6E-03	--	--	--	--	--	4.9E-07	--	--	--	--	4.9E-07	--	--	--	--
3 & 4 Methylphenol	--	5.2E+00	--	--	--	--	--	1.6E-03	--	--	--	--	1.6E-03	1.0E+02	1.6E-05	1.0E+03	1.6E-06
Acetophenone	--	2.1E-01	--	--	--	--	--	6.4E-05	--	--	--	--	6.4E-05	8.0E+02	8.0E-08	8.0E+03	8.0E-09
Benzaldehyde	--	1.7E+00	--	--	--	--	--	5.1E-04	--	--	--	--	5.1E-04	4.3E+01	1.2E-05	8.6E+01	6.0E-06
Phenol	--	2.0E+00	--	--	--	--	--	6.1E-04	--	--	--	--	6.1E-04	4.0E+01	1.5E-05	5.4E+01	1.1E-05
Benzo(b)fluoranthene	--	1.4E-01	4.9E-04	1.5E-01	5.8E-02	5.8E-02	--	4.4E-05	3.7E-05	1.4E-03	2.7E-04	2.7E-04	2.0E-03	1.0E+00	2.0E-03	1.0E+01	2.0E-04
Fluoranthene	--	2.5E-01	2.0E-03	2.6E-01	2.0E-01	2.0E-01	--	7.8E-05	1.5E-04	2.4E-03	9.3E-04	9.3E-04	4.5E-03	2.5E+01	1.8E-04	5.0E+01	9.1E-05
Phenanthrene	--	2.1E-01	4.3E-03	2.2E-01	6.4E-02	6.4E-02	--	6.5E-05	3.2E-04	2.0E-03	3.0E-04	3.0E-04	3.0E-03	7.0E-01	4.3E-03	7.0E+00	4.3E-04
Pyrene	--	2.1E-01	2.4E-03	2.1E-01	1.1E-01	1.1E-01	--	6.4E-05	1.8E-04	2.0E-03	4.9E-04	4.9E-04	3.2E-03	1.5E+01	2.1E-04	2.5E+01	1.3E-04
Aluminum	2.1E-01	--	--	--	--	--	1.4E-02	--	--	--	--	--	1.4E-02	1.9E+00	7.1E-03	1.9E+01	7.1E-04
Barium	4.9E-02	4.6E+01	1.4E+00	8.3E-01	8.3E-01	8.3E-01	3.2E-03	1.4E-02	1.1E-01	7.7E-03	3.9E-03	3.9E-03	1.4E-01	5.2E+01	2.7E-03	1.2E+02	1.2E-03
Beryllium	--	9.2E-02	1.8E-04	8.3E-04	8.3E-04	8.3E-04	--	2.9E-05	1.4E-05	7.7E-06	3.9E-06	3.9E-06	5.8E-05	5.3E-01	1.1E-04	5.3E-01	1.1E-04
Chromium	--	3.8E+01	3.1E-01	4.0E+00	4.0E+00	4.0E+00	--	1.2E-02	2.3E-02	3.7E-02	1.9E-02	1.9E-02	1.1E-01	2.4E+00	4.6E-02	4.1E+01	2.7E-03
Chromium, Hexavalent	--	2.4E-01	2.0E-03	2.4E-02	2.4E-02	2.4E-02	--	7.5E-05	1.5E-04	2.2E-04	1.1E-04	1.1E-04	6.7E-04	2.2E+01	3.0E-05	2.2E+01	3.0E-05
Lead	--	5.1E+01	1.8E+00	3.3E+00	3.3E+00	3.3E+00	--	1.6E-02	1.3E-01	3.1E-02	1.6E-02	1.6E-02	2.1E-01	4.7E+00	4.5E-02	1.5E+02	1.4E-03
Manganese	7.0E-01	5.2E+02	8.2E+00	2.3E+01	2.3E+01	2.3E+01	4.6E-02	1.6E-01	6.1E-01	2.1E-01	1.0E-01	1.0E-01	1.2E+00	8.8E+01	1.4E-02	2.8E+02	4.3E-03
Tin	--	2.2E+00	1.3E-02	--	--	--	--	6.7E-04	9.6E-04	--	--	--	1.6E-03	2.3E+01	7.0E-05	3.5E+01	4.7E-05
Silver	1.5E-05	--	--	--	--	--	9.8E-07	--	--	--	--	--	9.8E-07	3.6E+01	2.7E-08	7.2E+01	1.4E-08
Vanadium	--	1.7E+01	1.6E-02	1.4E-01	1.4E-01	1.4E-01	--	5.1E-03	1.2E-03	1.3E-03	6.5E-04	6.5E-04	8.9E-03	2.1E-01	4.2E-02	2.1E+00	4.2E-03
Bromide	1.3E-01	--	--	--	--	--	8.5E-03	--	--	--	--	--	8.5E-03	--	--	--	--
Chloride	--	2.1E+01	--	--	--	--	--	6.5E-03	--	--	--	--	6.5E-03	--	--	--	--
Nitrite as N	7.5E-02	--	--	--	--	--	4.9E-03	--	--	--	--	--	4.9E-03	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	2.6E+01	--	--	--	--	1.8E+00	8.1E-03	--	--	--	--	1.8E+00	--	--	--	--
Sulfate	--	8.6E+02	--	--	--	--	--	2.7E-01	--	--	--	--	2.7E-01	--	--	--	--

Table - Central Pond - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Central Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Lower South Ditch - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.1E-02	1.8E-02	2.0E-04	1.0E+00	1.2E-02	1.1E-01	1.2E-03	1.1E-01	1.2E-03
2,4,4-Trimethyl-2-pentene	--	3.5E-03	3.8E-02	1.3E-04	1.0E+00	3.6E-03	3.2E-01	1.1E-03	3.2E-01	1.1E-03
Acetaldehyde	--	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	4.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	--	2.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--	--	--
Benzaldehyde	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-04	--	2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	2.4E-03	3.2E+02	3.1E-04	1.0E-01	1.1E+00	3.6E+02	1.0E+00	3.2E+02	1.0E+00	3.2E+02
Di-n-octylphthalate	--	1.5E-01	1.6E-04	2.4E-05	1.1E+00	1.7E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenyl ether	--	1.8E+00	2.9E-02	5.3E-02	1.0E+00	1.9E+00	2.1E-01	3.9E-01	2.1E-01	3.9E-01
Diphenylamine	--	6.2E-02	7.3E-02	4.6E-03	1.0E+00	6.4E-02	8.6E-01	5.3E-02	8.6E-01	5.3E-02
N-Nitrosodi-n-propylamine	3.5E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
4,4`-DDT	--	2.5E-02	1.4E-03	3.6E-05	1.1E+00	2.7E-02	1.7E+00	4.1E-02	1.7E+00	4.1E-02
Hexachlorobenzene	--	1.6E-02	4.5E-03	7.3E-05	1.1E+00	1.7E-02	9.0E-02	1.5E-03	9.0E-02	1.5E-03
Aluminum	4.9E+00	--	5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	2.4E-02	1.3E+01	3.1E-02	4.0E-01	1.8E-02	2.3E-01	1.8E-02	2.3E-01	1.8E-02	2.3E-01
Beryllium	6.1E-04	9.6E-01	2.0E-03	1.9E-03	9.0E-03	8.6E-03	9.0E-03	8.6E-03	9.0E-03	8.6E-03
Cadmium	--	5.6E-01	5.6E-02	3.1E-02	4.6E-01	2.5E-01	4.6E-01	2.5E-01	4.6E-01	2.5E-01
Chromium	1.1E+00	1.9E+03	8.2E-03	1.6E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	1.4E+01	8.2E-03	1.2E-01	1.0E-01	1.4E+00	1.0E-01	1.4E+00	1.0E-01	1.4E+00
Cobalt	2.8E-02	--	1.5E-03	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	9.0E-03	--	4.1E-02	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	5.9E+00	--	8.5E-04	--	7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	6.3E-04	--	3.5E-02	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.5E+00	--	1.6E-02	--	4.4E-02	--	4.4E-02	--	4.4E-02	--
Mercury	--	1.8E-01	2.6E-02	4.6E-03	2.8E+00	5.0E-01	2.8E+00	5.0E-01	2.8E+00	5.0E-01
Nickel	--	1.4E+01	4.7E-02	6.6E-01	8.2E-01	1.2E+01	8.2E-01	1.2E+01	8.2E-01	1.2E+01
Silver	1.7E-05	2.5E+01	2.8E-03	7.0E-02	4.1E-01	1.0E+01	4.1E-01	1.0E+01	4.1E-01	1.0E+01
Tin	--	1.6E+00	6.0E-03	9.6E-03	--	--	--	--	--	--
Vanadium	--	8.7E+00	9.7E-04	8.4E-03	8.4E-03	7.3E-02	8.4E-03	7.3E-02	8.4E-03	7.3E-02
Bromide	3.2E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.6E+02	1.3E+02	--	--	--	--	--	--	--	--

Table - Lower South Ditch - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Nitrite as N	3.1E-02	--	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.7E+02	--	--	--	--	--	--	--	--
Sulfate	--	6.9E+02	--	--	--	--	--	--	--	--
Hydrazine	5.6E-05	1.9E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4,4'-Isopropylidenediphenol	5.9E-04	--	9.3E-02	--	1.0E+00	--	1.2E+00	--	1.2E+00	--
4-Nonylphenol (Tech.)	9.8E-03	--	2.9E-03	--	1.1E+00	--	6.5E-03	--	6.5E-03	--
Kempore (Azodicarbonamid	7.3E-01	--	--	--	--	--	--	--	--	--
C11-C22 Aromatics	--	5.3E+03	--	--	--	--	--	--	--	--
C19-C36 Aliphatics	--	3.5E+03	--	--	--	--	--	--	--	--
C9-C18 Aliphatics	--	4.3E+02	--	--	--	--	--	--	--	--
EPH, Total	--	9.5E+03	--	--	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Lower South Ditch - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	1.1E-02	2.0E-04	1.2E-02	1.2E-03	1.2E-03	--	7.7E-07	3.3E-06	2.4E-05	1.2E-06	1.2E-06	3.0E-05	4.1E-01	7.4E-05	4.1E+00	7.4E-06
2,4,4-Trimethyl-2-pentene	--	3.5E-03	1.3E-04	3.6E-03	1.1E-03	1.1E-03	--	2.4E-07	2.2E-06	7.4E-06	1.2E-06	1.2E-06	1.2E-05	4.1E-01	3.0E-05	4.1E+00	3.0E-06
Acetaldehyde	--	6.3E-02	--	--	--	--	--	4.4E-06	--	--	--	--	4.4E-06	2.4E+01	1.8E-07	2.4E+02	1.8E-08
Acetone	--	1.2E-01	--	--	--	--	--	8.3E-06	--	--	--	--	8.3E-06	2.0E+01	4.2E-07	1.0E+02	8.3E-08
Formaldehyde	--	4.4E-01	--	--	--	--	--	3.0E-05	--	--	--	--	3.0E-05	1.0E-01	3.0E-04	1.0E+00	3.0E-05
Aniline	--	2.3E-01	--	--	--	--	--	1.6E-05	--	--	--	--	1.6E-05	2.0E+00	8.0E-06	2.0E+01	8.0E-07
Azobenzene	5.3E-04	--	--	--	--	--	7.7E-06	--	--	--	--	--	7.7E-06	--	--	--	--
Benzaldehyde	--	1.2E-01	--	--	--	--	--	8.3E-06	--	--	--	--	8.3E-06	4.3E+01	1.9E-07	8.6E+01	9.7E-08
Benzo(a)pyrene	1.5E-04	--	--	--	--	--	2.2E-06	--	--	--	--	--	2.2E-06	1.0E+00	2.2E-06	1.0E+01	2.2E-07
Bis(2-Ethylhexyl)phthalate	2.4E-03	3.2E+02	1.0E-01	3.6E+02	3.2E+02	3.2E+02	3.6E-05	2.2E-02	1.7E-03	7.4E-01	3.3E-01	3.3E-01	1.4E+00	1.8E+01	7.8E-02	1.8E+02	7.8E-03
Di-n-octylphthalate	--	1.5E-01	2.4E-05	1.7E-01	1.5E-01	1.5E-01	--	1.0E-05	4.0E-07	3.5E-04	1.6E-04	1.6E-04	6.7E-04	1.0E+02	6.7E-06	4.0E+02	1.7E-06
Diphenyl ether	--	1.8E+00	5.3E-02	1.9E+00	3.9E-01	3.9E-01	--	1.3E-04	8.7E-04	3.9E-03	4.0E-04	4.0E-04	5.7E-03	3.0E+00	1.9E-03	3.0E+01	1.9E-04
Diphenylamine	--	6.2E-02	4.6E-03	6.4E-02	5.3E-02	5.3E-02	--	4.3E-06	7.5E-05	1.3E-04	5.5E-05	5.5E-05	3.2E-04	3.3E+01	9.8E-06	3.3E+02	9.7E-07
N-Nitrosodi-n-propylamine	3.5E-06	--	--	--	--	--	5.1E-08	--	--	--	--	--	5.1E-08	7.3E-02	7.0E-07	7.3E-01	7.0E-08
4,4`-DDT	--	2.5E-02	3.6E-05	2.7E-02	4.1E-02	4.1E-02	--	1.7E-06	5.9E-07	5.5E-05	4.3E-05	4.3E-05	1.4E-04	8.0E-01	1.8E-04	4.0E+00	3.6E-05
Hexachlorobenzene	--	1.6E-02	7.3E-05	1.7E-02	1.5E-03	1.5E-03	--	1.1E-06	1.2E-06	3.6E-05	1.5E-06	1.5E-06	4.1E-05	3.2E-01	1.3E-04	1.6E+00	2.6E-05
Aluminum	4.9E+00	--	--	--	--	--	7.1E-02	--	--	--	--	--	7.1E-02	1.9E+00	3.7E-02	1.9E+01	3.7E-03
Barium	2.4E-02	1.3E+01	4.0E-01	2.3E-01	2.3E-01	2.3E-01	3.5E-04	8.9E-04	6.6E-03	4.8E-04	2.4E-04	2.4E-04	8.8E-03	5.2E+01	1.7E-04	1.2E+02	7.4E-05
Beryllium	6.1E-04	9.6E-01	1.9E-03	8.6E-03	8.6E-03	8.6E-03	8.9E-06	6.6E-05	3.2E-05	1.8E-05	8.9E-06	8.9E-06	1.4E-04	5.3E-01	2.7E-04	5.3E-01	2.7E-04
Cadmium	--	5.6E-01	3.1E-02	2.5E-01	2.5E-01	2.5E-01	--	3.8E-05	5.1E-04	5.3E-04	2.6E-04	2.6E-04	1.6E-03	1.9E+00	8.6E-04	7.1E+00	2.3E-04
Chromium	1.1E+00	1.9E+03	1.6E+01	4.0E+00	4.0E+00	4.0E+00	1.6E-02	1.3E-01	2.6E-01	8.3E-03	4.1E-03	4.1E-03	4.3E-01	2.4E+00	1.8E-01	4.1E+01	1.1E-02
Chromium, Hexavalent	--	1.4E+01	1.2E-01	1.4E+00	1.4E+00	1.4E+00	--	1.0E-03	2.0E-03	3.0E-03	1.5E-03	1.5E-03	9.0E-03	2.2E+01	4.1E-04	2.2E+01	4.1E-04
Cobalt	2.8E-02	--	--	--	--	--	4.2E-04	--	--	--	--	--	4.2E-04	--	--	--	--
Copper	9.0E-03	--	--	--	--	--	1.3E-04	--	--	--	--	--	1.3E-04	1.5E+01	8.7E-06	1.5E+02	8.7E-07
Iron	5.9E+00	--	--	--	--	--	8.6E-02	--	--	--	--	--	8.6E-02	--	--	--	--
Lead	6.3E-04	--	--	--	--	--	9.2E-06	--	--	--	--	--	9.2E-06	4.7E+00	2.0E-06	1.5E+02	6.0E-08
Manganese	1.5E+00	--	--	--	--	--	2.2E-02	--	--	--	--	--	2.2E-02	8.8E+01	2.5E-04	2.8E+02	7.7E-05
Mercury	--	1.8E-01	4.6E-03	5.0E-01	5.0E-01	5.0E-01	--	1.2E-05	7.6E-05	1.0E-03	5.2E-04	5.2E-04	2.2E-03	1.0E+00	2.2E-03	1.0E+01	2.2E-04
Nickel	--	1.4E+01	6.6E-01	1.2E+01	1.2E+01	1.2E+01	--	9.8E-04	1.1E-02	2.4E-02	1.2E-02	1.2E-02	6.0E-02	4.0E+01	1.5E-03	8.0E+01	7.5E-04
Silver	1.7E-05	2.5E+01	7.0E-02	1.0E+01	1.0E+01	1.0E+01	2.5E-07	1.7E-03	1.2E-03	2.1E-02	1.1E-02	1.1E-02	4.5E-02	3.6E+01	1.3E-03	7.2E+01	6.3E-04
Tin	--	1.6E+00	9.6E-03	--	--	--	--	1.1E-04	1.6E-04	--	--	--	2.7E-04	2.3E+01	1.2E-05	3.5E+01	7.7E-06
Vanadium	--	8.7E+00	8.4E-03	7.3E-02	7.3E-02	7.3E-02	--	6.0E-04	1.4E-04	1.5E-04	7.5E-05	7.5E-05	1.0E-03	2.1E-01	4.9E-03	2.1E+00	4.9E-04
Bromide	3.2E-01	--	--	--	--	--	4.6E-03	--	--	--	--	--	4.6E-03	--	--	--	--
Chloride	1.6E+02	1.3E+02	--	--	--	--	2.4E+00	9.2E-03	--	--	--	--	2.4E+00	--	--	--	--
Nitrite as N	3.1E-02	--	--	--	--	--	4.5E-04	--	--	--	--	--	4.5E-04	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.7E+02	--	--	--	--	8.2E-01	1.2E-02	--	--	--	--	8.3E-01	--	--	--	--
Sulfate	--	6.9E+02	--	--	--	--	--	4.8E-02	--	--	--	--	4.8E-02	--	--	--	--
Hydrazine	5.6E-05	1.9E-03	--	--	--	--	8.1E-07	1.3E-07	--	--	--	--	9.4E-07	2.5E+00	3.8E-07	5.0E+00	1.9E-07
4,4'-Isopropylidenediphenol	5.9E-04	--	--	--	--	--	8.7E-06	--	--	--	--	--	8.7E-06	--	--	--	--
4-Nonylphenol (Tech.)	9.8E-03	--	--	--	--	--	1.4E-04	--	--	--	--	--	1.4E-04	5.0E+00	2.9E-05	5.0E+01	2.9E-06
Kempore (Azodicarbonamid	7.3E-01	--	--	--	--	--	1.1E-02	--	--	--	--	--	1.1E-02	--	--	--	--
C11-C22 Aromatics	--	5.3E+03	--	--	--	--	--	3.6E-01	--	--	--	--	3.6E-01	--	--	--	--

Table - Lower South Ditch - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
C19-C36 Aliphatics	--	3.5E+03	--	--	--	--	--	2.5E-01	--	--	--	--	2.5E-01	--	--	--	--
C9-C18 Aliphatics	--	4.3E+02	--	--	--	--	--	3.0E-02	--	--	--	--	3.0E-02	--	--	--	--
EPH, Total	--	9.5E+03	--	--	--	--	--	6.5E-01	--	--	--	--	6.5E-01	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - North Pond - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.0E-03	1.8E-02	3.6E-05	1.0E+00	2.1E-03	1.1E-01	2.2E-04	1.1E-01	2.2E-04
Acetone	--	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	--	3.6E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)anthracene	1.2E-04	--	3.6E-03	--	1.1E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	1.2E-04	--	2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	--	1.8E+00	3.1E-04	5.7E-04	1.1E+00	2.0E+00	1.0E+00	1.8E+00	1.0E+00	1.8E+00
Carbazole	--	1.6E-01	5.5E-02	8.8E-03	1.0E+00	1.6E-01	5.6E-01	8.9E-02	5.6E-01	8.9E-02
Caprolactam	3.3E-04	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Pyrene	3.9E-04	--	1.2E-02	--	1.0E+00	--	5.1E-01	--	5.1E-01	--
Aluminum	1.5E-01	--	5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	8.3E+00	2.8E-02	2.3E-01	1.3E-01	1.0E+00	1.3E-01	1.0E+00	1.3E-01	1.0E+00
Barium	3.4E-02	4.1E+01	3.1E-02	1.3E+00	1.8E-02	7.4E-01	1.8E-02	7.4E-01	1.8E-02	7.4E-01
Beryllium	--	4.8E-01	2.0E-03	9.6E-04	9.0E-03	4.3E-03	9.0E-03	4.3E-03	9.0E-03	4.3E-03
Cadmium	--	1.4E+00	5.6E-02	7.9E-02	4.6E-01	6.5E-01	4.6E-01	6.5E-01	4.6E-01	6.5E-01
Chromium	--	2.8E+02	8.2E-03	2.3E+00	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	5.9E-01	8.2E-03	4.8E-03	1.0E-01	5.9E-02	1.0E-01	5.9E-02	1.0E-01	5.9E-02
Copper	--	4.5E+01	4.1E-02	1.9E+00	1.6E+00	7.5E+01	1.6E+00	7.5E+01	1.6E+00	7.5E+01
Iron	1.9E+00	1.6E+04	8.5E-04	1.3E+01	7.2E-03	1.1E+02	7.2E-03	1.1E+02	7.2E-03	1.1E+02
Lead	9.3E-04	6.9E+01	3.5E-02	2.4E+00	6.6E-02	4.5E+00	6.6E-02	4.5E+00	6.6E-02	4.5E+00
Manganese	3.9E-01	4.2E+02	1.6E-02	6.7E+00	4.4E-02	1.8E+01	4.4E-02	1.8E+01	4.4E-02	1.8E+01
Silver	2.2E-05	--	2.8E-03	--	4.1E-01	--	4.1E-01	--	4.1E-01	--
Thallium	--	7.6E-01	8.0E-04	6.0E-04	--	--	1.0E+00	7.6E-01	1.0E+00	7.6E-01
Tin	--	5.9E+00	6.0E-03	3.5E-02	--	--	--	--	--	--
Vanadium	--	2.3E+01	9.7E-04	2.3E-02	8.4E-03	2.0E-01	8.4E-03	2.0E-01	8.4E-03	2.0E-01
Zinc	--	2.9E+02	5.0E-02	1.5E+01	2.6E-02	7.5E+00	2.6E-02	7.5E+00	2.6E-02	7.5E+00
Bromide	2.8E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.9E+02	1.8E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	--	1.2E+01	--	--	--	--	--	--	--	--
Sulfate	--	1.8E+02	--	--	--	--	--	--	--	--

Table - North Pond - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - North Pond - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.0E-03	3.6E-05	2.1E-03	2.2E-04	2.2E-04	--	9.2E-07	4.0E-06	2.9E-05	1.5E-06	1.5E-06	3.7E-05	4.1E-01	8.9E-05	4.1E+00	8.9E-06
Acetone	--	2.1E-01	--	--	--	--	--	9.6E-05	--	--	--	--	9.6E-05	2.0E+01	4.8E-06	1.0E+02	9.6E-07
Carbon disulfide	--	3.6E-03	--	--	--	--	--	1.7E-06	--	--	--	--	1.7E-06	--	--	--	--
Benzo(a)anthracene	1.2E-04	--	--	--	--	--	1.2E-05	--	--	--	--	--	1.2E-05	1.0E+00	1.2E-05	1.0E+01	1.2E-06
Benzo(a)pyrene	1.2E-04	--	--	--	--	--	1.2E-05	--	--	--	--	--	1.2E-05	1.0E+00	1.2E-05	1.0E+01	1.2E-06
Bis(2-Ethylhexyl)phthalate	--	1.8E+00	5.7E-04	2.0E+00	1.8E+00	1.8E+00	--	8.4E-04	6.3E-05	2.8E-02	1.3E-02	1.3E-02	5.4E-02	1.8E+01	3.0E-03	1.8E+02	3.0E-04
Carbazole	--	1.6E-01	8.8E-03	1.6E-01	8.9E-02	8.9E-02	--	7.4E-05	9.7E-04	2.3E-03	6.2E-04	6.2E-04	4.6E-03	5.0E+00	9.1E-04	5.0E+01	9.1E-05
Caprolactam	3.3E-04	--	--	--	--	--	3.2E-05	--	--	--	--	--	3.2E-05	8.0E+02	4.0E-08	8.0E+03	4.0E-09
Pyrene	3.9E-04	--	--	--	--	--	3.8E-05	--	--	--	--	--	3.8E-05	1.5E+01	2.5E-06	2.5E+01	1.5E-06
Aluminum	1.5E-01	--	--	--	--	--	1.5E-02	--	--	--	--	--	1.5E-02	1.9E+00	7.7E-03	1.9E+01	7.7E-04
Arsenic	--	8.3E+00	2.3E-01	1.0E+00	1.0E+00	1.0E+00	--	3.8E-03	2.5E-02	1.4E-02	7.2E-03	7.2E-03	5.8E-02	1.3E-01	4.6E-01	1.3E+00	4.6E-02
Barium	3.4E-02	4.1E+01	1.3E+00	7.4E-01	7.4E-01	7.4E-01	3.3E-03	1.9E-02	1.4E-01	1.0E-02	5.1E-03	5.1E-03	1.8E-01	5.2E+01	3.5E-03	1.2E+02	1.5E-03
Beryllium	--	4.8E-01	9.6E-04	4.3E-03	4.3E-03	4.3E-03	--	2.2E-04	1.1E-04	5.9E-05	3.0E-05	3.0E-05	4.5E-04	5.3E-01	8.4E-04	5.3E-01	8.4E-04
Cadmium	--	1.4E+00	7.9E-02	6.5E-01	6.5E-01	6.5E-01	--	6.5E-04	8.7E-03	9.0E-03	4.5E-03	4.5E-03	2.7E-02	1.9E+00	1.5E-02	7.1E+00	3.8E-03
Chromium	--	2.8E+02	2.3E+00	4.0E+00	4.0E+00	4.0E+00	--	1.3E-01	2.5E-01	5.5E-02	2.8E-02	2.8E-02	4.9E-01	2.4E+00	2.0E-01	4.1E+01	1.2E-02
Chromium, Hexavalent	--	5.9E-01	4.8E-03	5.9E-02	5.9E-02	5.9E-02	--	2.7E-04	5.3E-04	8.1E-04	4.1E-04	4.1E-04	2.4E-03	2.2E+01	1.1E-04	2.2E+01	1.1E-04
Copper	--	4.5E+01	1.9E+00	7.5E+01	7.5E+01	7.5E+01	--	2.1E-02	2.1E-01	1.0E+00	5.2E-01	5.2E-01	2.3E+00	1.5E+01	1.5E-01	1.5E+02	1.5E-02
Iron	1.9E+00	1.6E+04	1.3E+01	1.1E+02	1.1E+02	1.1E+02	1.8E-01	7.2E+00	1.5E+00	1.5E+00	7.7E-01	7.7E-01	1.2E+01	--	--	--	--
Lead	9.3E-04	6.9E+01	2.4E+00	4.5E+00	4.5E+00	4.5E+00	9.1E-05	3.2E-02	2.7E-01	6.2E-02	3.1E-02	3.1E-02	4.2E-01	4.7E+00	9.0E-02	1.5E+02	2.7E-03
Manganese	3.9E-01	4.2E+02	6.7E+00	1.8E+01	1.8E+01	1.8E+01	3.8E-02	1.9E-01	7.4E-01	2.5E-01	1.3E-01	1.3E-01	1.5E+00	8.8E+01	1.7E-02	2.8E+02	5.2E-03
Silver	2.2E-05	--	--	--	--	--	2.1E-06	--	--	--	--	--	2.1E-06	3.6E+01	5.9E-08	7.2E+01	3.0E-08
Thallium	--	7.6E-01	6.0E-04	--	7.6E-01	7.6E-01	--	3.5E-04	6.7E-05	--	5.2E-03	5.2E-03	1.1E-02	4.6E-02	2.4E-01	4.6E-01	2.4E-02
Tin	--	5.9E+00	3.5E-02	--	--	--	--	2.7E-03	3.9E-03	--	--	--	6.6E-03	2.3E+01	2.8E-04	3.5E+01	1.9E-04
Vanadium	--	2.3E+01	2.3E-02	2.0E-01	2.0E-01	2.0E-01	--	1.1E-02	2.5E-03	2.7E-03	1.3E-03	1.3E-03	1.9E-02	2.1E-01	8.9E-02	2.1E+00	8.9E-03
Zinc	--	2.9E+02	1.5E+01	7.5E+00	7.5E+00	7.5E+00	--	1.3E-01	1.6E+00	1.0E-01	5.2E-02	5.2E-02	1.9E+00	7.5E+01	2.6E-02	2.6E+02	7.6E-03
Bromide	2.8E-01	--	--	--	--	--	2.7E-02	--	--	--	--	--	2.7E-02	--	--	--	--
Chloride	1.9E+02	1.8E+02	--	--	--	--	1.9E+01	8.5E-02	--	--	--	--	1.9E+01	--	--	--	--
Nitrogen, as Ammonia	--	1.2E+01	--	--	--	--	--	5.6E-03	--	--	--	--	5.6E-03	--	--	--	--
Sulfate	--	1.8E+02	--	--	--	--	--	8.4E-02	--	--	--	--	8.4E-02	--	--	--	--

Table - North Pond - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Off-PWD - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		2.3E-02	1.8E-02	4.2E-04	1.0E+00	2.4E-02	1.1E-01	2.5E-03	1.1E-01	2.5E-03
2,4,4-Trimethyl-2-pentene		6.0E-03	3.8E-02	2.3E-04	1.0E+00	6.2E-03	3.2E-01	1.9E-03	3.2E-01	1.9E-03
Formaldehyde		5.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	2.5E-03		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
3 & 4 Methylphenol	7.6E-04		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)anthracene	4.7E-04		3.6E-03	--	1.1E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	8.9E-04		2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Benzo(b)fluoranthene	1.6E-03		3.5E-03	--	1.1E+00	--	4.2E-01	--	4.2E-01	--
Benzo(ghi)perylene	9.9E-04		1.1E-03	--	1.1E+00	--	4.7E-02	--	4.7E-02	--
Benzo(k)fluoranthene	6.1E-04		2.3E-03	--	1.1E+00	--	2.9E-01	--	2.9E-01	--
Chrysene	1.2E-03		3.4E-03	--	1.1E+00	--	4.4E-01	--	4.4E-01	--
Dibenz(a,h)anthracene	3.9E-04		9.7E-04	--	1.1E+00	--	3.8E-01	--	3.8E-01	--
Indeno(1,2,3-cd)pyrene	8.8E-04		1.0E-03	--	1.1E+00	--	2.8E-01	--	2.8E-01	--
Phenanthrene	5.3E-04		2.0E-02	--	1.0E+00	--	3.0E-01	--	3.0E-01	--
Pyrene	3.1E-03		1.2E-02	--	1.0E+00	--	5.1E-01	--	5.1E-01	--
4-Chlorophenyl phenyl ether		4.4E-02	1.5E-02	6.6E-04	1.0E+00	4.6E-02	7.9E-02	3.5E-03	7.9E-02	3.5E-03
Carbazole		4.5E-02	5.5E-02	2.4E-03	1.0E+00	4.6E-02	5.6E-01	2.5E-02	5.6E-01	2.5E-02
Diphenyl ether		3.3E-01	2.9E-02	9.5E-03	1.0E+00	3.4E-01	2.1E-01	7.1E-02	2.1E-01	7.1E-02
Diphenylmethanone		9.1E-02	1.1E-01	1.0E-02	1.1E+00	9.5E-02	1.6E+00	1.4E-01	1.6E+00	1.4E-01
Aluminum	8.2E-01		5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	3.5E-02	1.2E+01	3.1E-02	3.7E-01	1.8E-02	2.1E-01	1.8E-02	2.1E-01	1.8E-02	2.1E-01
Chromium	5.0E-02	1.4E+03	8.2E-03	1.1E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Iron	1.6E+01		8.5E-04	--	7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	2.7E-03		3.5E-02	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	8.5E-01		1.6E-02	--	4.4E-02	--	4.4E-02	--	4.4E-02	--
Zinc	3.8E-02		5.0E-02	--	2.6E-02	--	2.6E-02	--	2.6E-02	--
Arsenic		1.0E+01	2.8E-02	2.8E-01	1.3E-01	1.3E+00	1.3E-01	1.3E+00	1.3E-01	1.3E+00
Beryllium		1.2E+00	2.0E-03	2.4E-03	9.0E-03	1.1E-02	9.0E-03	1.1E-02	9.0E-03	1.1E-02

Table - Off-PWD - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Copper		2.5E+01	4.1E-02	1.0E+00	1.6E+00	4.1E+01	1.6E+00	4.1E+01	1.6E+00	4.1E+01
Silver		2.4E+01	2.8E-03	6.6E-02	4.1E-01	9.6E+00	4.1E-01	9.6E+00	4.1E-01	9.6E+00
Vanadium		1.2E+01	9.7E-04	1.1E-02	8.4E-03	9.9E-02	8.4E-03	9.9E-02	8.4E-03	9.9E-02
Bromide	1.5E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Nitrite as N	2.0E-02		--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	4.5E+01	2.5E+02	--	--	--	--	--	--	--	--
Chloride		1.5E+02	--	--	--	--	--	--	--	--
Sulfate		7.0E+02	--	--	--	--	--	--	--	--
Hydrazine		1.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Off-PWD - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.3E-02	4.2E-04	2.4E-02	2.5E-03	2.5E-03	--	5.6E-06	2.4E-05	1.7E-04	9.0E-06	9.0E-06	2.2E-04	4.1E-01	5.4E-04	4.1E+00	5.4E-05
2,4,4-Trimethyl-2-pentene	--	6.0E-03	2.3E-04	6.2E-03	1.9E-03	1.9E-03	--	1.4E-06	1.3E-05	4.4E-05	6.9E-06	6.9E-06	7.2E-05	4.1E-01	1.8E-04	4.1E+00	1.8E-05
Formaldehyde	--	5.1E-01	--	--	--	--	--	1.2E-04	--	--	--	--	1.2E-04	1.0E-01	1.2E-03	1.0E+00	1.2E-04
Carbon disulfide	2.5E-03	--	--	--	--	--	1.3E-04	--	--	--	--	--	1.3E-04	--	--	--	--
3 & 4 Methylphenol	7.6E-04	--	--	--	--	--	3.8E-05	--	--	--	--	--	3.8E-05	1.0E+02	3.8E-07	1.0E+03	3.8E-08
Benzo(a)anthracene	4.7E-04	--	--	--	--	--	2.3E-05	--	--	--	--	--	2.3E-05	1.0E+00	2.3E-05	1.0E+01	2.3E-06
Benzo(a)pyrene	8.9E-04	--	--	--	--	--	4.5E-05	--	--	--	--	--	4.5E-05	1.0E+00	4.5E-05	1.0E+01	4.5E-06
Benzo(b)fluoranthene	1.6E-03	--	--	--	--	--	8.0E-05	--	--	--	--	--	8.0E-05	1.0E+00	8.0E-05	1.0E+01	8.0E-06
Benzo(ghi)perylene	9.9E-04	--	--	--	--	--	5.0E-05	--	--	--	--	--	5.0E-05	1.0E+00	5.0E-05	1.0E+01	5.0E-06
Benzo(k)fluoranthene	6.1E-04	--	--	--	--	--	3.1E-05	--	--	--	--	--	3.1E-05	1.0E+00	3.1E-05	1.0E+01	3.1E-06
Chrysene	1.2E-03	--	--	--	--	--	6.1E-05	--	--	--	--	--	6.1E-05	1.0E+00	6.1E-05	1.0E+01	6.1E-06
Dibenz(a,h)anthracene	3.9E-04	--	--	--	--	--	2.0E-05	--	--	--	--	--	2.0E-05	1.0E+00	2.0E-05	1.0E+01	2.0E-06
Indeno(1,2,3-cd)pyrene	8.8E-04	--	--	--	--	--	4.4E-05	--	--	--	--	--	4.4E-05	1.0E+00	4.4E-05	1.0E+01	4.4E-06
Phenanthrene	5.3E-04	--	--	--	--	--	2.7E-05	--	--	--	--	--	2.7E-05	7.0E-01	3.8E-05	7.0E+00	3.8E-06
Pyrene	3.1E-03	--	--	--	--	--	1.5E-04	--	--	--	--	--	1.5E-04	1.5E+01	1.0E-05	2.5E+01	6.2E-06
4-Chlorophenyl phenyl ether	--	4.4E-02	6.6E-04	4.6E-02	3.5E-03	3.5E-03	--	1.1E-05	3.8E-05	3.3E-04	1.3E-05	1.3E-05	4.0E-04	1.0E+03	4.0E-07	1.0E+04	4.0E-08
Carbazole	--	4.5E-02	2.4E-03	4.6E-02	2.5E-02	2.5E-02	--	1.1E-05	1.4E-04	3.3E-04	8.9E-05	8.9E-05	6.6E-04	5.0E+00	1.3E-04	5.0E+01	1.3E-05
Diphenyl ether	--	3.3E-01	9.5E-03	3.4E-01	7.1E-02	7.1E-02	--	7.9E-05	5.4E-04	2.4E-03	2.5E-04	2.5E-04	3.6E-03	3.0E+00	1.2E-03	3.0E+01	1.2E-04
Diphenylmethanone	--	9.1E-02	1.0E-02	9.5E-02	1.4E-01	1.4E-01	--	2.2E-05	5.8E-04	6.8E-04	5.1E-04	5.1E-04	2.3E-03	3.8E+01	6.1E-05	3.8E+02	6.1E-06
Aluminum	8.2E-01	--	--	--	--	--	4.1E-02	--	--	--	--	--	4.1E-02	1.9E+00	2.1E-02	1.9E+01	2.1E-03
Barium	3.5E-02	1.2E+01	3.7E-01	2.1E-01	2.1E-01	2.1E-01	1.7E-03	2.8E-03	2.1E-02	1.5E-03	7.6E-04	7.6E-04	2.8E-02	5.2E+01	5.5E-04	1.2E+02	2.4E-04
Chromium	5.0E-02	1.4E+03	1.1E+01	4.0E+00	4.0E+00	4.0E+00	2.5E-03	3.2E-01	6.3E-01	2.9E-02	1.4E-02	1.4E-02	1.0E+00	2.4E+00	4.2E-01	4.1E+01	2.5E-02
Iron	1.6E+01	--	--	--	--	--	8.2E-01	--	--	--	--	--	8.2E-01	--	--	--	--
Lead	2.7E-03	--	--	--	--	--	1.3E-04	--	--	--	--	--	1.3E-04	4.7E+00	2.9E-05	1.5E+02	8.7E-07
Manganese	8.5E-01	--	--	--	--	--	4.3E-02	--	--	--	--	--	4.3E-02	8.8E+01	4.9E-04	2.8E+02	1.5E-04
Zinc	3.8E-02	--	--	--	--	--	1.9E-03	--	--	--	--	--	1.9E-03	7.5E+01	2.5E-05	2.6E+02	7.4E-06
Arsenic	--	1.0E+01	2.8E-01	1.3E+00	1.3E+00	1.3E+00	--	2.4E-03	1.6E-02	9.1E-03	4.5E-03	4.5E-03	3.6E-02	1.3E-01	2.9E-01	1.3E+00	2.9E-02
Beryllium	--	1.2E+00	2.4E-03	1.1E-02	1.1E-02	1.1E-02	--	2.9E-04	1.4E-04	7.7E-05	3.9E-05	3.9E-05	5.8E-04	5.3E-01	1.1E-03	5.3E-01	1.1E-03
Copper	--	2.5E+01	1.0E+00	4.1E+01	4.1E+01	4.1E+01	--	5.9E-03	5.8E-02	2.9E-01	1.5E-01	1.5E-01	6.4E-01	1.5E+01	4.2E-02	1.5E+02	4.2E-03
Silver	--	2.4E+01	6.6E-02	9.6E+00	9.6E+00	9.6E+00	--	5.6E-03	3.8E-03	6.9E-02	3.4E-02	3.4E-02	1.5E-01	3.6E+01	4.1E-03	7.2E+01	2.0E-03
Vanadium	--	1.2E+01	1.1E-02	9.9E-02	9.9E-02	9.9E-02	--	2.8E-03	6.5E-04	7.0E-04	3.5E-04	3.5E-04	4.9E-03	2.1E-01	2.3E-02	2.1E+00	2.3E-03
Bromide	1.5E-01	--	--	--	--	--	7.5E-03	--	--	--	--	--	7.5E-03	--	--	--	--
Nitrite as N	2.0E-02	--	--	--	--	--	1.0E-03	--	--	--	--	--	1.0E-03	--	--	--	--
Nitrogen, as Ammonia	4.5E+01	2.5E+02	--	--	--	--	2.2E+00	6.1E-02	--	--	--	--	2.3E+00	--	--	--	--
Chloride	--	1.5E+02	--	--	--	--	--	3.5E-02	--	--	--	--	3.5E-02	--	--	--	--
Sulfate	--	7.0E+02	--	--	--	--	--	1.7E-01	--	--	--	--	1.7E-01	--	--	--	--
Hydrazine	--	1.3E-03	--	--	--	--	--	3.1E-07	--	--	--	--	3.1E-07	2.5E+00	1.2E-07	5.0E+00	6.2E-08

Table - Off-PWD - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Off-PWD

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - On PWD/WDW - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	3.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	4.2E+00	3.1E-04	1.3E-03	1.1E+00	4.7E+00	1.0E+00	4.2E+00	1.0E+00	4.2E+00
Benzene	9.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Barium	1.8E+01	3.1E-02	5.6E-01	1.8E-02	3.3E-01	1.8E-02	3.3E-01	1.8E-02	3.3E-01
Beryllium	2.5E-01	2.0E-03	4.9E-04	9.0E-03	2.2E-03	9.0E-03	2.2E-03	9.0E-03	2.2E-03
Cadmium	5.7E-01	5.6E-02	3.2E-02	4.6E-01	2.6E-01	4.6E-01	2.6E-01	4.6E-01	2.6E-01
Chromium	2.4E+01	8.2E-03	2.0E-01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Lead	5.0E+01	3.5E-02	1.7E+00	6.6E-02	3.3E+00	6.6E-02	3.3E+00	6.6E-02	3.3E+00
Mercury	2.3E-01	2.6E-02	5.9E-03	2.8E+00	6.6E-01	2.8E+00	6.6E-01	2.8E+00	6.6E-01
Vanadium	1.6E+01	9.7E-04	1.5E-02	8.4E-03	1.3E-01	8.4E-03	1.3E-01	8.4E-03	1.3E-01

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - On PWD/WDW - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	3.4E-01	--	--	--	--	1.6E-04	--	--	--	--	1.6E-04	2.0E+01	7.9E-06	1.0E+02	1.6E-06
Bis(2-Ethylhexyl)phthalate	4.2E+00	1.3E-03	4.7E+00	4.2E+00	4.2E+00	1.9E-03	1.5E-04	6.5E-02	2.9E-02	2.9E-02	1.3E-01	1.8E+01	6.8E-03	1.8E+02	6.8E-04
Benzene	9.3E-01	--	--	--	--	4.3E-04	--	--	--	--	4.3E-04	2.6E+01	1.6E-05	2.6E+02	1.6E-06
Barium	1.8E+01	5.6E-01	3.3E-01	3.3E-01	3.3E-01	8.3E-03	6.2E-02	4.5E-03	2.3E-03	2.3E-03	7.9E-02	5.2E+01	1.5E-03	1.2E+02	6.7E-04
Beryllium	2.5E-01	4.9E-04	2.2E-03	2.2E-03	2.2E-03	1.1E-04	5.5E-05	3.1E-05	1.5E-05	1.5E-05	2.3E-04	5.3E-01	4.3E-04	5.3E-01	4.3E-04
Cadmium	5.7E-01	3.2E-02	2.6E-01	2.6E-01	2.6E-01	2.7E-04	3.6E-03	3.6E-03	1.8E-03	1.8E-03	1.1E-02	1.9E+00	6.0E-03	7.1E+00	1.6E-03
Chromium	2.4E+01	2.0E-01	4.0E+00	4.0E+00	4.0E+00	1.1E-02	2.2E-02	5.5E-02	2.8E-02	2.8E-02	1.4E-01	2.4E+00	6.0E-02	4.1E+01	3.5E-03
Lead	5.0E+01	1.7E+00	3.3E+00	3.3E+00	3.3E+00	2.3E-02	1.9E-01	4.5E-02	2.3E-02	2.3E-02	3.1E-01	4.7E+00	6.5E-02	1.5E+02	2.0E-03
Mercury	2.3E-01	5.9E-03	6.6E-01	6.6E-01	6.6E-01	1.1E-04	6.6E-04	9.1E-03	4.5E-03	4.5E-03	1.9E-02	1.0E+00	1.9E-02	1.0E+01	1.9E-03
Vanadium	1.6E+01	1.5E-02	1.3E-01	1.3E-01	1.3E-01	7.2E-03	1.7E-03	1.8E-03	9.1E-04	9.1E-04	1.3E-02	2.1E-01	6.0E-02	2.1E+00	6.0E-03

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Storm Water Detention Basin - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		5.1E-03	1.8E-02	9.3E-05	1.0E+00	5.3E-03	1.1E-01	5.5E-04	1.1E-01	5.5E-04
2,4,4-Trimethyl-2-pentene		2.7E-03	3.8E-02	1.0E-04	1.0E+00	2.7E-03	3.2E-01	8.5E-04	3.2E-01	8.5E-04
Acetone		1.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		2.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		9.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		2.3E+00	3.1E-04	7.1E-04	1.1E+00	2.5E+00	1.0E+00	2.3E+00	1.0E+00	2.3E+00
Phenol		1.7E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
N-Nitrosodiphenylamine	7.4E-06		1.2E-01	--	1.1E+00	--	1.7E+00	--	1.7E+00	--
Benzo(a)pyrene		2.2E-01	2.2E-03	4.9E-04	1.1E+00	2.4E-01	2.2E-01	4.9E-02	2.2E-01	4.9E-02
Arsenic		1.1E+01	2.8E-02	3.0E-01	1.3E-01	1.4E+00	1.3E-01	1.4E+00	1.3E-01	1.4E+00
Barium	2.6E-02	5.0E+01	3.1E-02	1.5E+00	1.8E-02	9.0E-01	1.8E-02	9.0E-01	1.8E-02	9.0E-01
Beryllium		1.0E-01	2.0E-03	2.1E-04	9.0E-03	9.4E-04	9.0E-03	9.4E-04	9.0E-03	9.4E-04
Chromium		4.2E+01	8.2E-03	3.4E-01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Vanadium		2.1E+01	9.7E-04	2.0E-02	8.4E-03	1.7E-01	8.4E-03	1.7E-01	8.4E-03	1.7E-01
Chloride		9.7E+00	--	--	--	--	--	--	--	--
Nitrite as N	2.6E-02		--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	1.8E+01	--	--	--	--	--	--	--	--
Sulfate		1.4E+03	--	--	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Storm Water Detention Basin - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	5.1E-03	9.3E-05	5.3E-03	5.5E-04	5.5E-04	--	1.9E-06	8.4E-06	6.0E-05	3.1E-06	3.1E-06	7.7E-05	4.1E-01	1.9E-04	4.1E+00	1.9E-05
2,4,4-Trimethyl-2-pentene	--	2.7E-03	1.0E-04	2.7E-03	8.5E-04	8.5E-04	--	1.0E-06	9.1E-06	3.1E-05	4.9E-06	4.9E-06	5.1E-05	4.1E-01	1.2E-04	4.1E+00	1.2E-05
Acetone	--	1.4E-01	--	--	--	--	--	5.3E-05	--	--	--	--	5.3E-05	2.0E+01	2.7E-06	1.0E+02	5.3E-07
3 & 4 Methylphenol	--	2.9E+00	--	--	--	--	--	1.1E-03	--	--	--	--	1.1E-03	1.0E+02	1.1E-05	1.0E+03	1.1E-06
Acetophenone	--	1.6E-01	--	--	--	--	--	6.1E-05	--	--	--	--	6.1E-05	8.0E+02	7.6E-08	8.0E+03	7.6E-09
Benzaldehyde	--	9.6E-01	--	--	--	--	--	3.7E-04	--	--	--	--	3.7E-04	4.3E+01	8.5E-06	8.6E+01	4.3E-06
Bis(2-Ethylhexyl)phthalate	--	2.3E+00	7.1E-04	2.5E+00	2.3E+00	2.3E+00	--	8.7E-04	6.5E-05	2.9E-02	1.3E-02	1.3E-02	5.6E-02	1.8E+01	3.0E-03	1.8E+02	3.0E-04
Phenol	--	1.7E+00	--	--	--	--	--	6.3E-04	--	--	--	--	6.3E-04	4.0E+01	1.6E-05	5.4E+01	1.2E-05
N-Nitrosodiphenylamine	7.4E-06	--	--	--	--	--	5.9E-07	--	--	--	--	--	5.9E-07	2.0E+01	3.0E-08	2.0E+02	3.0E-09
Benzo(a)pyrene	--	2.2E-01	4.9E-04	2.4E-01	4.9E-02	4.9E-02	--	8.4E-05	4.4E-05	2.7E-03	2.8E-04	2.8E-04	3.4E-03	1.0E+00	3.4E-03	1.0E+01	3.4E-04
Arsenic	--	1.1E+01	3.0E-01	1.4E+00	1.4E+00	1.4E+00	--	4.1E-03	2.7E-02	1.5E-02	7.7E-03	7.7E-03	6.2E-02	1.3E-01	4.9E-01	1.3E+00	4.9E-02
Barium	2.6E-02	5.0E+01	1.5E+00	9.0E-01	9.0E-01	9.0E-01	2.1E-03	1.9E-02	1.4E-01	1.0E-02	5.1E-03	5.1E-03	1.8E-01	5.2E+01	3.5E-03	1.2E+02	1.5E-03
Beryllium	--	1.0E-01	2.1E-04	9.4E-04	9.4E-04	9.4E-04	--	4.0E-05	1.9E-05	1.1E-05	5.4E-06	5.4E-06	8.0E-05	5.3E-01	1.5E-04	5.3E-01	1.5E-04
Chromium	--	4.2E+01	3.4E-01	4.0E+00	4.0E+00	4.0E+00	--	1.6E-02	3.1E-02	4.6E-02	2.3E-02	2.3E-02	1.4E-01	2.4E+00	5.7E-02	4.1E+01	3.4E-03
Vanadium	--	2.1E+01	2.0E-02	1.7E-01	1.7E-01	1.7E-01	--	7.8E-03	1.8E-03	2.0E-03	9.8E-04	9.8E-04	1.4E-02	2.1E-01	6.4E-02	2.1E+00	6.4E-03
Chloride	--	9.7E+00	--	--	--	--	--	3.7E-03	--	--	--	--	3.7E-03	--	--	--	--
Nitrite as N	2.6E-02	--	--	--	--	--	2.1E-03	--	--	--	--	--	2.1E-03	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	1.8E+01	--	--	--	--	6.0E-01	6.9E-03	--	--	--	--	6.1E-01	--	--	--	--
Sulfate	--	1.4E+03	--	--	--	--	--	5.3E-01	--	--	--	--	5.3E-01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Upper South Ditch - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.8E-02	1.8E-02	3.3E-04	1.0E+00	1.9E-02	1.1E-01	2.0E-03	1.1E-01	2.0E-03
2,4,4-Trimethyl-2-pentene	--	2.9E-03	3.8E-02	1.1E-04	1.0E+00	2.9E-03	3.2E-01	9.2E-04	3.2E-01	9.2E-04
4-iso-Propyltoluene	--	1.8E-03	3.3E-02	5.9E-05	1.0E+00	1.8E-03	2.6E-01	4.7E-04	2.6E-01	4.7E-04
Acetaldehyde	--	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	7.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol	--	1.3E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone	--	9.0E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Benzaldehyde	--	3.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	2.4E-03	4.2E+01	3.1E-04	1.3E-02	1.1E+00	4.7E+01	1.0E+00	4.2E+01	1.0E+00	4.2E+01
Caprolactam	--	5.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Diphenyl ether	--	1.5E-01	2.9E-02	4.3E-03	1.0E+00	1.6E-01	2.1E-01	3.2E-02	2.1E-01	3.2E-02
Di-n-octylphthalate	--	1.5E-01	1.6E-04	2.4E-05	1.1E+00	1.7E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenylmethanone	--	3.1E-02	1.1E-01	3.4E-03	1.1E+00	3.2E-02	1.6E+00	4.8E-02	1.6E+00	4.8E-02
N-Nitrosodi-n-propylamine	3.5E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Phenol	--	7.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aluminum	4.9E+00	--	5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	5.3E+00	2.8E-02	1.5E-01	1.3E-01	6.8E-01	1.3E-01	6.8E-01	1.3E-01	6.8E-01
Barium	2.4E-02	2.7E+01	3.1E-02	8.4E-01	1.8E-02	4.9E-01	1.8E-02	4.9E-01	1.8E-02	4.9E-01
Beryllium	6.1E-04	4.4E-01	2.0E-03	8.8E-04	9.0E-03	4.0E-03	9.0E-03	4.0E-03	9.0E-03	4.0E-03
Chromium	1.1E+00	4.0E+02	8.2E-03	3.3E+00	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	7.0E+00	8.2E-03	5.7E-02	1.0E-01	7.0E-01	1.0E-01	7.0E-01	1.0E-01	7.0E-01
Cobalt	2.8E-02	--	1.5E-03	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	9.0E-03	--	4.1E-02	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	5.9E+00	1.2E+04	8.5E-04	1.1E+01	7.2E-03	9.0E+01	7.2E-03	9.0E+01	7.2E-03	9.0E+01
Lead	6.3E-04	--	3.5E-02	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.5E+00	--	1.6E-02	--	4.4E-02	--	4.4E-02	--	4.4E-02	--
Silver	1.7E-05	7.5E+00	2.8E-03	2.1E-02	4.1E-01	3.1E+00	4.1E-01	3.1E+00	4.1E-01	3.1E+00
Vanadium	--	1.0E+01	9.7E-04	1.0E-02	8.4E-03	8.8E-02	8.4E-03	8.8E-02	8.4E-03	8.8E-02
Bromide	3.2E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.6E+02	7.4E+01	--	--	--	--	--	--	--	--
Nitrite as N	3.1E-02	--	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.5E+02	--	--	--	--	--	--	--	--
Sulfate	--	4.7E+02	--	--	--	--	--	--	--	--

Table - Upper South Ditch - CTE - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Hydrazine	5.6E-05	9.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Upper South Ditch - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	1.8E-02	3.3E-04	1.9E-02	2.0E-03	2.0E-03	--	1.6E-06	6.8E-06	4.9E-05	2.5E-06	2.5E-06	6.2E-05	4.1E-01	1.5E-04	4.1E+00	1.5E-05
2,4,4-Trimethyl-2-pentene	--	2.9E-03	1.1E-04	2.9E-03	9.2E-04	9.2E-04	--	2.5E-07	2.2E-06	7.6E-06	1.2E-06	1.2E-06	1.2E-05	4.1E-01	3.0E-05	4.1E+00	3.0E-06
4-iso-Propyltoluene	--	1.8E-03	5.9E-05	1.8E-03	4.7E-04	4.7E-04	--	1.5E-07	1.2E-06	4.8E-06	6.1E-07	6.1E-07	7.4E-06	--	--	--	--
Acetaldehyde	--	8.3E-02	--	--	--	--	--	7.2E-06	--	--	--	--	7.2E-06	2.4E+01	3.0E-07	2.4E+02	3.0E-08
Formaldehyde	--	7.5E-01	--	--	--	--	--	6.4E-05	--	--	--	--	6.4E-05	1.0E-01	6.4E-04	1.0E+00	6.4E-05
3 & 4 Methylphenol	--	1.3E+00	--	--	--	--	--	1.1E-04	--	--	--	--	1.1E-04	1.0E+02	1.1E-06	1.0E+03	1.1E-07
Acetophenone	--	9.0E-02	--	--	--	--	--	7.8E-06	--	--	--	--	7.8E-06	8.0E+02	9.7E-09	8.0E+03	9.7E-10
Azobenzene	5.3E-04	--	--	--	--	--	9.7E-06	--	--	--	--	--	9.7E-06	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	--	--	--	--	2.7E-06	--	--	--	--	--	2.7E-06	1.0E+00	2.7E-06	1.0E+01	2.7E-07
Benzaldehyde	--	3.5E-01	--	--	--	--	--	3.0E-05	--	--	--	--	3.0E-05	4.3E+01	7.1E-07	8.6E+01	3.6E-07
Bis(2-Ethylhexyl)phthalate	2.4E-03	4.2E+01	1.3E-02	4.7E+01	4.2E+01	4.2E+01	4.4E-05	3.7E-03	2.7E-04	1.2E-01	5.5E-02	5.5E-02	2.4E-01	1.8E+01	1.3E-02	1.8E+02	1.3E-03
Caprolactam	--	5.3E-02	--	--	--	--	--	4.6E-06	--	--	--	--	4.6E-06	8.0E+02	5.7E-09	8.0E+03	5.7E-10
Diphenyl ether	--	1.5E-01	4.3E-03	1.6E-01	3.2E-02	3.2E-02	--	1.3E-05	8.9E-05	4.0E-04	4.2E-05	4.2E-05	5.9E-04	3.0E+00	2.0E-04	3.0E+01	2.0E-05
Di-n-octylphthalate	--	1.5E-01	2.4E-05	1.7E-01	1.5E-01	1.5E-01	--	1.3E-05	5.0E-07	4.4E-04	1.9E-04	1.9E-04	8.4E-04	1.0E+02	8.4E-06	4.0E+02	2.1E-06
Diphenylmethanone	--	3.1E-02	3.4E-03	3.2E-02	4.8E-02	4.8E-02	--	2.6E-06	7.1E-05	8.3E-05	6.2E-05	6.2E-05	2.8E-04	3.8E+01	7.4E-06	3.8E+02	7.4E-07
N-Nitrosodi-n-propylamine	3.5E-06	--	--	--	--	--	6.4E-08	--	--	--	--	--	6.4E-08	7.3E-02	8.8E-07	7.3E-01	8.8E-08
Phenol	--	7.2E-01	--	--	--	--	--	6.3E-05	--	--	--	--	6.3E-05	4.0E+01	1.6E-06	5.4E+01	1.2E-06
Aluminum	4.9E+00	--	--	--	--	--	8.9E-02	--	--	--	--	--	8.9E-02	1.9E+00	4.6E-02	1.9E+01	4.6E-03
Arsenic	--	5.3E+00	1.5E-01	6.8E-01	6.8E-01	6.8E-01	--	4.6E-04	3.1E-03	1.8E-03	8.8E-04	8.8E-04	7.0E-03	1.3E-01	5.6E-02	1.3E+00	5.6E-03
Barium	2.4E-02	2.7E+01	8.4E-01	4.9E-01	4.9E-01	4.9E-01	4.4E-04	2.3E-03	1.7E-02	1.3E-03	6.4E-04	6.4E-04	2.3E-02	5.2E+01	4.4E-04	1.2E+02	1.9E-04
Beryllium	6.1E-04	4.4E-01	8.8E-04	4.0E-03	4.0E-03	4.0E-03	1.1E-05	3.8E-05	1.8E-05	1.0E-05	5.1E-06	5.1E-06	8.8E-05	5.3E-01	1.6E-04	5.3E-01	1.6E-04
Chromium	1.1E+00	4.0E+02	3.3E+00	4.0E+00	4.0E+00	4.0E+00	2.0E-02	3.5E-02	6.9E-02	1.0E-02	5.2E-03	5.2E-03	1.4E-01	2.4E+00	6.0E-02	4.1E+01	3.6E-03
Chromium, Hexavalent	--	7.0E+00	5.7E-02	7.0E-01	7.0E-01	7.0E-01	--	6.0E-04	1.2E-03	1.8E-03	9.0E-04	9.0E-04	5.4E-03	2.2E+01	2.5E-04	2.2E+01	2.5E-04
Cobalt	2.8E-02	--	--	--	--	--	5.2E-04	--	--	--	--	--	5.2E-04	--	--	--	--
Copper	9.0E-03	--	--	--	--	--	1.6E-04	--	--	--	--	--	1.6E-04	1.5E+01	1.1E-05	1.5E+02	1.1E-06
Iron	5.9E+00	1.2E+04	1.1E+01	9.0E+01	9.0E+01	9.0E+01	1.1E-01	1.1E+00	2.2E-01	2.3E-01	1.2E-01	1.2E-01	1.9E+00	--	--	--	--
Lead	6.3E-04	--	--	--	--	--	1.1E-05	--	--	--	--	--	1.1E-05	4.7E+00	2.4E-06	1.5E+02	7.5E-08
Manganese	1.5E+00	--	--	--	--	--	2.7E-02	--	--	--	--	--	2.7E-02	8.8E+01	3.1E-04	2.8E+02	9.6E-05
Silver	1.7E-05	7.5E+00	2.1E-02	3.1E+00	3.1E+00	3.1E+00	3.1E-07	6.5E-04	4.3E-04	7.9E-03	3.9E-03	3.9E-03	1.7E-02	3.6E+01	4.7E-04	7.2E+01	2.3E-04
Vanadium	--	1.0E+01	1.0E-02	8.8E-02	8.8E-02	8.8E-02	--	9.0E-04	2.1E-04	2.3E-04	1.1E-04	1.1E-04	1.6E-03	2.1E-01	7.5E-03	2.1E+00	7.5E-04
Bromide	3.2E-01	--	--	--	--	--	5.8E-03	--	--	--	--	--	5.8E-03	--	--	--	--
Chloride	1.6E+02	7.4E+01	--	--	--	--	3.0E+00	6.4E-03	--	--	--	--	3.0E+00	--	--	--	--
Nitrite as N	3.1E-02	--	--	--	--	--	5.7E-04	--	--	--	--	--	5.7E-04	--	--	--	--
Nitrogen, as Ammonia	5.6E+01	1.5E+02	--	--	--	--	1.0E+00	1.3E-02	--	--	--	--	1.0E+00	--	--	--	--
Sulfate	--	4.7E+02	--	--	--	--	--	4.1E-02	--	--	--	--	4.1E-02	--	--	--	--
Hydrazine	5.6E-05	9.1E-04	--	--	--	--	1.0E-06	7.9E-08	--	--	--	--	1.1E-06	2.5E+00	4.4E-07	5.0E+00	2.2E-07

Table - Upper South Ditch - CTE - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - CTE
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Central Pond - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Central Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.78E-03	1.82E-02	1.23E-04	1.04E+00	7.02E-03	1.08E-01	7.28E-04
2,4,4-Trimethyl-2-pentene		5.68E-03	3.78E-02	2.14E-04	1.03E+00	5.84E-03	3.23E-01	1.83E-03
Acetone		1.15E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methyl Tertbutyl Ether		1.58E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		5.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetophenone		2.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde		1.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenol		1.95E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene		1.40E-01	3.53E-03	4.95E-04	1.07E+00	1.49E-01	4.16E-01	5.82E-02
Fluoranthene		2.50E-01	8.06E-03	2.02E-03	1.05E+00	2.63E-01	7.97E-01	1.99E-01
Phenanthrene		2.10E-01	2.05E-02	4.30E-03	1.03E+00	2.17E-01	3.04E-01	6.38E-02
Pyrene		2.05E-01	1.17E-02	2.40E-03	1.04E+00	2.14E-01	5.14E-01	1.05E-01
Aluminum	2.10E-01		5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	4.90E-02	4.55E+01	3.12E-02	1.42E+00	1.82E-02	8.28E-01	1.82E-02	8.28E-01
Beryllium		9.20E-02	2.00E-03	1.84E-04	9.00E-03	8.28E-04	9.00E-03	8.28E-04
Chromium		3.83E+01	8.20E-03	3.14E-01	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent		2.40E-01	8.20E-03	1.97E-03	1.00E-01	2.40E-02	1.00E-01	2.40E-02
Lead		5.05E+01	3.50E-02	1.77E+00	6.60E-02	3.33E+00	6.60E-02	3.33E+00
Manganese	7.00E-01	5.15E+02	1.58E-02	8.16E+00	4.38E-02	2.25E+01	4.38E-02	2.25E+01
Tin		2.15E+00	6.00E-03	1.29E-02	--	--	--	--
Silver	1.50E-05		2.80E-03	--	4.09E-01	--	4.09E-01	--
Vanadium		1.65E+01	9.70E-04	1.60E-02	8.40E-03	1.39E-01	8.40E-03	1.39E-01
Bromide	1.30E-01		0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride		2.10E+01	--	--	--	--	--	--
Nitrite as N	7.50E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	2.80E+01	2.60E+01	--	--	--	--	--	--
Sulfate		8.55E+02	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Central Pond - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Central Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	6.78E-03	1.23E-04	7.02E-03	7.28E-04	--	6.69E-09	6.80E-09	4.85E-08	5.03E-09	6.7E-08	4.10E-01	1.6E-07	4.10E+00	1.6E-08
2,4,4-Trimethyl-2-pentene	--	5.68E-03	2.14E-04	5.84E-03	1.83E-03	--	5.60E-09	1.18E-08	4.03E-08	1.26E-08	7.0E-08	4.10E-01	1.7E-07	4.10E+00	1.7E-08
Acetone	--	1.15E-01	0.00E+00	0.00E+00	0.00E+00	--	1.14E-07	0.00E+00	0.00E+00	0.00E+00	1.1E-07	2.00E+01	5.7E-09	1.00E+02	1.1E-09
Methyl Tertbutyl Ether	--	1.58E-03	0.00E+00	0.00E+00	0.00E+00	--	1.56E-09	0.00E+00	0.00E+00	0.00E+00	1.6E-09	--	--	--	--
3 & 4 Methylphenol	--	5.20E+00	0.00E+00	0.00E+00	0.00E+00	--	5.13E-06	0.00E+00	0.00E+00	0.00E+00	5.1E-06	1.00E+02	5.1E-08	1.00E+03	5.1E-09
Acetophenone	--	2.05E-01	0.00E+00	0.00E+00	0.00E+00	--	2.02E-07	0.00E+00	0.00E+00	0.00E+00	2.0E-07	8.00E+02	2.5E-10	8.00E+03	2.5E-11
Benzaldehyde	--	1.65E+00	0.00E+00	0.00E+00	0.00E+00	--	1.63E-06	0.00E+00	0.00E+00	0.00E+00	1.6E-06	4.29E+01	3.8E-08	8.57E+01	1.9E-08
Phenol	--	1.95E+00	0.00E+00	0.00E+00	0.00E+00	--	1.93E-06	0.00E+00	0.00E+00	0.00E+00	1.9E-06	4.00E+01	4.8E-08	5.35E+01	3.6E-08
Benzo(b)fluoranthene	--	1.40E-01	4.95E-04	1.49E-01	5.82E-02	--	1.38E-07	2.73E-08	1.03E-06	4.02E-07	1.6E-06	1.00E+00	1.6E-06	1.00E+01	1.6E-07
Fluoranthene	--	2.50E-01	2.02E-03	2.63E-01	1.99E-01	--	2.47E-07	1.11E-07	1.82E-06	1.38E-06	3.6E-06	2.50E+01	1.4E-07	5.00E+01	7.1E-08
Phenanthrene	--	2.10E-01	4.30E-03	2.17E-01	6.38E-02	--	2.07E-07	2.38E-07	1.50E-06	4.41E-07	2.4E-06	7.00E-01	3.4E-06	7.00E+00	3.4E-07
Pyrene	--	2.05E-01	2.40E-03	2.14E-01	1.05E-01	--	2.02E-07	1.33E-07	1.48E-06	7.28E-07	2.5E-06	1.50E+01	1.7E-07	2.50E+01	1.0E-07
Aluminum	2.10E-01	--	--	--	--	1.45E-05	--	--	--		1.5E-05	1.93E+00	7.5E-06	1.93E+01	7.5E-07
Barium	4.90E-02	4.55E+01	1.42E+00	8.28E-01	8.28E-01	3.39E-06	4.49E-05	7.85E-05	5.72E-06	5.72E-06	1.4E-04	5.18E+01	2.7E-06	1.19E+02	1.2E-06
Beryllium	--	9.20E-02	1.84E-04	8.28E-04	8.28E-04	--	9.08E-08	1.02E-08	5.72E-09	5.72E-09	1.1E-07	5.32E-01	2.1E-07	5.32E-01	2.1E-07
Chromium	--	3.83E+01	3.14E-01	4.00E+00	4.00E+00	--	3.78E-05	1.74E-05	2.76E-05	2.76E-05	1.1E-04	2.40E+00	4.6E-05	4.06E+01	2.7E-06
Chromium, Hexavalent	--	2.40E-01	1.97E-03	2.40E-02	2.40E-02	--	2.37E-07	1.09E-07	1.66E-07	1.66E-07	6.8E-07	2.20E+01	3.1E-08	2.20E+01	3.1E-08
Lead	--	5.05E+01	1.77E+00	3.33E+00	3.33E+00	--	4.99E-05	9.77E-05	2.30E-05	2.30E-05	1.9E-04	4.70E+00	4.1E-05	1.54E+02	1.3E-06
Manganese	7.00E-01	5.15E+02	8.16E+00	2.25E+01	2.25E+01	4.85E-05	5.08E-04	4.51E-04	1.56E-04	1.56E-04	1.3E-03	8.80E+01	1.5E-05	2.84E+02	4.6E-06
Tin	--	2.15E+00	1.29E-02	--	--	--	2.12E-06	7.13E-07	--		2.8E-06	2.34E+01	1.2E-07	3.50E+01	8.1E-08
Silver	1.50E-05	--	--	--	--	1.04E-09	--	--	--		1.0E-09	3.62E+01	2.9E-11	7.25E+01	1.4E-11
Vanadium	--	1.65E+01	1.60E-02	1.39E-01	1.39E-01	--	1.63E-05	8.85E-07	9.58E-07	9.58E-07	1.9E-05	2.10E-01	9.1E-05	2.10E+00	9.1E-06
Bromide	1.30E-01	--	--	--	--	9.01E-06	--	--	--		9.0E-06	--	--	--	--
Chloride	--	2.10E+01	--	--	--	--	2.07E-05	--	--		2.1E-05	--	--	--	--
Nitrite as N	7.50E-02	--	--	--	--	5.20E-06	--	--	--		5.2E-06	--	--	--	--
Nitrogen, as Ammonia	2.80E+01	2.60E+01	--	--	--	1.94E-03	2.57E-05	--	--		2.0E-03	--	--	--	--
Sulfate	--	8.55E+02	--	--	--	--	8.44E-04	--	--		8.4E-04	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Lower South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.11E-02	1.82E-02	2.02E-04	1.04E+00	1.15E-02	1.08E-01	1.20E-03
2,4,4-Trimethyl-2-pentene	--	3.50E-03	3.78E-02	1.32E-04	1.03E+00	3.60E-03	3.23E-01	1.13E-03
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	--	4.35E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Aniline	--	2.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)pyrene	1.50E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Bis(2-Ethylhexyl)phthalate	2.44E-03	3.22E+02	3.13E-04	1.01E-01	1.12E+00	3.60E+02	1.00E+00	3.22E+02
Di-n-octylphthalate	--	1.50E-01	1.61E-04	2.42E-05	1.13E+00	1.70E-01	1.00E+00	1.50E-01
Diphenyl ether	--	1.84E+00	2.86E-02	5.25E-02	1.03E+00	1.90E+00	2.13E-01	3.91E-01
Diphenylamine	--	6.20E-02	7.35E-02	4.55E-03	1.03E+00	6.41E-02	8.57E-01	5.31E-02
N-Nitrosodi-n-propylamine	3.51E-06	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
4,4`-DDT	--	2.47E-02	1.45E-03	3.57E-05	1.09E+00	2.68E-02	1.67E+00	4.12E-02
Hexachlorobenzene	--	1.63E-02	4.49E-03	7.33E-05	1.06E+00	1.73E-02	9.00E-02	1.47E-03
Aluminum	4.90E+00	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	2.43E-02	1.28E+01	3.12E-02	4.00E-01	1.82E-02	2.34E-01	1.82E-02	2.34E-01
Beryllium	6.08E-04	9.60E-01	2.00E-03	1.92E-03	9.00E-03	8.64E-03	9.00E-03	8.64E-03
Cadmium	--	5.55E-01	5.60E-02	3.11E-02	4.59E-01	2.55E-01	4.59E-01	2.55E-01
Chromium	1.10E+00	1.92E+03	8.20E-03	1.58E+01	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent	--	1.45E+01	8.20E-03	1.19E-01	1.00E-01	1.45E+00	1.00E-01	1.45E+00
Cobalt	2.85E-02	--	1.49E-03	--	2.44E-02	--	2.44E-02	--
Copper	9.02E-03	--	4.12E-02	--	1.65E+00	--	1.65E+00	--
Iron	5.91E+00	--	8.50E-04	--	7.20E-03	--	7.20E-03	--
Lead	6.30E-04	--	3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	1.49E+00	--	1.58E-02	--	4.38E-02	--	4.38E-02	--
Mercury	--	1.78E-01	2.57E-02	4.56E-03	2.84E+00	5.04E-01	2.84E+00	5.04E-01
Nickel	--	1.41E+01	4.70E-02	6.64E-01	8.18E-01	1.16E+01	8.18E-01	1.16E+01
Silver	1.70E-05	2.51E+01	2.80E-03	7.04E-02	4.09E-01	1.03E+01	4.09E-01	1.03E+01
Tin	--	1.60E+00	6.00E-03	9.60E-03	--	--	--	--
Vanadium	--	8.65E+00	9.70E-04	8.39E-03	8.40E-03	7.27E-02	8.40E-03	7.27E-02
Bromide	3.16E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	1.64E+02	1.33E+02	--	--	--	--	--	--
Nitrite as N	3.10E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.72E+02	--	--	--	--	--	--
Sulfate	--	6.90E+02	--	--	--	--	--	--
Hydrazine	5.56E-05	1.85E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	5.93E-04	--	9.33E-02	--	1.04E+00	--	1.21E+00	--
4-Nonylphenol (Tech.)	9.81E-03	--	2.93E-03	--	1.07E+00	--	6.48E-03	--

Table Lower South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Kempore (Azodicarbonamide)	7.25E-01	--	--	--	--	--	--	--
C11-C22 Aromatics	--	5.25E+03	--	--	--	--	--	--
C19-C36 Aliphatics	--	3.55E+03	--	--	--	--	--	--
C9-C18 Aliphatics	--	4.33E+02	--	--	--	--	--	--
EPH, Total	--	9.45E+03	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Lower South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	1.11E-02	2.02E-04	1.15E-02	1.20E-03	--	2.44E-09	2.48E-09	1.77E-08	1.84E-09	2.4E-08	4.10E-01	6.0E-08	4.10E+00	6.0E-09
2,4,4-Trimethyl-2-pentene	--	3.50E-03	1.32E-04	3.60E-03	1.13E-03	--	7.68E-10	1.62E-09	5.53E-09	1.73E-09	9.7E-09	4.10E-01	2.4E-08	4.10E+00	2.4E-09
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00	0.00E+00	--	1.38E-08	0.00E+00	0.00E+00	0.00E+00	1.4E-08	2.40E+01	5.8E-10	2.40E+02	5.8E-11
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	2.63E-08	0.00E+00	0.00E+00	0.00E+00	2.6E-08	2.00E+01	1.3E-09	1.00E+02	2.6E-10
Formaldehyde	--	4.35E-01	0.00E+00	0.00E+00	0.00E+00	--	9.54E-08	0.00E+00	0.00E+00	0.00E+00	9.5E-08	1.00E-01	9.5E-07	1.00E+00	9.5E-08
Aniline	--	2.30E-01	0.00E+00	0.00E+00	0.00E+00	--	5.05E-08	0.00E+00	0.00E+00	0.00E+00	5.0E-08	2.00E+00	2.5E-08	2.00E+01	2.5E-09
Azobenzene	5.30E-04	--	--	--	--	8.16E-09	--	--	--	--	8.2E-09	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	2.63E-08	0.00E+00	0.00E+00	0.00E+00	2.6E-08	4.29E+01	6.1E-10	8.57E+01	3.1E-10
Benzo(a)pyrene	1.50E-04	--	--	--	--	2.31E-09	--	--	--	--	2.3E-09	1.00E+00	2.3E-09	1.00E+01	2.3E-10
Bis(2-Ethylhexyl)phthalate	2.44E-03	3.22E+02	1.01E-01	3.60E+02	3.22E+02	3.76E-08	7.06E-05	1.24E-06	5.52E-04	4.94E-04	1.1E-03	1.83E+01	6.1E-05	1.83E+02	6.1E-06
Di-n-octylphthalate	--	1.50E-01	2.42E-05	1.70E-01	1.50E-01	--	3.29E-08	2.97E-10	2.61E-07	2.30E-07	5.2E-07	1.00E+02	5.2E-09	4.00E+02	1.3E-09
Diphenyl ether	--	1.84E+00	5.25E-02	1.90E+00	3.91E-01	--	4.04E-07	6.45E-07	2.91E-06	6.01E-07	4.6E-06	3.00E+00	1.5E-06	3.00E+01	1.5E-07
Diphenylamine	--	6.20E-02	4.55E-03	6.41E-02	5.31E-02	--	1.36E-08	5.59E-08	9.84E-08	8.16E-08	2.5E-07	3.30E+01	7.6E-09	3.33E+02	7.5E-10
N-Nitrosodi-n-propylamine	3.51E-06	--	--	--	--	5.40E-11	--	--	--	--	5.4E-11	7.29E-02	7.4E-10	7.29E-01	7.4E-11
4,4`-DDT	--	2.47E-02	3.57E-05	2.68E-02	4.12E-02	--	5.41E-09	4.39E-10	4.11E-08	6.33E-08	1.1E-07	8.00E-01	1.4E-07	4.00E+00	2.8E-08
Hexachlorobenzene	--	1.63E-02	7.33E-05	1.73E-02	1.47E-03	--	3.58E-09	9.01E-10	2.66E-08	2.26E-09	3.3E-08	3.20E-01	1.0E-07	1.60E+00	2.1E-08
Aluminum	4.90E+00	--	--	--	--	7.54E-05	--	--	--	--	7.5E-05	1.93E+00	3.9E-05	1.93E+01	3.9E-06
Barium	2.43E-02	1.28E+01	4.00E-01	2.34E-01	2.34E-01	3.73E-07	2.82E-06	4.92E-06	3.59E-07	3.59E-07	8.8E-06	5.18E+01	1.7E-07	1.19E+02	7.4E-08
Beryllium	6.08E-04	9.60E-01	1.92E-03	8.64E-03	8.64E-03	9.36E-09	2.11E-07	2.36E-08	1.33E-08	1.33E-08	2.7E-07	5.32E-01	5.1E-07	5.32E-01	5.1E-07
Cadmium	--	5.55E-01	3.11E-02	2.55E-01	2.55E-01	--	1.22E-07	3.82E-07	3.91E-07	3.91E-07	1.3E-06	1.86E+00	6.9E-07	7.10E+00	1.8E-07
Chromium	1.10E+00	1.92E+03	1.58E+01	4.00E+00	4.00E+00	1.69E-05	4.22E-04	1.94E-04	6.14E-06	6.14E-06	6.4E-04	2.40E+00	2.7E-04	4.06E+01	1.6E-05
Chromium, Hexavalent	--	1.45E+01	1.19E-01	1.45E+00	1.45E+00	--	3.17E-06	1.46E-06	2.22E-06	2.22E-06	9.1E-06	2.20E+01	4.1E-07	2.20E+01	4.1E-07
Cobalt	2.85E-02	--	--	--	--	4.39E-07	--	--	--	--	4.4E-07	--	--	--	--
Copper	9.02E-03	--	--	--	--	1.39E-07	--	--	--	--	1.4E-07	1.52E+01	9.1E-09	1.52E+02	9.1E-10
Iron	5.91E+00	--	--	--	--	9.10E-05	--	--	--	--	9.1E-05	--	--	--	--
Lead	6.30E-04	--	--	--	--	9.70E-09	--	--	--	--	9.7E-09	4.70E+00	2.1E-09	1.54E+02	6.3E-11
Manganese	1.49E+00	--	--	--	--	2.30E-05	--	--	--	--	2.3E-05	8.80E+01	2.6E-07	2.84E+02	8.1E-08
Mercury	--	1.78E-01	4.56E-03	5.04E-01	5.04E-01	--	3.89E-08	5.61E-08	7.73E-07	7.73E-07	1.6E-06	1.01E+00	1.6E-06	1.01E+01	1.6E-07
Nickel	--	1.41E+01	6.64E-01	1.16E+01	1.16E+01	--	3.10E-06	8.16E-06	1.78E-05	1.78E-05	4.7E-05	4.00E+01	1.2E-06	8.00E+01	5.8E-07
Silver	1.70E-05	2.51E+01	7.04E-02	1.03E+01	1.03E+01	2.62E-10	5.51E-06	8.64E-07	1.58E-05	1.58E-05	3.8E-05	3.62E+01	1.0E-06	7.25E+01	5.2E-07
Tin	--	1.60E+00	9.60E-03	--	--	--	3.51E-07	1.18E-07	--	--	4.7E-07	2.34E+01	2.0E-08	3.50E+01	1.3E-08
Vanadium	--	8.65E+00	8.39E-03	7.27E-02	7.27E-02	--	1.90E-06	1.03E-07	1.12E-07	1.12E-07	2.2E-06	2.10E-01	1.1E-05	2.10E+00	1.1E-06
Bromide	3.16E-01	--	--	--	--	4.87E-06	--	--	--	--	4.9E-06	--	--	--	--
Chloride	1.64E+02	1.33E+02	--	--	--	2.52E-03	2.93E-05	--	--	--	2.6E-03	--	--	--	--
Nitrite as N	3.10E-02	--	--	--	--	4.77E-07	--	--	--	--	4.8E-07	--	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.72E+02	--	--	--	8.62E-04	3.78E-05	--	--	--	9.0E-04	--	--	--	--
Sulfate	--	6.90E+02	--	--	--	--	1.51E-04	--	--	--	1.5E-04	--	--	--	--
Hydrazine	5.56E-05	1.85E-03	0.00E+00	0.00E+00	0.00E+00	8.56E-10	4.06E-10	0.00E+00	0.00E+00	0.00E+00	1.3E-09	2.50E+00	5.0E-10	5.00E+00	2.5E-10
4,4'-Isopropylidenediphenol	5.93E-04	--	--	--	--	9.13E-09	--	--	--	--	9.1E-09	--	--	--	--
4-Nonylphenol (Tech.)	9.81E-03	--	--	--	--	1.51E-07	--	--	--	--	1.5E-07	5.00E+00	3.0E-08	5.00E+01	3.0E-09
Kempore (Azodicarbonamide)	7.25E-01	--	--	--	--	1.12E-05	--	--	--	--	1.1E-05	--	--	--	--
C11-C22 Aromatics	--	5.25E+03	--	--	--	--	1.15E-03	--	--	--	1.2E-03	--	--	--	--
C19-C36 Aliphatics	--	3.55E+03	--	--	--	--	7.78E-04	--	--	--	7.8E-04	--	--	--	--
C9-C18 Aliphatics	--	4.33E+02	--	--	--	--	9.50E-05	--	--	--	9.5E-05	--	--	--	--
EPH, Total	--	9.45E+03	--	--	--	--	2.07E-03	--	--	--	2.1E-03	--	--	--	--

Table Lower South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Lower South Ditch

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table North Pond - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	North Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-03	1.82E-02	3.63E-05	1.04E+00	2.07E-03	1.08E-01	2.15E-04
Acetone	--	2.09E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon disulfide	--	3.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.19E-04	--	3.63E-03	--	1.07E+00	--	3.36E-01	--
Benzo(a)pyrene	1.23E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Bis(2-Ethylhexyl)phthalate	--	1.83E+00	3.13E-04	5.72E-04	1.12E+00	2.04E+00	1.00E+00	1.83E+00
Carbazole	--	1.60E-01	5.48E-02	8.77E-03	1.03E+00	1.65E-01	5.59E-01	8.95E-02
Caprolactam	3.30E-04	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Pyrene	3.90E-04	--	1.17E-02	--	1.04E+00	--	5.14E-01	--
Aluminum	1.53E-01	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Arsenic	--	8.25E+00	2.79E-02	2.30E-01	1.27E-01	1.05E+00	1.27E-01	1.05E+00
Barium	3.38E-02	4.08E+01	3.12E-02	1.27E+00	1.82E-02	7.42E-01	1.82E-02	7.42E-01
Beryllium	--	4.78E-01	2.00E-03	9.55E-04	9.00E-03	4.30E-03	9.00E-03	4.30E-03
Cadmium	--	1.41E+00	5.60E-02	7.91E-02	4.59E-01	6.48E-01	4.59E-01	6.48E-01
Chromium	--	2.78E+02	8.20E-03	2.28E+00	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent	--	5.86E-01	8.20E-03	4.81E-03	1.00E-01	5.86E-02	1.00E-01	5.86E-02
Copper	--	4.54E+01	4.12E-02	1.87E+00	1.65E+00	7.48E+01	1.65E+00	7.48E+01
Iron	1.87E+00	1.55E+04	8.50E-04	1.32E+01	7.20E-03	1.12E+02	7.20E-03	1.12E+02
Lead	9.30E-04	6.85E+01	3.50E-02	2.40E+00	6.60E-02	4.52E+00	6.60E-02	4.52E+00
Manganese	3.90E-01	4.20E+02	1.58E-02	6.65E+00	4.38E-02	1.84E+01	4.38E-02	1.84E+01
Silver	2.20E-05	--	2.80E-03	--	4.09E-01	--	4.09E-01	--
Thallium	--	7.55E-01	8.00E-04	6.04E-04	--	--	1.00E+00	7.55E-01
Tin	--	5.85E+00	6.00E-03	3.51E-02	--	--	--	--
Vanadium	--	2.33E+01	9.70E-04	2.26E-02	8.40E-03	1.95E-01	8.40E-03	1.95E-01
Zinc	--	2.88E+02	5.05E-02	1.45E+01	2.60E-02	7.48E+00	2.60E-02	7.48E+00
Bromide	2.80E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	1.90E+02	1.84E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	--	1.22E+01	--	--	--	--	--	--
Sulfate	--	1.83E+02	--	--	--	--	--	--

Table North Pond - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	North Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table North Pond - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	North Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-03	3.63E-05	2.07E-03	2.15E-04	--	1.76E-08	1.78E-08	1.27E-07	1.32E-08	1.8E-07	4.10E-01	4.3E-07	4.10E+00	4.3E-08
Acetone	--	2.09E-01	0.00E+00	0.00E+00	0.00E+00	--	1.83E-06	0.00E+00	0.00E+00	0.00E+00	1.8E-06	2.00E+01	9.2E-08	1.00E+02	1.8E-08
Carbon disulfide	--	3.61E-03	0.00E+00	0.00E+00	0.00E+00	--	3.17E-08	0.00E+00	0.00E+00	0.00E+00	3.2E-08	--	--	--	--
Benzo(a)anthracene	1.19E-04	--	--	--	--	7.33E-08	--	--	--	--	7.3E-08	1.00E+00	7.3E-08	1.00E+01	7.3E-09
Benzo(a)pyrene	1.23E-04	--	--	--	--	7.54E-08	--	--	--	--	7.5E-08	1.00E+00	7.5E-08	1.00E+01	7.5E-09
Bis(2-Ethylhexyl)phthalate	--	1.83E+00	5.72E-04	2.04E+00	1.83E+00	--	1.60E-05	2.81E-07	1.25E-04	1.12E-04	2.5E-04	1.83E+01	1.4E-05	1.83E+02	1.4E-06
Carbazole	--	1.60E-01	8.77E-03	1.65E-01	8.95E-02	--	1.40E-06	4.31E-06	1.01E-05	5.50E-06	2.1E-05	5.00E+00	4.3E-06	5.00E+01	4.3E-07
Caprolactam	3.30E-04	--	--	--	--	2.03E-07	--	--	--	--	2.0E-07	8.00E+02	2.5E-10	8.00E+03	2.5E-11
Pyrene	3.90E-04	--	--	--	--	2.40E-07	--	--	--	--	2.4E-07	1.50E+01	1.6E-08	2.50E+01	9.6E-09
Aluminum	1.53E-01	--	--	--	--	9.39E-05	--	--	--	--	9.4E-05	1.93E+00	4.9E-05	1.93E+01	4.9E-06
Arsenic	--	8.25E+00	2.30E-01	1.05E+00	1.05E+00	--	7.24E-05	1.13E-04	6.44E-05	6.44E-05	3.1E-04	1.26E-01	2.5E-03	1.26E+00	2.5E-04
Barium	3.38E-02	4.08E+01	1.27E+00	7.42E-01	7.42E-01	2.08E-05	3.58E-04	6.25E-04	4.56E-05	4.56E-05	1.1E-03	5.18E+01	2.1E-05	1.19E+02	9.2E-06
Beryllium	--	4.78E-01	9.55E-04	4.30E-03	4.30E-03	--	4.19E-06	4.69E-07	2.64E-07	2.64E-07	5.2E-06	5.32E-01	9.8E-06	5.32E-01	9.8E-06
Cadmium	--	1.41E+00	7.91E-02	6.48E-01	6.48E-01	--	1.24E-05	3.89E-05	3.98E-05	3.98E-05	1.3E-04	1.86E+00	7.0E-05	7.10E+00	1.8E-05
Chromium	--	2.78E+02	2.28E+00	4.00E+00	4.00E+00	--	2.44E-03	1.12E-03	2.46E-04	2.46E-04	4.0E-03	2.40E+00	1.7E-03	4.06E+01	1.0E-04
Chromium, Hexavalent	--	5.86E-01	4.81E-03	5.86E-02	5.86E-02	--	5.15E-06	2.36E-06	3.60E-06	3.60E-06	1.5E-05	2.20E+01	6.7E-07	2.20E+01	6.7E-07
Copper	--	4.54E+01	1.87E+00	7.48E+01	7.48E+01	--	3.98E-04	9.19E-04	4.59E-03	4.59E-03	1.1E-02	1.52E+01	6.9E-04	1.52E+02	6.9E-05
Iron	1.87E+00	1.55E+04	1.32E+01	1.12E+02	1.12E+02	1.15E-03	1.36E-01	6.47E-03	6.85E-03	6.85E-03	1.6E-01	--	--	--	--
Lead	9.30E-04	6.85E+01	2.40E+00	4.52E+00	4.52E+00	5.73E-07	6.01E-04	1.18E-03	2.78E-04	2.78E-04	2.3E-03	4.70E+00	5.0E-04	1.54E+02	1.5E-05
Manganese	3.90E-01	4.20E+02	6.65E+00	1.84E+01	1.84E+01	2.40E-04	3.69E-03	3.27E-03	1.13E-03	1.13E-03	9.5E-03	8.80E+01	1.1E-04	2.84E+02	3.3E-05
Silver	2.20E-05	--	--	--	--	1.35E-08	--	--	--	--	1.4E-08	3.62E+01	3.7E-10	7.25E+01	1.9E-10
Thallium	--	7.55E-01	6.04E-04	--	7.55E-01	--	6.63E-06	2.97E-07	--	4.64E-05	5.3E-05	4.60E-02	1.2E-03	4.60E-01	1.2E-04
Tin	--	5.85E+00	3.51E-02	--	--	--	5.13E-05	1.72E-05	--	--	6.9E-05	2.34E+01	2.9E-06	3.50E+01	2.0E-06
Vanadium	--	2.33E+01	2.26E-02	1.95E-01	1.95E-01	--	2.04E-04	1.11E-05	1.20E-05	1.20E-05	2.4E-04	2.10E-01	1.1E-03	2.10E+00	1.1E-04
Zinc	--	2.88E+02	1.45E+01	7.48E+00	7.48E+00	--	2.52E-03	7.13E-03	4.59E-04	4.59E-04	1.1E-02	7.54E+01	1.4E-04	2.55E+02	4.1E-05
Bromide	2.80E-01	--	--	--	--	1.72E-04	--	--	--	--	1.7E-04	--	--	--	--
Chloride	1.90E+02	1.84E+02	--	--	--	1.17E-01	1.61E-03	--	--	--	1.2E-01	--	--	--	--
Nitrogen, as Ammonia	--	1.22E+01	--	--	--	--	1.07E-04	--	--	--	1.1E-04	--	--	--	--
Sulfate	--	1.83E+02	--	--	--	--	1.60E-03	--	--	--	1.6E-03	--	--	--	--

Table North Pond - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	North Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Off-PWD - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Off-PWD

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene		2.33E-02	1.82E-02	4.24E-04	1.04E+00	2.42E-02	1.08E-01	2.51E-03
2,4,4-Trimethyl-2-pentene		6.00E-03	3.78E-02	2.27E-04	1.03E+00	6.17E-03	3.23E-01	1.94E-03
Formaldehyde		5.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon disulfide	2.50E-03		0.00E+00	--	0.00E+00	--	0.00E+00	--
3 & 4 Methylphenol	7.60E-04		0.00E+00	--	0.00E+00	--	0.00E+00	--
Benzo(a)anthracene	4.66E-04		3.63E-03	--	1.07E+00	--	3.36E-01	--
Benzo(a)pyrene	8.87E-04		2.22E-03	--	1.08E+00	--	2.23E-01	--
Benzo(b)fluoranthene	1.59E-03		3.53E-03	--	1.07E+00	--	4.16E-01	--
Benzo(ghi)perylene	9.92E-04		1.14E-03	--	1.09E+00	--	4.70E-02	--
Benzo(k)fluoranthene	6.09E-04		2.28E-03	--	1.08E+00	--	2.91E-01	--
Chrysene	1.21E-03		3.40E-03	--	1.07E+00	--	4.38E-01	--
Dibenz(a,h)anthracene	3.92E-04		9.72E-04	--	1.09E+00	--	3.77E-01	--
Indeno(1,2,3-cd)pyrene	8.81E-04		1.04E-03	--	1.09E+00	--	2.81E-01	--
Phenanthrene	5.32E-04		2.05E-02	--	1.03E+00	--	3.04E-01	--
Pyrene	3.06E-03		1.17E-02	--	1.04E+00	--	5.14E-01	--
4-Chlorophenyl phenyl ether		4.42E-02	1.49E-02	6.57E-04	1.04E+00	4.59E-02	7.94E-02	3.51E-03
Carbazole		4.47E-02	5.48E-02	2.45E-03	1.03E+00	4.60E-02	5.59E-01	2.50E-02
Diphenyl ether		3.33E-01	2.86E-02	9.49E-03	1.03E+00	3.43E-01	2.13E-01	7.07E-02
Diphenylmethanone		9.05E-02	1.12E-01	1.02E-02	1.05E+00	9.54E-02	1.58E+00	1.43E-01
Aluminum	8.20E-01		5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	3.45E-02	1.17E+01	3.12E-02	3.65E-01	1.82E-02	2.13E-01	1.82E-02	2.13E-01
Chromium	4.95E-02	1.35E+03	8.20E-03	1.11E+01	--	4.00E+00	--	4.00E+00
Iron	1.64E+01		8.50E-04	--	7.20E-03	--	7.20E-03	--
Lead	2.68E-03		3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	8.53E-01		1.58E-02	--	4.38E-02	--	4.38E-02	--
Zinc	3.75E-02		5.05E-02	--	2.60E-02	--	2.60E-02	--
Arsenic		1.00E+01	2.79E-02	2.79E-01	1.27E-01	1.27E+00	1.27E-01	1.27E+00
Beryllium		1.20E+00	2.00E-03	2.40E-03	9.00E-03	1.08E-02	9.00E-03	1.08E-02
Copper		2.47E+01	4.12E-02	1.02E+00	1.65E+00	4.06E+01	1.65E+00	4.06E+01
Silver		2.36E+01	2.80E-03	6.60E-02	4.09E-01	9.64E+00	4.09E-01	9.64E+00
Vanadium		1.17E+01	9.70E-04	1.14E-02	8.40E-03	9.86E-02	8.40E-03	9.86E-02
Bromide	1.48E-01		0.00E+00	--	0.00E+00	--	0.00E+00	--
Nitrite as N	2.00E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	4.45E+01	2.54E+02	--	--	--	--	--	--
Chloride		1.47E+02	--	--	--	--	--	--
Sulfate		6.97E+02	--	--	--	--	--	--
Hydrazine		1.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table Off-PWD - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Off-PWD

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Off-PWD - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Off-PWD

Cas No	COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
107-39-1	2,4,4-Trimethyl-1-pentene	--	2.33E-02	4.24E-04	2.42E-02	2.51E-03	--	1.77E-08	1.80E-08	1.28E-07	1.33E-08	1.8E-07	4.10E-01	4.3E-07	4.10E+00	4.3E-08
107-40-4	2,4,4-Trimethyl-2-pentene	--	6.00E-03	2.27E-04	6.17E-03	1.94E-03	--	4.54E-09	9.60E-09	3.27E-08	1.03E-08	5.7E-08	4.10E-01	1.4E-07	4.10E+00	1.4E-08
50-00-0	Formaldehyde	--	5.05E-01	0.00E+00	0.00E+00	0.00E+00	--	3.82E-07	0.00E+00	0.00E+00	0.00E+00	3.8E-07	1.00E-01	3.8E-06	1.00E+00	3.8E-07
75-15-0	Carbon disulfide	2.50E-03	--	--	--	--	1.33E-07	--	--	--	--	1.3E-07	--	--	--	--
15831-10-4	3 & 4 Methylphenol	7.60E-04	--	--	--	--	4.04E-08	--	--	--	--	4.0E-08	1.00E+02	4.0E-10	1.00E+03	4.0E-11
56-55-3	Benzo(a)anthracene	4.66E-04	--	--	--	--	2.47E-08	--	--	--	--	2.5E-08	1.00E+00	2.5E-08	1.00E+01	2.5E-09
50-32-8	Benzo(a)pyrene	8.87E-04	--	--	--	--	4.71E-08	--	--	--	--	4.7E-08	1.00E+00	4.7E-08	1.00E+01	4.7E-09
205-99-2	Benzo(b)fluoranthene	1.59E-03	--	--	--	--	8.47E-08	--	--	--	--	8.5E-08	1.00E+00	8.5E-08	1.00E+01	8.5E-09
191-24-2	Benzo(ghi)perylene	9.92E-04	--	--	--	--	5.27E-08	--	--	--	--	5.3E-08	1.00E+00	5.3E-08	1.00E+01	5.3E-09
207-08-9	Benzo(k)fluoranthene	6.09E-04	--	--	--	--	3.24E-08	--	--	--	--	3.2E-08	1.00E+00	3.2E-08	1.00E+01	3.2E-09
218-01-9	Chrysene	1.21E-03	--	--	--	--	6.45E-08	--	--	--	--	6.4E-08	1.00E+00	6.4E-08	1.00E+01	6.4E-09
53-70-3	Dibenz(a,h)anthracene	3.92E-04	--	--	--	--	2.08E-08	--	--	--	--	2.1E-08	1.00E+00	2.1E-08	1.00E+01	2.1E-09
193-39-5	Indeno(1,2,3-cd)pyrene	8.81E-04	--	--	--	--	4.68E-08	--	--	--	--	4.7E-08	1.00E+00	4.7E-08	1.00E+01	4.7E-09
85-01-8	Phenanthrene	5.32E-04	--	--	--	--	2.82E-08	--	--	--	--	2.8E-08	7.00E-01	4.0E-08	7.00E+00	4.0E-09
129-00-0	Pyrene	3.06E-03	--	--	--	--	1.62E-07	--	--	--	--	1.6E-07	1.50E+01	1.1E-08	2.50E+01	6.5E-09
7005-72-3	4-Chlorophenyl phenyl ether	--	4.42E-02	6.57E-04	4.59E-02	3.51E-03	--	3.34E-08	2.78E-08	2.43E-07	1.86E-08	3.2E-07	1.00E+03	3.2E-10	1.00E+04	3.2E-11
86-74-8	Carbazole	--	4.47E-02	2.45E-03	4.60E-02	2.50E-02	--	3.38E-08	1.04E-07	2.43E-07	1.32E-07	5.1E-07	5.00E+00	1.0E-07	5.00E+01	1.0E-08
101-84-8	Diphenyl ether	--	3.33E-01	9.49E-03	3.43E-01	7.07E-02	--	2.52E-07	4.02E-07	1.82E-06	3.74E-07	2.8E-06	3.00E+00	9.5E-07	3.00E+01	9.5E-08
119-61-9	Diphenylmethanone	--	9.05E-02	1.02E-02	9.54E-02	1.43E-01	--	6.85E-08	4.31E-07	5.05E-07	7.57E-07	1.8E-06	3.80E+01	4.6E-08	3.80E+02	4.6E-09
7429-90-5	Aluminum	8.20E-01	--	--	--	--	4.35E-05	--	--	--	--	4.4E-05	1.93E+00	2.3E-05	1.93E+01	2.3E-06
7440-39-3	Barium	3.45E-02	1.17E+01	3.65E-01	2.13E-01	2.13E-01	1.83E-06	8.86E-06	1.55E-05	1.13E-06	1.13E-06	2.8E-05	5.18E+01	5.5E-07	1.19E+02	2.4E-07
7440-47-3	Chromium	4.95E-02	1.35E+03	1.11E+01	4.00E+00	4.00E+00	2.63E-06	1.02E-03	4.69E-04	2.12E-05	2.12E-05	1.5E-03	2.40E+00	6.4E-04	4.06E+01	3.8E-05
7439-89-6	Iron	1.64E+01	--	--	--	--	8.68E-04	--	--	--	--	8.7E-04	--	--	--	--
7439-92-1	Lead	2.68E-03	--	--	--	--	1.42E-07	--	--	--	--	1.4E-07	4.70E+00	3.0E-08	1.54E+02	9.2E-10
7439-96-5	Manganese	8.53E-01	--	--	--	--	4.53E-05	--	--	--	--	4.5E-05	8.80E+01	5.1E-07	2.84E+02	1.6E-07
7440-66-6	Zinc	3.75E-02	--	--	--	--	1.99E-06	--	--	--	--	2.0E-06	7.54E+01	2.6E-08	2.55E+02	7.8E-09
7440-38-2	Arsenic	--	1.00E+01	2.79E-01	1.27E+00	1.27E+00	--	7.57E-06	1.18E-05	6.73E-06	6.73E-06	3.3E-05	1.26E-01	2.6E-04	1.26E+00	2.6E-05
7440-41-7	Beryllium	--	1.20E+00	2.40E-03	1.08E-02	1.08E-02	--	9.08E-07	1.02E-07	5.72E-08	5.72E-08	1.1E-06	5.32E-01	2.1E-06	5.32E-01	2.1E-06
7440-50-8	Copper	--	2.47E+01	1.02E+00	4.06E+01	4.06E+01	--	1.87E-05	4.31E-05	2.15E-04	2.15E-04	4.9E-04	1.52E+01	3.2E-05	1.52E+02	3.2E-06
7440-22-4	Silver	--	2.36E+01	6.60E-02	9.64E+00	9.64E+00	--	1.78E-05	2.80E-06	5.11E-05	5.11E-05	1.2E-04	3.62E+01	3.4E-06	7.25E+01	1.7E-06
7440-62-2	Vanadium	--	1.17E+01	1.14E-02	9.86E-02	9.86E-02	--	8.88E-06	4.82E-07	5.22E-07	5.22E-07	1.0E-05	2.10E-01	5.0E-05	2.10E+00	5.0E-06
24959-67-9	Bromide	1.48E-01	--	--	--	--	7.88E-06	--	--	--	--	7.9E-06	--	--	--	--
14797-65-0	Nitrite as N	2.00E-02	--	--	--	--	1.06E-06	--	--	--	--	1.1E-06	--	--	--	--
HLA0043	Nitrogen, as Ammonia	4.45E+01	2.54E+02	--	--	--	2.36E-03	1.93E-04	--	--	--	2.6E-03	--	--	--	--
16887-00-6	Chloride	--	1.47E+02	--	--	--	--	1.11E-04	--	--	--	1.1E-04	--	--	--	--
14808-79-8	Sulfate	--	6.97E+02	--	--	--	--	5.27E-04	--	--	--	5.3E-04	--	--	--	--
302-01-2	Hydrazine	--	1.30E-03	0.00E+00	0.00E+00	0.00E+00	--	9.84E-10	0.00E+00	0.00E+00	0.00E+00	9.8E-10	2.50E+00	3.9E-10	5.00E+00	2.0E-10

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient

Table Off-PWD - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Off-PWD

C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment

LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table On-PWD/WDW - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	On PWD/WDW

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Acetone	--	3.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	--	4.20E+00	3.13E-04	1.32E-03	1.12E+00	4.69E+00	1.00E+00	4.20E+00
Benzene	--	9.29E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Barium	--	1.80E+01	3.12E-02	5.62E-01	1.82E-02	3.28E-01	1.82E-02	3.28E-01
Beryllium	--	2.47E-01	2.00E-03	4.95E-04	9.00E-03	2.23E-03	9.00E-03	2.23E-03
Cadmium	--	5.74E-01	5.60E-02	3.22E-02	4.59E-01	2.64E-01	4.59E-01	2.64E-01
Chromium	--	2.43E+01	8.20E-03	1.99E-01	--	4.00E+00	--	4.00E+00
Lead	--	4.97E+01	3.50E-02	1.74E+00	6.60E-02	3.28E+00	6.60E-02	3.28E+00
Mercury	--	2.31E-01	2.57E-02	5.94E-03	2.84E+00	6.56E-01	2.84E+00	6.56E-01
Vanadium	--	1.57E+01	9.70E-04	1.52E-02	8.40E-03	1.32E-01	8.40E-03	1.32E-01

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table On-PWD/WDW - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	On PWD/WDW

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Acetone	--	3.40E-01	0.00E+00	0.00E+00	0.00E+00	--	1.49E-06	0.00E+00	0.00E+00	0.00E+00	1.5E-06	2.00E+01	7.5E-08	1.00E+02	1.5E-08
Bis(2-Ethylhexyl)phthalate	--	4.20E+00	1.32E-03	4.69E+00	4.20E+00	--	1.84E-05	3.24E-07	1.44E-04	1.29E-04	2.9E-04	1.83E+01	1.6E-05	1.83E+02	1.6E-06
Benzene	--	9.29E-01	0.00E+00	0.00E+00	0.00E+00	--	4.07E-06	0.00E+00	0.00E+00	0.00E+00	4.1E-06	2.64E+01	1.5E-07	2.64E+02	1.5E-08
Barium	--	1.80E+01	5.62E-01	3.28E-01	3.28E-01	--	7.90E-05	1.38E-04	1.01E-05	1.01E-05	2.4E-04	5.18E+01	4.6E-06	1.19E+02	2.0E-06
Beryllium	--	2.47E-01	4.95E-04	2.23E-03	2.23E-03	--	1.09E-06	1.22E-07	6.84E-08	6.84E-08	1.3E-06	5.32E-01	2.5E-06	5.32E-01	2.5E-06
Cadmium	--	5.74E-01	3.22E-02	2.64E-01	2.64E-01	--	2.52E-06	7.90E-06	8.10E-06	8.10E-06	2.7E-05	1.86E+00	1.4E-05	7.10E+00	3.7E-06
Chromium	--	2.43E+01	1.99E-01	4.00E+00	4.00E+00	--	1.07E-04	4.89E-05	1.23E-04	1.23E-04	4.0E-04	2.40E+00	1.7E-04	4.06E+01	9.9E-06
Lead	--	4.97E+01	1.74E+00	3.28E+00	3.28E+00	--	2.18E-04	4.27E-04	1.01E-04	1.01E-04	8.5E-04	4.70E+00	1.8E-04	1.54E+02	5.5E-06
Mercury	--	2.31E-01	5.94E-03	6.56E-01	6.56E-01	--	1.01E-06	1.46E-06	2.01E-05	2.01E-05	4.3E-05	1.01E+00	4.2E-05	1.01E+01	4.2E-06
Vanadium	--	1.57E+01	1.52E-02	1.32E-01	1.32E-01	--	6.87E-05	3.73E-06	4.04E-06	4.04E-06	8.1E-05	2.10E-01	3.8E-04	2.10E+00	3.8E-05

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Storm Water Detention Basin - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Storm Water Detention Basin

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene		5.10E-03	1.82E-02	9.26E-05	1.04E+00	5.29E-03	1.08E-01	5.48E-04
2,4,4-Trimethyl-2-pentene		2.65E-03	3.78E-02	1.00E-04	1.03E+00	2.73E-03	3.23E-01	8.55E-04
Acetone		1.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		2.90E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetophenone		1.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde		9.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		2.28E+00	3.13E-04	7.13E-04	1.12E+00	2.54E+00	1.00E+00	2.28E+00
Phenol		1.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N-Nitrosodiphenylamine	7.40E-06		1.20E-01	--	1.06E+00	--	1.74E+00	--
Benzo(a)pyrene		2.20E-01	2.22E-03	4.88E-04	1.08E+00	2.37E-01	2.23E-01	4.91E-02
Arsenic		1.07E+01	2.79E-02	2.99E-01	1.27E-01	1.36E+00	1.27E-01	1.36E+00
Barium	2.60E-02	4.95E+01	3.12E-02	1.54E+00	1.82E-02	9.01E-01	1.82E-02	9.01E-01
Beryllium		1.05E-01	2.00E-03	2.09E-04	9.00E-03	9.41E-04	9.00E-03	9.41E-04
Chromium		4.15E+01	8.20E-03	3.40E-01	--	4.00E+00	--	4.00E+00
Vanadium		2.05E+01	9.70E-04	1.99E-02	8.40E-03	1.72E-01	8.40E-03	1.72E-01
Chloride		9.65E+00	--	--	--	--	--	--
Nitrite as N	2.60E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	7.50E+00	1.80E+01	--	--	--	--	--	--
Sulfate		1.40E+03	--	--	--	--	--	--

Table Storm Water Detention Basin - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Storm Water Detention Basin

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Storm Water Detention Basin - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Storm Water Detention Basin

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	5.10E-03	9.26E-05	5.29E-03	5.48E-04	--	6.15E-09	6.26E-09	4.46E-08	4.63E-09	6.2E-08	4.10E-01	1.5E-07	4.10E+00	1.5E-08
2,4,4-Trimethyl-2-pentene	--	2.65E-03	1.00E-04	2.73E-03	8.55E-04	--	3.20E-09	6.76E-09	2.30E-08	7.22E-09	4.0E-08	4.10E-01	9.8E-08	4.10E+00	9.8E-09
Acetone	--	1.40E-01	0.00E+00	0.00E+00	0.00E+00	--	1.69E-07	0.00E+00	0.00E+00	0.00E+00	1.7E-07	2.00E+01	8.4E-09	1.00E+02	1.7E-09
3 & 4 Methylphenol	--	2.90E+00	0.00E+00	0.00E+00	0.00E+00	--	3.50E-06	0.00E+00	0.00E+00	0.00E+00	3.5E-06	1.00E+02	3.5E-08	1.00E+03	3.5E-09
Acetophenone	--	1.60E-01	0.00E+00	0.00E+00	0.00E+00	--	1.93E-07	0.00E+00	0.00E+00	0.00E+00	1.9E-07	8.00E+02	2.4E-10	8.00E+03	2.4E-11
Benzaldehyde	--	9.60E-01	0.00E+00	0.00E+00	0.00E+00	--	1.16E-06	0.00E+00	0.00E+00	0.00E+00	1.2E-06	4.29E+01	2.7E-08	8.57E+01	1.4E-08
Bis(2-Ethylhexyl)phthalate	--	2.28E+00	7.13E-04	2.54E+00	2.28E+00	--	2.75E-06	4.82E-08	2.15E-05	1.92E-05	4.3E-05	1.83E+01	2.4E-06	1.83E+02	2.4E-07
Phenol	--	1.65E+00	0.00E+00	0.00E+00	0.00E+00	--	1.99E-06	0.00E+00	0.00E+00	0.00E+00	2.0E-06	4.00E+01	5.0E-08	5.35E+01	3.7E-08
N-Nitrosodiphenylamine	7.40E-06	--	--	--	--	6.27E-10	--	--	--	--	6.3E-10	2.00E+01	3.1E-11	2.00E+02	3.1E-12
Benzo(a)pyrene	--	2.20E-01	4.88E-04	2.37E-01	4.91E-02	--	2.65E-07	3.30E-08	2.00E-06	4.14E-07	2.7E-06	1.00E+00	2.7E-06	1.00E+01	2.7E-07
Arsenic	--	1.07E+01	2.99E-01	1.36E+00	1.36E+00	--	1.29E-05	2.02E-05	1.15E-05	1.15E-05	5.6E-05	1.26E-01	4.4E-04	1.26E+00	4.4E-05
Barium	2.60E-02	4.95E+01	1.54E+00	9.01E-01	9.01E-01	2.20E-06	5.97E-05	1.04E-04	7.61E-06	7.61E-06	1.8E-04	5.18E+01	3.5E-06	1.19E+02	1.5E-06
Beryllium	--	1.05E-01	2.09E-04	9.41E-04	9.41E-04	--	1.26E-07	1.41E-08	7.94E-09	7.94E-09	1.6E-07	5.32E-01	2.9E-07	5.32E-01	2.9E-07
Chromium	--	4.15E+01	3.40E-01	4.00E+00	4.00E+00	--	5.01E-05	2.30E-05	3.38E-05	3.38E-05	1.4E-04	2.40E+00	5.9E-05	4.06E+01	3.5E-06
Vanadium	--	2.05E+01	1.99E-02	1.72E-01	1.72E-01	--	2.47E-05	1.34E-06	1.45E-06	1.45E-06	2.9E-05	2.10E-01	1.4E-04	2.10E+00	1.4E-05
Chloride	--	9.65E+00	--	--	--	--	1.16E-05	--	--	--	1.2E-05	--	--	--	--
Nitrite as N	2.60E-02	--	--	--	--	2.20E-06	--	--	--	--	2.2E-06	--	--	--	--
Nitrogen, as Ammonia	7.50E+00	1.80E+01	--	--	--	6.35E-04	2.17E-05	--	--	--	6.6E-04	--	--	--	--
Sulfate	--	1.40E+03	--	--	--	--	1.69E-03	--	--	--	1.7E-03	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Upper South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	1.82E-02	1.82E-02	3.30E-04	1.04E+00	1.88E-02	1.08E-01	1.95E-03
2,4,4-Trimethyl-2-pentene	--	2.85E-03	3.78E-02	1.08E-04	1.03E+00	2.93E-03	3.23E-01	9.19E-04
4-iso-Propyltoluene	--	1.79E-03	3.31E-02	5.91E-05	1.03E+00	1.84E-03	2.65E-01	4.73E-04
Acetaldehyde	--	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	--	7.45E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol	--	1.29E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetophenone	--	9.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Benzaldehyde	--	3.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	2.44E-03	4.22E+01	3.13E-04	1.32E-02	1.12E+00	4.72E+01	1.00E+00	4.22E+01
Caprolactam	--	5.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diphenyl ether	--	1.51E-01	2.86E-02	4.32E-03	1.03E+00	1.56E-01	2.13E-01	3.22E-02
Di-n-octylphthalate	--	1.50E-01	1.61E-04	2.42E-05	1.13E+00	1.70E-01	1.00E+00	1.50E-01
Diphenylmethanone	--	3.05E-02	1.12E-01	3.43E-03	1.05E+00	3.22E-02	1.58E+00	4.82E-02
N-Nitrosodi-n-propylamine	3.51E-06	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Phenol	--	7.24E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Aluminum	4.90E+00	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Arsenic	--	5.33E+00	2.79E-02	1.49E-01	1.27E-01	6.77E-01	1.27E-01	6.77E-01
Barium	2.43E-02	2.70E+01	3.12E-02	8.42E-01	1.82E-02	4.91E-01	1.82E-02	4.91E-01
Beryllium	6.08E-04	4.39E-01	2.00E-03	8.78E-04	9.00E-03	3.95E-03	9.00E-03	3.95E-03
Chromium	1.10E+00	4.05E+02	8.20E-03	3.32E+00	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent	--	6.98E+00	8.20E-03	5.73E-02	1.00E-01	6.98E-01	1.00E-01	6.98E-01
Cobalt	2.85E-02	--	1.49E-03	--	2.44E-02	--	2.44E-02	--
Copper	9.02E-03	--	4.12E-02	--	1.65E+00	--	1.65E+00	--
Iron	5.91E+00	1.24E+04	8.50E-04	1.06E+01	7.20E-03	8.96E+01	7.20E-03	8.96E+01
Lead	6.30E-04	--	3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	1.49E+00	--	1.58E-02	--	4.38E-02	--	4.38E-02	--
Silver	1.70E-05	7.46E+00	2.80E-03	2.09E-02	4.09E-01	3.05E+00	4.09E-01	3.05E+00
Vanadium	--	1.05E+01	9.70E-04	1.01E-02	8.40E-03	8.78E-02	8.40E-03	8.78E-02
Bromide	3.16E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	1.64E+02	7.44E+01	--	--	--	--	--	--
Nitrite as N	3.10E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.48E+02	--	--	--	--	--	--
Sulfate	--	4.69E+02	--	--	--	--	--	--
Hydrazine	5.56E-05	9.10E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	5.93E-04	--	9.33E-02	--	1.04E+00	--	1.21E+00	--
4-Nonylphenol (Tech.)	9.81E-03	--	2.93E-03	--	1.07E+00	--	6.48E-03	--
Dimethylformamide	--	1.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kempore (Azodicarbonamide)	7.25E-01	--	--	--	--	--	--	--

Table Upper South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
C11-C22 Aromatics	--	1.71E+01	--	--	--	--	--	--
C19-C36 Aliphatics	--	2.90E+01	--	--	--	--	--	--
C9-C18 Aliphatics	--	2.60E+01	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Upper South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	1.82E-02	3.30E-04	1.88E-02	1.95E-03	--	4.98E-09	5.06E-09	3.61E-08	3.75E-09	5.0E-08	4.10E-01	1.2E-07	4.10E+00	1.2E-08
2,4,4-Trimethyl-2-pentene	--	2.85E-03	1.08E-04	2.93E-03	9.19E-04	--	7.82E-10	1.65E-09	5.63E-09	1.76E-09	9.8E-09	4.10E-01	2.4E-08	4.10E+00	2.4E-09
4-iso-Propyltoluene	--	1.79E-03	5.91E-05	1.84E-03	4.73E-04	--	4.90E-10	9.07E-10	3.53E-09	9.08E-10	5.8E-09	--	--	--	--
Acetaldehyde	--	8.30E-02	0.00E+00	0.00E+00	0.00E+00	--	2.28E-08	0.00E+00	0.00E+00	0.00E+00	2.3E-08	2.40E+01	9.5E-10	2.40E+02	9.5E-11
Formaldehyde	--	7.45E-01	0.00E+00	0.00E+00	0.00E+00	--	2.04E-07	0.00E+00	0.00E+00	0.00E+00	2.0E-07	1.00E-01	2.0E-06	1.00E+00	2.0E-07
3 & 4 Methylphenol	--	1.29E+00	0.00E+00	0.00E+00	0.00E+00	--	3.54E-07	0.00E+00	0.00E+00	0.00E+00	3.5E-07	1.00E+02	3.5E-09	1.00E+03	3.5E-10
Acetophenone	--	9.00E-02	0.00E+00	0.00E+00	0.00E+00	--	2.47E-08	0.00E+00	0.00E+00	0.00E+00	2.5E-08	8.00E+02	3.1E-11	8.00E+03	3.1E-12
Azobenzene	5.30E-04	--	--	--	--	1.02E-08	--	--	--	--	1.0E-08	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	--	--	--	2.89E-09	--	--	--	--	2.9E-09	1.00E+00	2.9E-09	1.00E+01	2.9E-10
Benzaldehyde	--	3.53E-01	0.00E+00	0.00E+00	0.00E+00	--	9.67E-08	0.00E+00	0.00E+00	0.00E+00	9.7E-08	4.29E+01	2.3E-09	8.57E+01	1.1E-09
Bis(2-Ethylhexyl)phthalate	2.44E-03	4.22E+01	1.32E-02	4.72E+01	4.22E+01	4.70E-08	1.16E-05	2.03E-07	9.06E-05	8.11E-05	1.8E-04	1.83E+01	1.0E-05	1.83E+02	1.0E-06
Caprolactam	--	5.30E-02	0.00E+00	0.00E+00	0.00E+00	--	1.45E-08	0.00E+00	0.00E+00	0.00E+00	1.5E-08	8.00E+02	1.8E-11	8.00E+03	1.8E-12
Diphenyl ether	--	1.51E-01	4.32E-03	1.56E-01	3.22E-02	--	4.15E-08	6.63E-08	2.99E-07	6.17E-08	4.7E-07	3.00E+00	1.6E-07	3.00E+01	1.6E-08
Di-n-octylphthalate	--	1.50E-01	2.42E-05	1.70E-01	1.50E-01	--	4.11E-08	3.71E-10	3.26E-07	2.88E-07	6.6E-07	1.00E+02	6.6E-09	4.00E+02	1.6E-09
Diphenylmethanone	--	3.05E-02	3.43E-03	3.22E-02	4.82E-02	--	8.36E-09	5.27E-08	6.17E-08	9.25E-08	2.2E-07	3.80E+01	5.7E-09	3.80E+02	5.7E-10
N-Nitrosodi-n-propylamine	3.51E-06	--	--	--	--	6.75E-11	--	--	--	--	6.8E-11	7.29E-02	9.3E-10	7.29E-01	9.3E-11
Phenol	--	7.24E-01	0.00E+00	0.00E+00	0.00E+00	--	1.99E-07	0.00E+00	0.00E+00	0.00E+00	2.0E-07	4.00E+01	5.0E-09	5.35E+01	3.7E-09
Aluminum	4.90E+00	--	--	--	--	9.43E-05	--	--	--	--	9.4E-05	1.93E+00	4.9E-05	1.93E+01	4.9E-06
Arsenic	--	5.33E+00	1.49E-01	6.77E-01	6.77E-01	--	1.46E-06	2.29E-06	1.30E-06	1.30E-06	6.4E-06	1.26E-01	5.0E-05	1.26E+00	5.0E-06
Barium	2.43E-02	2.70E+01	8.42E-01	4.91E-01	4.91E-01	4.67E-07	7.41E-06	1.29E-05	9.43E-07	9.43E-07	2.3E-05	5.18E+01	4.4E-07	1.19E+02	1.9E-07
Beryllium	6.08E-04	4.39E-01	8.78E-04	3.95E-03	3.95E-03	1.17E-08	1.20E-07	1.35E-08	7.59E-09	7.59E-09	1.6E-07	5.32E-01	3.0E-07	5.32E-01	3.0E-07
Chromium	1.10E+00	4.05E+02	3.32E+00	4.00E+00	4.00E+00	2.12E-05	1.11E-04	5.10E-05	7.68E-06	7.68E-06	2.0E-04	2.40E+00	8.3E-05	4.06E+01	4.9E-06
Chromium, Hexavalent	--	6.98E+00	5.73E-02	6.98E-01	6.98E-01	--	1.92E-06	8.79E-07	1.34E-06	1.34E-06	5.5E-06	2.20E+01	2.5E-07	2.20E+01	2.5E-07
Cobalt	2.85E-02	--	--	--	--	5.48E-07	--	--	--	--	5.5E-07	--	--	--	--
Copper	9.02E-03	--	--	--	--	1.74E-07	--	--	--	--	1.7E-07	1.52E+01	1.1E-08	1.52E+02	1.1E-09
Iron	5.91E+00	1.24E+04	1.06E+01	8.96E+01	8.96E+01	1.14E-04	3.41E-03	1.62E-04	1.72E-04	1.72E-04	4.0E-03	--	--	--	--
Lead	6.30E-04	--	--	--	--	1.21E-08	--	--	--	--	1.2E-08	4.70E+00	2.6E-09	1.54E+02	7.9E-11

Table Upper South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - CTE
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Manganese	1.49E+00	--	--	--	--	2.87E-05	--	--	--	--	2.9E-05	8.80E+01	3.3E-07	2.84E+02	1.0E-07
Silver	1.70E-05	7.46E+00	2.09E-02	3.05E+00	3.05E+00	3.27E-10	2.05E-06	3.21E-07	5.86E-06	5.86E-06	1.4E-05	3.62E+01	3.9E-07	7.25E+01	1.9E-07
Vanadium	--	1.05E+01	1.01E-02	8.78E-02	8.78E-02	--	2.87E-06	1.56E-07	1.68E-07	1.68E-07	3.4E-06	2.10E-01	1.6E-05	2.10E+00	1.6E-06
Bromide	3.16E-01	--	--	--	--	6.09E-06	--	--	--	--	6.1E-06	--	--	--	--
Chloride	1.64E+02	7.44E+01	--	--	--	3.16E-03	2.04E-05	--	--	--	3.2E-03	--	--	--	--
Nitrite as N	3.10E-02	--	--	--	--	5.97E-07	--	--	--	--	6.0E-07	--	--	--	--
Nitrogen, as Ammonia	5.60E+01	1.48E+02	--	--	--	1.08E-03	4.06E-05	--	--	--	1.1E-03	--	--	--	--
Sulfate	--	4.69E+02	--	--	--	--	1.29E-04	--	--	--	1.3E-04	--	--	--	--
Hydrazine	5.56E-05	9.10E-04	0.00E+00	0.00E+00	0.00E+00	1.07E-09	2.50E-10	0.00E+00	0.00E+00	0.00E+00	1.3E-09	2.50E+00	5.3E-10	5.00E+00	2.6E-10
4,4'-Isopropylidenediphenol	5.93E-04	--	--	--	--	1.14E-08	--	--	--	--	1.1E-08	--	--	--	--
4-Nonylphenol (Tech.)	9.81E-03	--	--	--	--	1.89E-07	--	--	--	--	1.9E-07	5.00E+00	3.8E-08	5.00E+01	3.8E-09
Dimethylformamide	--	1.79E-01	0.00E+00	0.00E+00	0.00E+00	--	4.90E-08	0.00E+00	0.00E+00	0.00E+00	4.9E-08	2.00E+01	2.5E-09	2.00E+02	2.5E-10
Kempore (Azodicarbonamide)	7.25E-01	--	--	--	--	1.40E-05	--	--	--	--	1.4E-05	--	--	--	--
C11-C22 Aromatics	--	1.71E+01	--	--	--	--	4.70E-06	--	--	--	4.7E-06	--	--	--	--
C19-C36 Aliphatics	--	2.90E+01	--	--	--	--	7.95E-06	--	--	--	8.0E-06	--	--	--	--
C9-C18 Aliphatics	--	2.60E+01	--	--	--	--	7.13E-06	--	--	--	7.1E-06	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.9E-02	2.2E-03	4.2E-05	5.4E+00	1.0E-01	2.0E+00	3.8E-02	2.0E+00	3.8E-02
Bis(2-Ethylhexyl)phthalate	1.9E-02	3.1E-04	5.8E-06	5.6E+00	1.0E-01	6.0E+01	1.1E+00	6.0E+01	1.1E+00
Fluoranthene	2.6E-02	8.1E-03	2.1E-04	5.3E+00	1.4E-01	2.2E-01	5.7E-03	2.2E-01	5.7E-03
Phenanthrene	2.2E-02	2.0E-02	4.5E-04	5.2E+00	1.1E-01	4.3E-02	9.6E-04	4.3E-02	9.6E-04
Pyrene	2.8E-02	1.2E-02	3.3E-04	5.2E+00	1.5E-01	1.1E-01	3.2E-03	1.1E-01	3.2E-03
Aluminum	7.4E+03	5.7E-04	4.2E+00	8.6E-03	6.3E+01	5.3E-03	3.9E+01	5.3E-03	3.9E+01
Arsenic	5.0E+00	2.8E-02	1.4E-01	3.6E-02	1.8E-01	1.0E-01	5.2E-01	1.0E-01	5.2E-01
Cadmium	1.5E-01	5.7E-01	8.6E-02	3.7E-01	5.6E-02	4.9E-01	7.4E-02	4.9E-01	7.4E-02
Chromium	6.2E+00	8.2E-03	5.1E-02	--	4.0E+00	6.9E-02	4.3E-01	6.9E-02	4.3E-01
Cobalt	1.6E+00	1.5E-03	2.3E-03	2.4E-02	3.8E-02	4.1E-03	6.4E-03	4.1E-03	6.4E-03
Copper	4.1E+00	7.6E-02	3.1E-01	6.3E-02	2.6E-01	1.6E-01	6.5E-01	1.6E-01	6.5E-01
Iron	6.3E+03	8.5E-04	5.4E+00	7.2E-03	4.5E+01	2.2E-02	1.4E+02	2.2E-02	1.4E+02
Lead	1.6E+01	2.5E-02	3.9E-01	6.3E-02	9.9E-01	8.3E-02	1.3E+00	8.3E-02	1.3E+00
Manganese	2.8E+01	1.6E-02	4.4E-01	2.2E-02	6.2E-01	4.1E-03	1.1E-01	4.1E-03	1.1E-01
Mercury	7.7E-02	--	--	7.4E-01	5.7E-02	1.1E-02	8.4E-04	1.1E-02	8.4E-04
Nickel	4.0E+00	8.4E-02	3.3E-01	9.5E-01	3.8E+00	1.1E-01	4.3E-01	1.1E-01	4.3E-01
Selenium	4.1E-01	2.8E-01	1.1E-01	3.4E-01	1.4E-01	3.8E-01	1.5E-01	3.8E-01	1.5E-01
Tin	2.3E+00	6.0E-03	1.4E-02	--	--	4.0E+00	9.0E+00	4.0E+00	9.0E+00
Vanadium	1.2E+01	9.7E-04	1.2E-02	8.4E-03	1.0E-01	2.5E-03	2.9E-02	2.5E-03	2.9E-02
Zinc	8.5E+00	5.6E-02	4.7E-01	6.2E-02	5.3E-01	3.1E-02	2.7E-01	3.1E-02	2.7E-01
Nitrogen, as Ammonia	1.3E+02	--	--	--	--	--	--	--	--
Sulfate	2.8E+01	--	--	--	--	--	--	--	--

Table - Background - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	Background

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-08	4.3E+01	7.5E-10	8.6E+01	3.7E-10
Benzo(a)pyrene	1.9E-02	4.2E-05	1.0E-01	3.8E-02	3.8E-02	9.6E-09	4.0E-10	3.2E-07	3.7E-07	1.6E-06	2.3E-06	1.0E+00	2.3E-06	1.0E+01	2.3E-07
Bis(2-Ethylhexyl)phthalate	1.9E-02	5.8E-06	1.0E-01	1.1E+00	1.1E+00	9.4E-09	5.5E-11	3.3E-07	1.1E-05	4.6E-05	5.7E-05	1.8E+01	3.1E-06	1.8E+02	3.1E-07
Fluoranthene	2.6E-02	2.1E-04	1.4E-01	5.7E-03	5.7E-03	1.3E-08	2.0E-09	4.3E-07	5.4E-08	2.3E-07	7.4E-07	2.5E+01	2.9E-08	5.0E+01	1.5E-08
Phenanthrene	2.2E-02	4.5E-04	1.1E-01	9.6E-04	9.6E-04	1.1E-08	4.3E-09	3.6E-07	9.1E-09	3.9E-08	4.3E-07	7.0E-01	6.1E-07	7.0E+00	6.1E-08
Pyrene	2.8E-02	3.3E-04	1.5E-01	3.2E-03	3.2E-03	1.4E-08	3.1E-09	4.7E-07	3.1E-08	1.3E-07	6.5E-07	1.5E+01	4.3E-08	2.5E+01	2.6E-08
Aluminum	7.4E+03	4.2E+00	6.3E+01	3.9E+01	3.9E+01	3.8E-03	4.0E-05	2.0E-04	3.7E-04	1.6E-03	6.0E-03	1.9E+00	3.1E-03	1.9E+01	3.1E-04
Arsenic	5.0E+00	1.4E-01	1.8E-01	5.2E-01	5.2E-01	2.5E-06	1.3E-06	5.7E-07	5.0E-06	2.2E-05	3.1E-05	1.3E-01	2.5E-04	1.3E+00	2.5E-05
Cadmium	1.5E-01	8.6E-02	5.6E-02	7.4E-02	7.4E-02	7.7E-08	8.2E-07	1.8E-07	7.0E-07	3.0E-06	4.8E-06	1.9E+00	2.6E-06	7.1E+00	6.8E-07
Chromium	6.2E+00	5.1E-02	4.0E+00	4.3E-01	4.3E-01	3.1E-06	4.8E-07	1.3E-05	4.1E-06	1.8E-05	3.8E-05	2.4E+00	1.6E-05	4.1E+01	9.4E-07
Cobalt	1.6E+00	2.3E-03	3.8E-02	6.4E-03	6.4E-03	7.9E-07	2.2E-08	1.2E-07	6.1E-08	2.6E-07	1.3E-06	--	--	--	--
Copper	4.1E+00	3.1E-01	2.6E-01	6.5E-01	6.5E-01	2.1E-06	3.0E-06	8.3E-07	6.2E-06	2.7E-05	3.9E-05	1.5E+01	2.6E-06	1.5E+02	2.6E-07
Iron	6.3E+03	5.4E+00	4.5E+01	1.4E+02	1.4E+02	3.2E-03	5.1E-05	1.4E-04	1.3E-03	5.8E-03	1.1E-02	--	--	--	--
Lead	1.6E+01	3.9E-01	9.9E-01	1.3E+00	1.3E+00	8.0E-06	3.7E-06	3.1E-06	1.2E-05	5.3E-05	8.1E-05	4.7E+00	1.7E-05	1.5E+02	5.2E-07
Manganese	2.8E+01	4.4E-01	6.2E-01	1.1E-01	1.1E-01	1.4E-05	4.2E-06	2.0E-06	1.1E-06	4.7E-06	2.6E-05	8.8E+01	3.0E-07	2.8E+02	9.2E-08
Mercury	7.7E-02	--	5.7E-02	8.4E-04	8.4E-04	3.9E-08	--	1.8E-07	7.9E-09	3.4E-08	2.6E-07	1.0E+00	2.6E-07	1.0E+01	2.6E-08
Nickel	4.0E+00	3.3E-01	3.8E+00	4.3E-01	4.3E-01	2.0E-06	3.2E-06	1.2E-05	4.1E-06	1.8E-05	3.9E-05	4.0E+01	9.7E-07	8.0E+01	4.9E-07
Selenium	4.1E-01	1.1E-01	1.4E-01	1.5E-01	1.5E-01	2.1E-07	1.1E-06	4.4E-07	1.5E-06	6.4E-06	9.6E-06	4.4E-01	2.2E-05	7.9E-01	1.2E-05
Tin	2.3E+00	1.4E-02	--	9.0E+00	9.0E+00	1.1E-06	1.3E-07	--	8.6E-05	3.7E-04	4.6E-04	2.3E+01	2.0E-05	3.5E+01	1.3E-05
Vanadium	1.2E+01	1.2E-02	1.0E-01	2.9E-02	2.9E-02	6.1E-06	1.1E-07	3.2E-07	2.8E-07	1.2E-06	8.0E-06	2.1E-01	3.8E-05	2.1E+00	3.8E-06
Zinc	8.5E+00	4.7E-01	5.3E-01	2.7E-01	2.7E-01	4.3E-06	4.5E-06	1.7E-06	2.5E-06	1.1E-05	2.4E-05	7.5E+01	3.2E-07	2.6E+02	9.4E-08
Nitrogen, as Ammonia	1.3E+02	--	--	--	--	6.5E-05	--	--	--	--	6.5E-05	--	--	--	--
Sulfate	2.8E+01	--	--	--	--	1.4E-05	--	--	--	--	1.4E-05	--	--	--	--

Table - Background - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	Background

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-14.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-2 - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.4E-01	2.2E-03	5.3E-04	5.4E+00	1.3E+00	2.0E+00	4.9E-01	2.0E+00	4.9E-01
Bis(2-Ethylhexyl)phthalate	2.2E+01	3.1E-04	7.0E-03	5.6E+00	1.3E+02	6.0E+01	1.3E+03	6.0E+01	1.3E+03
Diphenyl ether	1.2E-01	2.9E-02	3.4E-03	5.2E+00	6.2E-01	2.4E-02	2.9E-03	2.4E-02	2.9E-03
Fluoranthene	9.4E-01	8.1E-03	7.6E-03	5.3E+00	4.9E+00	2.2E-01	2.0E-01	2.2E-01	2.0E-01
Phenanthrene	6.8E-01	2.0E-02	1.4E-02	5.2E+00	3.5E+00	4.3E-02	3.0E-02	4.3E-02	3.0E-02
Pyrene	6.6E-01	1.2E-02	7.7E-03	5.2E+00	3.4E+00	1.1E-01	7.5E-02	1.1E-01	7.5E-02
4,4'-DDD	3.9E-02	2.4E-03	9.5E-05	5.4E+00	2.1E-01	1.7E+00	6.7E-02	1.7E+00	6.7E-02
4,4'-DDE	4.9E-02	9.6E-04	4.7E-05	5.5E+00	2.7E-01	8.7E+00	4.2E-01	8.7E+00	4.2E-01
4,4'-DDT	2.7E-01	1.4E-03	3.9E-04	5.4E+00	1.5E+00	4.2E+00	1.1E+00	4.2E+00	1.1E+00
Aluminum	8.7E+03	5.7E-04	5.0E+00	8.6E-03	7.5E+01	5.3E-03	4.6E+01	5.3E-03	4.6E+01
Arsenic	6.7E+00	4.0E-02	2.7E-01	5.0E-02	3.3E-01	1.2E-01	7.9E-01	1.2E-01	7.9E-01
Cadmium	5.1E-01	2.9E-01	1.5E-01	2.5E-01	1.3E-01	2.7E-01	1.4E-01	2.7E-01	1.4E-01
Chromium	3.9E+01	8.2E-03	3.2E-01	--	4.0E+00	7.1E-03	2.8E-01	7.1E-03	2.8E-01
Copper	1.8E+01	2.8E-02	4.9E-01	1.9E-02	3.4E-01	1.2E-01	2.2E+00	1.2E-01	2.2E+00
Iron	1.1E+04	8.5E-04	9.3E+00	7.2E-03	7.9E+01	2.0E-02	2.2E+02	2.0E-02	2.2E+02
Lead	4.0E+01	1.3E-02	5.1E-01	4.3E-02	1.7E+00	6.2E-02	2.5E+00	6.2E-02	2.5E+00
Mercury	1.5E-01	--	--	3.5E-01	5.1E-02	1.1E-02	1.6E-03	1.1E-02	1.6E-03
Selenium	1.1E+00	2.0E-01	2.2E-01	1.9E-01	2.2E-01	1.9E-01	2.1E-01	1.9E-01	2.1E-01
Vanadium	2.4E+01	9.7E-04	2.3E-02	8.4E-03	2.0E-01	2.5E-03	5.8E-02	2.5E-03	5.8E-02
Zinc	4.9E+01	2.0E-02	9.6E-01	2.4E-02	1.2E+00	6.9E-03	3.3E-01	6.9E-03	3.3E-01
Chloride	7.9E+01	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	--	--	--	--	--	--

Table - EA-2 - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-2

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-2 - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-07	2.4E+01	1.2E-08	2.4E+02	1.2E-09
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E-06	4.3E+01	6.2E-08	8.6E+01	3.1E-08
Benzo(a)pyrene	2.4E-01	5.3E-04	1.3E+00	4.9E-01	4.9E-01	3.4E-07	1.4E-08	1.1E-05	1.3E-05	5.6E-05	8.0E-05	1.0E+00	8.0E-05	1.0E+01	8.0E-06
Bis(2-Ethylhexyl)phthalate	2.2E+01	7.0E-03	1.3E+02	1.3E+03	1.3E+03	3.2E-05	1.9E-07	1.1E-03	3.5E-02	1.5E-01	1.9E-01	1.8E+01	1.0E-02	1.8E+02	1.0E-03
Diphenyl ether	1.2E-01	3.4E-03	6.2E-01	2.9E-03	2.9E-03	1.7E-07	9.0E-08	5.4E-06	7.7E-08	3.3E-07	6.1E-06	3.0E+00	2.0E-06	3.0E+01	2.0E-07
Fluoranthene	9.4E-01	7.6E-03	4.9E+00	2.0E-01	2.0E-01	1.3E-06	2.0E-07	4.3E-05	5.4E-06	2.3E-05	7.4E-05	2.5E+01	2.9E-06	5.0E+01	1.5E-06
Phenanthrene	6.8E-01	1.4E-02	3.5E+00	3.0E-02	3.0E-02	9.6E-07	3.7E-07	3.1E-05	7.8E-07	3.4E-06	3.6E-05	7.0E-01	5.2E-05	7.0E+00	5.2E-06
Pyrene	6.6E-01	7.7E-03	3.4E+00	7.5E-02	7.5E-02	9.3E-07	2.0E-07	3.0E-05	2.0E-06	8.6E-06	4.2E-05	1.5E+01	2.8E-06	2.5E+01	1.7E-06
4,4'-DDD	3.9E-02	9.5E-05	2.1E-01	6.7E-02	6.7E-02	5.5E-08	2.5E-09	1.8E-06	1.8E-06	7.7E-06	1.1E-05	8.0E-01	1.4E-05	4.0E+00	2.8E-06
4,4'-DDE	4.9E-02	4.7E-05	2.7E-01	4.2E-01	4.2E-01	6.9E-08	1.2E-09	2.3E-06	1.1E-05	4.8E-05	6.2E-05	8.0E-01	7.8E-05	4.0E+00	1.6E-05
4,4'-DDT	2.7E-01	3.9E-04	1.5E+00	1.1E+00	1.1E+00	3.8E-07	1.0E-08	1.3E-05	3.0E-05	1.3E-04	1.7E-04	8.0E-01	2.2E-04	4.0E+00	4.3E-05
Aluminum	8.7E+03	5.0E+00	7.5E+01	4.6E+01	4.6E+01	1.2E-02	1.3E-04	6.6E-04	1.2E-03	5.2E-03	1.9E-02	1.9E+00	1.0E-02	1.9E+01	1.0E-03
Arsenic	6.7E+00	2.7E-01	3.3E-01	7.9E-01	7.9E-01	9.4E-06	7.1E-06	2.9E-06	2.1E-05	9.0E-05	1.3E-04	1.3E-01	1.0E-03	1.3E+00	1.0E-04
Cadmium	5.1E-01	1.5E-01	1.3E-01	1.4E-01	1.4E-01	7.2E-07	3.9E-06	1.1E-06	3.7E-06	1.6E-05	2.5E-05	1.9E+00	1.4E-05	7.1E+00	3.6E-06
Chromium	3.9E+01	3.2E-01	4.0E+00	2.8E-01	2.8E-01	5.5E-05	8.5E-06	3.5E-05	7.4E-06	3.2E-05	1.4E-04	2.4E+00	5.8E-05	4.1E+01	3.4E-06
Copper	1.8E+01	4.9E-01	3.4E-01	2.2E+00	2.2E+00	2.5E-05	1.3E-05	2.9E-06	5.8E-05	2.5E-04	3.5E-04	1.5E+01	2.3E-05	1.5E+02	2.3E-06
Iron	1.1E+04	9.3E+00	7.9E+01	2.2E+02	2.2E+02	1.5E-02	2.4E-04	6.9E-04	5.7E-03	2.5E-02	4.7E-02	--	--	--	--
Lead	4.0E+01	5.1E-01	1.7E+00	2.5E+00	2.5E+00	5.6E-05	1.3E-05	1.5E-05	6.5E-05	2.8E-04	4.3E-04	4.7E+00	9.2E-05	1.5E+02	2.8E-06
Mercury	1.5E-01	--	5.1E-02	1.6E-03	1.6E-03	2.1E-07	--	4.5E-07	4.2E-08	1.8E-07	8.8E-07	1.0E+00	8.7E-07	1.0E+01	8.7E-08
Selenium	1.1E+00	2.2E-01	2.2E-01	2.1E-01	2.1E-01	1.6E-06	5.7E-06	1.9E-06	5.6E-06	2.4E-05	3.9E-05	4.4E-01	9.0E-05	7.9E-01	5.0E-05
Vanadium	2.4E+01	2.3E-02	2.0E-01	5.8E-02	5.8E-02	3.3E-05	6.0E-07	1.7E-06	1.5E-06	6.6E-06	4.4E-05	2.1E-01	2.1E-04	2.1E+00	2.1E-05
Zinc	4.9E+01	9.6E-01	1.2E+00	3.3E-01	3.3E-01	6.9E-05	2.5E-05	1.0E-05	8.8E-06	3.8E-05	1.5E-04	7.5E+01	2.0E-06	2.6E+02	5.9E-07
Chloride	7.9E+01	--	--	--	--	1.1E-04	--	--	--	--	1.1E-04	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	--	--	6.2E-04	--	--	--	--	6.2E-04	--	--	--	--

Table - EA-2 - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-2

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-14.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-4 - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.3E-01	2.2E-03	7.4E-04	5.4E+00	1.8E+00	2.0E+00	6.8E-01	2.0E+00	6.8E-01
Bis(2-Ethylhexyl)phthalate	9.0E+00	3.1E-04	2.8E-03	5.6E+00	5.0E+01	6.0E+01	5.4E+02	6.0E+01	5.4E+02
Fluoranthene	8.5E-01	8.1E-03	6.9E-03	5.3E+00	4.5E+00	2.2E-01	1.9E-01	2.2E-01	1.9E-01
Naphthalene	2.1E-01	9.6E-02	2.0E-02	5.2E+00	1.1E+00	3.0E-03	6.3E-04	3.0E-03	6.3E-04
Phenanthrene	6.9E-01	2.0E-02	1.4E-02	5.2E+00	3.6E+00	4.3E-02	3.0E-02	4.3E-02	3.0E-02
Pyrene	8.2E-01	1.2E-02	9.6E-03	5.2E+00	4.3E+00	1.1E-01	9.4E-02	1.1E-01	9.4E-02
4,4'-DDD	2.1E-02	2.4E-03	5.2E-05	5.4E+00	1.1E-01	1.7E+00	3.7E-02	1.7E+00	3.7E-02
4,4'-DDE	1.1E-02	9.6E-04	1.1E-05	5.5E+00	6.0E-02	8.7E+00	9.5E-02	8.7E+00	9.5E-02
4,4'-DDT	2.5E-02	1.4E-03	3.7E-05	5.4E+00	1.4E-01	4.2E+00	1.1E-01	4.2E+00	1.1E-01
Alpha-BHC	5.8E-03	5.1E-02	2.9E-04	5.1E+00	3.0E-02	9.1E-03	5.3E-05	9.1E-03	5.3E-05
Gamma-BHC/Lindane	1.9E-02	5.9E-02	1.1E-03	5.1E+00	1.0E-01	7.0E-03	1.4E-04	7.0E-03	1.4E-04
Aluminum	7.0E+03	5.7E-04	4.0E+00	8.6E-03	6.0E+01	5.3E-03	3.7E+01	5.3E-03	3.7E+01
Arsenic	7.6E+00	3.5E-02	2.7E-01	4.4E-02	3.4E-01	1.1E-01	8.6E-01	1.1E-01	8.6E-01
Cadmium	4.2E-01	3.2E-01	1.3E-01	2.6E-01	1.1E-01	3.0E-01	1.2E-01	3.0E-01	1.2E-01
Chromium	2.7E+02	8.2E-03	2.2E+00	--	4.0E+00	7.7E-03	2.1E+00	7.7E-03	2.1E+00
Chromium, Hexavalent	1.1E+01	8.2E-03	8.6E-02	--	4.0E+00	7.7E-03	8.2E-02	7.7E-03	8.2E-02
Cobalt	5.0E+00	1.5E-03	7.5E-03	2.4E-02	1.2E-01	4.1E-03	2.1E-02	4.1E-03	2.1E-02
Copper	1.4E+01	3.2E-02	4.4E-01	2.2E-02	3.1E-01	1.3E-01	1.8E+00	1.3E-01	1.8E+00
Iron	9.0E+03	8.5E-04	7.6E+00	7.2E-03	6.5E+01	2.1E-02	1.9E+02	2.1E-02	1.9E+02
Lead	2.4E+01	1.8E-02	4.3E-01	5.2E-02	1.3E+00	7.2E-02	1.7E+00	7.2E-02	1.7E+00
Manganese	8.4E+01	1.6E-02	1.3E+00	1.0E-02	8.7E-01	4.1E-03	3.4E-01	4.1E-03	3.4E-01
Mercury	1.2E-01	--	--	5.6E-01	6.6E-02	1.1E-02	1.3E-03	1.1E-02	1.3E-03
Nickel	1.0E+01	3.6E-03	3.6E-02	9.5E-01	9.6E+00	5.0E-02	5.0E-01	5.0E-02	5.0E-01
Vanadium	1.7E+01	9.7E-04	1.6E-02	8.4E-03	1.4E-01	2.5E-03	4.1E-02	2.5E-03	4.1E-02
Zinc	2.3E+01	3.1E-02	6.9E-01	3.6E-02	8.1E-01	1.3E-02	3.0E-01	1.3E-02	3.0E-01
Chloride	5.4E+01	--	--	--	--	--	--	--	--
Cyanide, Total	5.8E+00	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	--	--	--	--	--	--
Sulfate	1.1E+03	--	--	--	--	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	--	--	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	--	--	--	--	--	--

Table - EA-4 - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-4 - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E-07	2.4E+01	1.9E-08	2.4E+02	1.9E-09
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-06	4.3E+01	5.5E-08	8.6E+01	2.7E-08
Benzo(a)pyrene	3.3E-01	7.4E-04	1.8E+00	6.8E-01	6.8E-01	3.3E-06	1.4E-07	1.1E-04	1.3E-04	5.4E-04	7.8E-04	1.0E+00	7.8E-04	1.0E+01	7.8E-05
Bis(2-Ethylhexyl)phthalate	9.0E+00	2.8E-03	5.0E+01	5.4E+02	5.4E+02	8.9E-05	5.2E-07	3.1E-03	1.0E-01	4.3E-01	5.4E-01	1.8E+01	2.9E-02	1.8E+02	2.9E-03
Fluoranthene	8.5E-01	6.9E-03	4.5E+00	1.9E-01	1.9E-01	8.4E-06	1.3E-06	2.8E-04	3.4E-05	1.5E-04	4.7E-04	2.5E+01	1.9E-05	5.0E+01	9.4E-06
Naphthalene	2.1E-01	2.0E-02	1.1E+00	6.3E-04	6.3E-04	2.1E-06	3.7E-06	6.8E-05	1.2E-07	5.1E-07	7.4E-05	3.0E+01	2.5E-06	3.0E+02	2.5E-07
Phenanthrene	6.9E-01	1.4E-02	3.6E+00	3.0E-02	3.0E-02	6.8E-06	2.6E-06	2.2E-04	5.5E-06	2.4E-05	2.6E-04	7.0E-01	3.7E-04	7.0E+00	3.7E-05
Pyrene	8.2E-01	9.6E-03	4.3E+00	9.4E-02	9.4E-02	8.1E-06	1.8E-06	2.6E-04	1.7E-05	7.5E-05	3.7E-04	1.5E+01	2.4E-05	2.5E+01	1.5E-05
4,4'-DDD	2.1E-02	5.2E-05	1.1E-01	3.7E-02	3.7E-02	2.1E-07	9.6E-09	7.1E-06	6.8E-06	3.0E-05	4.4E-05	8.0E-01	5.5E-05	4.0E+00	1.1E-05
4,4'-DDE	1.1E-02	1.1E-05	6.0E-02	9.5E-02	9.5E-02	1.1E-07	1.9E-09	3.7E-06	1.8E-05	7.6E-05	9.8E-05	8.0E-01	1.2E-04	4.0E+00	2.4E-05
4,4'-DDT	2.5E-02	3.7E-05	1.4E-01	1.1E-01	1.1E-01	2.5E-07	6.8E-09	8.4E-06	2.0E-05	8.6E-05	1.1E-04	8.0E-01	1.4E-04	4.0E+00	2.9E-05
Alpha-BHC	5.8E-03	2.9E-04	3.0E-02	5.3E-05	5.3E-05	5.7E-08	5.4E-08	1.8E-06	9.7E-09	4.2E-08	2.0E-06	5.0E+00	4.0E-07	2.0E+01	1.0E-07
Gamma-BHC/Lindane	1.9E-02	1.1E-03	1.0E-01	1.4E-04	1.4E-04	1.9E-07	2.1E-07	6.2E-06	2.5E-08	1.1E-07	6.7E-06	5.0E+00	1.3E-06	1.0E+01	6.7E-07
Aluminum	7.0E+03	4.0E+00	6.0E+01	3.7E+01	3.7E+01	6.9E-02	7.4E-04	3.7E-03	6.8E-03	3.0E-02	1.1E-01	1.9E+00	5.7E-02	1.9E+01	5.7E-03
Arsenic	7.6E+00	2.7E-01	3.4E-01	8.6E-01	8.6E-01	7.5E-05	5.0E-05	2.1E-05	1.6E-04	6.9E-04	1.0E-03	1.3E-01	7.9E-03	1.3E+00	7.9E-04
Cadmium	4.2E-01	1.3E-01	1.1E-01	1.2E-01	1.2E-01	4.2E-06	2.5E-05	6.8E-06	2.3E-05	1.0E-04	1.6E-04	1.9E+00	8.5E-05	7.1E+00	2.2E-05
Chromium	2.7E+02	2.2E+00	4.0E+00	2.1E+00	2.1E+00	2.7E-03	4.1E-04	2.5E-04	3.9E-04	1.7E-03	5.4E-03	2.4E+00	2.3E-03	4.1E+01	1.3E-04
Chromium, Hexavalent	1.1E+01	8.6E-02	4.0E+00	8.2E-02	8.2E-02	1.0E-04	1.6E-05	2.5E-04	1.5E-05	6.5E-05	4.5E-04	2.2E+01	2.0E-05	2.2E+01	2.0E-05
Cobalt	5.0E+00	7.5E-03	1.2E-01	2.1E-02	2.1E-02	5.0E-05	1.4E-06	7.5E-06	3.8E-06	1.6E-05	7.9E-05	--	--	--	--
Copper	1.4E+01	4.4E-01	3.1E-01	1.8E+00	1.8E+00	1.4E-04	8.2E-05	1.9E-05	3.3E-04	1.4E-03	2.0E-03	1.5E+01	1.3E-04	1.5E+02	1.3E-05
Iron	9.0E+03	7.6E+00	6.5E+01	1.9E+02	1.9E+02	8.9E-02	1.4E-03	4.0E-03	3.5E-02	1.5E-01	2.8E-01	--	--	--	--
Lead	2.4E+01	4.3E-01	1.3E+00	1.7E+00	1.7E+00	2.4E-04	7.9E-05	7.8E-05	3.2E-04	1.4E-03	2.1E-03	4.7E+00	4.5E-04	1.5E+02	1.4E-05
Manganese	8.4E+01	1.3E+00	8.7E-01	3.4E-01	3.4E-01	8.3E-04	2.5E-04	5.4E-05	6.4E-05	2.8E-04	1.5E-03	8.8E+01	1.7E-05	2.8E+02	5.2E-06
Mercury	1.2E-01	--	6.6E-02	1.3E-03	1.3E-03	1.2E-06	--	4.1E-06	2.4E-07	1.0E-06	6.5E-06	1.0E+00	6.5E-06	1.0E+01	6.5E-07
Nickel	1.0E+01	3.6E-02	9.6E+00	5.0E-01	5.0E-01	1.0E-04	6.7E-06	5.9E-04	9.3E-05	4.0E-04	1.2E-03	4.0E+01	3.0E-05	8.0E+01	1.5E-05
Vanadium	1.7E+01	1.6E-02	1.4E-01	4.1E-02	4.1E-02	1.7E-04	3.0E-06	8.7E-06	7.7E-06	3.3E-05	2.2E-04	2.1E-01	1.0E-03	2.1E+00	1.0E-04
Zinc	2.3E+01	6.9E-01	8.1E-01	3.0E-01	3.0E-01	2.2E-04	1.3E-04	5.0E-05	5.5E-05	2.4E-04	6.9E-04	7.5E+01	9.2E-06	2.6E+02	2.7E-06
Chloride	5.4E+01	--	--	--	--	5.3E-04	--	--	--	--	5.3E-04	--	--	--	--
Cyanide, Total	5.8E+00	--	--	--	--	5.7E-05	--	--	--	--	5.7E-05	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	--	--	2.6E-03	--	--	--	--	2.6E-03	--	--	--	--
Sulfate	1.1E+03	--	--	--	--	1.1E-02	--	--	--	--	1.1E-02	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	--	--	3.2E-04	--	--	--	--	3.2E-04	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	--	--	4.2E-04	--	--	--	--	4.2E-04	--	--	--	--

Table - EA-4 - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-14.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-5 - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	7.2E-02	2.2E-03	1.6E-04	5.4E+00	3.9E-01	2.0E+00	1.5E-01	2.0E+00	1.5E-01
Bis(2-Ethylhexyl)phthalate	3.1E+01	3.1E-04	9.8E-03	5.6E+00	1.7E+02	6.0E+01	1.9E+03	6.0E+01	1.9E+03
Diphenyl ether	3.7E-01	2.9E-02	1.1E-02	5.2E+00	1.9E+00	2.4E-02	9.1E-03	2.4E-02	9.1E-03
Fluoranthene	4.4E-01	8.1E-03	3.6E-03	5.3E+00	2.3E+00	2.2E-01	9.6E-02	2.2E-01	9.6E-02
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	2.6E-01	2.0E-02	5.3E-03	5.2E+00	1.3E+00	4.3E-02	1.1E-02	4.3E-02	1.1E-02
Pyrene	2.8E-01	1.2E-02	3.3E-03	5.2E+00	1.5E+00	1.1E-01	3.3E-02	1.1E-01	3.3E-02
4,4'-DDT	4.5E-02	1.4E-03	6.5E-05	5.4E+00	2.4E-01	4.2E+00	1.9E-01	4.2E+00	1.9E-01
Hexachlorobenzene	2.9E-02	4.5E-03	1.3E-04	5.3E+00	1.5E-01	6.0E-01	1.7E-02	6.0E-01	1.7E-02
Aluminum	1.1E+04	5.7E-04	6.2E+00	8.6E-03	9.3E+01	5.3E-03	5.7E+01	5.3E-03	5.7E+01
Antimony	3.4E-01	2.0E-03	6.9E-04	2.0E-01	6.8E-02	5.0E-02	1.7E-02	5.0E-02	1.7E-02
Arsenic	1.9E+01	1.6E-02	3.1E-01	2.2E-02	4.3E-01	8.7E-02	1.7E+00	8.7E-02	1.7E+00
Cadmium	5.2E-01	2.9E-01	1.5E-01	2.5E-01	1.3E-01	2.7E-01	1.4E-01	2.7E-01	1.4E-01
Chromium	6.6E+03	8.2E-03	5.5E+01	--	4.0E+00	1.2E-03	8.1E+00	1.2E-03	8.1E+00
Chromium, Hexavalent	7.9E+01	8.2E-03	6.5E-01	--	4.0E+00	1.2E-03	9.6E-02	1.2E-03	9.6E-02
Copper	3.8E+01	1.6E-02	6.3E-01	1.0E-02	3.9E-01	1.1E-01	4.1E+00	1.1E-01	4.1E+00
Iron	1.4E+04	8.5E-04	1.2E+01	7.2E-03	1.0E+02	1.8E-02	2.6E+02	1.8E-02	2.6E+02
Lead	7.1E+01	8.0E-03	5.6E-01	3.3E-02	2.4E+00	5.1E-02	3.6E+00	5.1E-02	3.6E+00
Mercury	6.4E-01	--	--	2.5E-01	1.6E-01	1.1E-02	7.0E-03	1.1E-02	7.0E-03
Silver	1.0E+02	2.8E-03	2.9E-01	4.1E-01	4.2E+01	8.0E-04	8.2E-02	8.0E-04	8.2E-02
Thallium	1.9E+00	8.0E-04	1.5E-03	2.2E-02	4.2E-02	2.2E-02	4.2E-02	2.2E-02	4.2E-02
Tin	2.9E+03	6.0E-03	1.8E+01	--	--	4.0E+00	1.2E+04	4.0E+00	1.2E+04
Vanadium	3.9E+01	9.7E-04	3.8E-02	8.4E-03	3.3E-01	2.5E-03	9.6E-02	2.5E-03	9.6E-02
Zinc	1.7E+01	3.7E-02	6.2E-01	4.2E-02	7.2E-01	1.7E-02	2.9E-01	1.7E-02	2.9E-01
Cyanide, Total	6.5E+00	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	--	--	--	--	--	--
Sulfate	7.4E+01	--	--	--	--	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	--	--	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	--	--	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	--	--	--	--	--	--

Table - EA-5 - CTE - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-5 - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.2E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.2E-08	2.4E+01	1.7E-09	2.4E+02	1.7E-10
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08	2.0E+00	3.1E-08	2.0E+01	3.1E-09
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08	4.3E+01	1.4E-09	8.6E+01	7.1E-10
Benzo(a)pyrene	7.2E-02	1.6E-04	3.9E-01	1.5E-01	1.5E-01	3.7E-08	1.5E-09	1.2E-06	1.4E-06	6.1E-06	8.7E-06	1.0E+00	8.7E-06	1.0E+01	8.7E-07
Bis(2-Ethylhexyl)phthalate	3.1E+01	9.8E-03	1.7E+02	1.9E+03	1.9E+03	1.6E-05	9.3E-08	5.5E-04	1.8E-02	7.7E-02	9.6E-02	1.8E+01	5.2E-03	1.8E+02	5.2E-04
Diphenyl ether	3.7E-01	1.1E-02	1.9E+00	9.1E-03	9.1E-03	1.9E-07	1.0E-07	6.1E-06	8.7E-08	3.8E-07	6.9E-06	3.0E+00	2.3E-06	3.0E+01	2.3E-07
Fluoranthene	4.4E-01	3.6E-03	2.3E+00	9.6E-02	9.6E-02	2.3E-07	3.4E-08	7.4E-06	9.2E-07	4.0E-06	1.3E-05	2.5E+01	5.0E-07	5.0E+01	2.5E-07
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-07	7.3E-02	1.8E-06	7.3E-01	1.8E-07
Phenanthrene	2.6E-01	5.3E-03	1.3E+00	1.1E-02	1.1E-02	1.3E-07	5.0E-08	4.2E-06	1.1E-07	4.6E-07	5.0E-06	7.0E-01	7.1E-06	7.0E+00	7.1E-07
Pyrene	2.8E-01	3.3E-03	1.5E+00	3.3E-02	3.3E-02	1.5E-07	3.2E-08	4.7E-06	3.1E-07	1.3E-06	6.5E-06	1.5E+01	4.4E-07	2.5E+01	2.6E-07
4,4'-DDT	4.5E-02	6.5E-05	2.4E-01	1.9E-01	1.9E-01	2.3E-08	6.2E-10	7.7E-07	1.8E-06	7.9E-06	1.0E-05	8.0E-01	1.3E-05	4.0E+00	2.6E-06
Hexachlorobenzene	2.9E-02	1.3E-04	1.5E-01	1.7E-02	1.7E-02	1.5E-08	1.2E-09	4.9E-07	1.7E-07	7.2E-07	1.4E-06	3.2E-01	4.3E-06	1.6E+00	8.7E-07
Aluminum	1.1E+04	6.2E+00	9.3E+01	5.7E+01	5.7E+01	5.5E-03	5.9E-05	2.9E-04	5.4E-04	2.3E-03	8.7E-03	1.9E+00	4.5E-03	1.9E+01	4.5E-04
Antimony	3.4E-01	6.9E-04	6.8E-02	1.7E-02	1.7E-02	1.7E-07	6.6E-09	2.2E-07	1.6E-07	7.0E-07	1.3E-06	1.3E+01	9.5E-08	1.4E+01	8.8E-08
Arsenic	1.9E+01	3.1E-01	4.3E-01	1.7E+00	1.7E+00	9.9E-06	2.9E-06	1.4E-06	1.6E-05	7.0E-05	1.0E-04	1.3E-01	7.9E-04	1.3E+00	7.9E-05
Cadmium	5.2E-01	1.5E-01	1.3E-01	1.4E-01	1.4E-01	2.6E-07	1.4E-06	4.1E-07	1.3E-06	5.8E-06	9.3E-06	1.9E+00	5.0E-06	7.1E+00	1.3E-06
Chromium	6.6E+03	5.5E+01	4.0E+00	8.1E+00	8.1E+00	3.4E-03	5.2E-04	1.3E-05	7.7E-05	3.3E-04	4.3E-03	2.4E+00	1.8E-03	4.1E+01	1.1E-04
Chromium, Hexavalent	7.9E+01	6.5E-01	4.0E+00	9.6E-02	9.6E-02	4.0E-05	6.2E-06	1.3E-05	9.1E-07	3.9E-06	6.4E-05	2.2E+01	2.9E-06	2.2E+01	2.9E-06
Copper	3.8E+01	6.3E-01	3.9E-01	4.1E+00	4.1E+00	1.9E-05	6.0E-06	1.2E-06	3.9E-05	1.7E-04	2.4E-04	1.5E+01	1.6E-05	1.5E+02	1.6E-06
Iron	1.4E+04	1.2E+01	1.0E+02	2.6E+02	2.6E+02	7.2E-03	1.1E-04	3.2E-04	2.5E-03	1.1E-02	2.1E-02	--	--	--	--
Lead	7.1E+01	5.6E-01	2.4E+00	3.6E+00	3.6E+00	3.6E-05	5.4E-06	7.5E-06	3.4E-05	1.5E-04	2.3E-04	4.7E+00	4.9E-05	1.5E+02	1.5E-06
Mercury	6.4E-01	--	1.6E-01	7.0E-03	7.0E-03	3.3E-07	--	5.1E-07	6.7E-08	2.9E-07	1.2E-06	1.0E+00	1.2E-06	1.0E+01	1.2E-07
Silver	1.0E+02	2.9E-01	4.2E+01	8.2E-02	8.2E-02	5.2E-05	2.7E-06	1.3E-04	7.8E-07	3.4E-06	1.9E-04	3.6E+01	5.3E-06	7.2E+01	2.7E-06
Thallium	1.9E+00	1.5E-03	4.2E-02	4.2E-02	4.2E-02	9.5E-07	1.4E-08	1.3E-07	4.0E-07	1.7E-06	3.2E-06	4.6E-02	7.0E-05	4.6E-01	7.0E-06
Tin	2.9E+03	1.8E+01	--	1.2E+04	1.2E+04	1.5E-03	1.7E-04	--	1.1E-01	4.8E-01	6.0E-01	2.3E+01	2.5E-02	3.5E+01	1.7E-02
Vanadium	3.9E+01	3.8E-02	3.3E-01	9.6E-02	9.6E-02	2.0E-05	3.6E-07	1.0E-06	9.1E-07	4.0E-06	2.6E-05	2.1E-01	1.2E-04	2.1E+00	1.2E-05
Zinc	1.7E+01	6.2E-01	7.2E-01	2.9E-01	2.9E-01	8.6E-06	5.9E-06	2.3E-06	2.8E-06	1.2E-05	3.2E-05	7.5E+01	4.2E-07	2.6E+02	1.2E-07
Cyanide, Total	6.5E+00	--	--	--	--	3.3E-06	--	--	--	--	3.3E-06	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	--	--	2.1E-04	--	--	--	--	2.1E-04	--	--	--	--
Sulfate	7.4E+01	--	--	--	--	3.8E-05	--	--	--	--	3.8E-05	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	--	--	2.3E-03	--	--	--	--	2.3E-03	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	--	--	1.7E-03	--	--	--	--	1.7E-03	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	--	--	2.5E-04	--	--	--	--	2.5E-04	--	--	--	--

Table - EA-5 - CTE - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-14.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.9E-02	2.2E-03	4.2E-05	5.4E+00	1.0E-01	2.0E+00	3.8E-02
Bis(2-Ethylhexyl)phthalate	1.9E-02	3.1E-04	5.8E-06	5.6E+00	1.0E-01	6.0E+01	1.1E+00
Fluoranthene	2.6E-02	8.1E-03	2.1E-04	5.3E+00	1.4E-01	2.2E-01	5.7E-03
Phenanthrene	2.2E-02	2.0E-02	4.5E-04	5.2E+00	1.1E-01	4.3E-02	9.6E-04
Pyrene	2.8E-02	1.2E-02	3.3E-04	5.2E+00	1.5E-01	1.1E-01	3.2E-03
Aluminum	7.4E+03	5.7E-04	4.2E+00	8.6E-03	6.3E+01	5.3E-03	3.9E+01
Arsenic	5.0E+00	2.8E-02	1.4E-01	3.6E-02	1.8E-01	1.0E-01	5.2E-01
Cadmium	1.5E-01	5.7E-01	8.6E-02	3.7E-01	5.6E-02	4.9E-01	7.4E-02
Chromium	6.2E+00	8.2E-03	5.1E-02	--	4.0E+00	6.9E-02	4.3E-01
Cobalt	1.6E+00	1.5E-03	2.3E-03	2.4E-02	3.8E-02	4.1E-03	6.4E-03
Copper	4.1E+00	7.6E-02	3.1E-01	6.3E-02	2.6E-01	1.6E-01	6.5E-01
Iron	6.3E+03	8.5E-04	5.4E+00	7.2E-03	4.5E+01	2.2E-02	1.4E+02
Lead	1.6E+01	2.5E-02	3.9E-01	6.3E-02	9.9E-01	8.3E-02	1.3E+00
Manganese	2.8E+01	1.6E-02	4.4E-01	2.2E-02	6.2E-01	4.1E-03	1.1E-01
Mercury	7.7E-02	--	--	7.4E-01	5.7E-02	1.1E-02	8.4E-04
Nickel	4.0E+00	8.4E-02	3.3E-01	9.5E-01	3.8E+00	1.1E-01	4.3E-01
Selenium	4.1E-01	2.8E-01	1.1E-01	3.4E-01	1.4E-01	3.8E-01	1.5E-01
Tin	2.3E+00	6.0E-03	1.4E-02	--	--	4.0E+00	9.0E+00
Vanadium	1.2E+01	9.7E-04	1.2E-02	8.4E-03	1.0E-01	2.5E-03	2.9E-02
Zinc	8.5E+00	5.6E-02	4.7E-01	6.2E-02	5.3E-01	3.1E-02	2.7E-01
Nitrogen, as Ammonia	1.3E+02	--	--	--	--	--	--
Sulfate	2.8E+01	--	--	--	--	--	--

Table - Background - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	Background

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{inv} - Chemical concentration in invertebrates

C_{mam} - Chemical concentration in mammal tissue

C_{plant} - Chemical concentration in plant

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Background - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Benzaldehyde	6.3E-02	0.0E+00	0.0E+00	0.0E+00	9.3E-05	0.0E+00	0.0E+00	0.0E+00	9.3E-05	4.3E+01	2.2E-06	8.6E+01	1.1E-06
Benzo(a)pyrene	1.9E-02	4.2E-05	1.0E-01	3.8E-02	2.8E-05	2.3E-06	3.0E-02	1.3E-03	3.2E-02	1.0E+00	3.2E-02	1.0E+01	3.2E-03
Bis(2-Ethylhexyl)phthalate	1.9E-02	5.8E-06	1.0E-01	1.1E+00	2.7E-05	3.2E-07	3.1E-02	3.8E-02	6.9E-02	1.8E+01	3.8E-03	1.8E+02	3.8E-04
Fluoranthene	2.6E-02	2.1E-04	1.4E-01	5.7E-03	3.8E-05	1.2E-05	4.1E-02	1.9E-04	4.1E-02	2.5E+01	1.6E-03	5.0E+01	8.2E-04
Phenanthrene	2.2E-02	4.5E-04	1.1E-01	9.6E-04	3.2E-05	2.5E-05	3.4E-02	3.3E-05	3.4E-02	7.0E-01	4.8E-02	7.0E+00	4.8E-03
Pyrene	2.8E-02	3.3E-04	1.5E-01	3.2E-03	4.2E-05	1.8E-05	4.4E-02	1.1E-04	4.4E-02	1.5E+01	2.9E-03	2.5E+01	1.8E-03
Aluminum	7.4E+03	4.2E+00	6.3E+01	3.9E+01	1.1E+01	2.3E-01	1.9E+01	1.3E+00	3.1E+01	1.9E+00	1.6E+01	1.9E+01	1.6E+00
Arsenic	5.0E+00	1.4E-01	1.8E-01	5.2E-01	7.3E-03	7.7E-03	5.4E-02	1.8E-02	8.6E-02	1.3E-01	6.9E-01	1.3E+00	6.9E-02
Cadmium	1.5E-01	8.6E-02	5.6E-02	7.4E-02	2.2E-04	4.7E-03	1.7E-02	2.5E-03	2.4E-02	1.9E+00	1.3E-02	7.1E+00	3.4E-03
Chromium	6.2E+00	5.1E-02	4.0E+00	4.3E-01	9.1E-03	2.8E-03	1.2E+00	1.5E-02	1.2E+00	2.4E+00	5.1E-01	4.1E+01	3.0E-02
Cobalt	1.6E+00	2.3E-03	3.8E-02	6.4E-03	2.3E-03	1.3E-04	1.1E-02	2.2E-04	1.4E-02	--	--	--	--
Copper	4.1E+00	3.1E-01	2.6E-01	6.5E-01	6.1E-03	1.7E-02	7.7E-02	2.2E-02	1.2E-01	1.5E+01	8.1E-03	1.5E+02	8.1E-04
Iron	6.3E+03	5.4E+00	4.5E+01	1.4E+02	9.3E+00	3.0E-01	1.3E+01	4.8E+00	2.8E+01	--	--	--	--
Lead	1.6E+01	3.9E-01	9.9E-01	1.3E+00	2.3E-02	2.2E-02	2.9E-01	4.4E-02	3.8E-01	4.7E+00	8.1E-02	1.5E+02	2.5E-03
Manganese	2.8E+01	4.4E-01	6.2E-01	1.1E-01	4.1E-02	2.4E-02	1.8E-01	3.9E-03	2.5E-01	8.8E+01	2.9E-03	2.8E+02	8.9E-04
Mercury	7.7E-02	--	5.7E-02	8.4E-04	1.1E-04	--	1.7E-02	2.8E-05	1.7E-02	1.0E+00	1.7E-02	1.0E+01	1.7E-03
Nickel	4.0E+00	3.3E-01	3.8E+00	4.3E-01	5.9E-03	1.8E-02	1.1E+00	1.5E-02	1.2E+00	4.0E+01	2.9E-02	8.0E+01	1.4E-02
Selenium	4.1E-01	1.1E-01	1.4E-01	1.5E-01	6.0E-04	6.3E-03	4.1E-02	5.3E-03	5.3E-02	4.4E-01	1.2E-01	7.9E-01	6.7E-02
Tin	2.3E+00	1.4E-02	--	9.0E+00	3.3E-03	7.5E-04	--	3.1E-01	3.1E-01	2.3E+01	1.3E-02	3.5E+01	8.9E-03
Vanadium	1.2E+01	1.2E-02	1.0E-01	2.9E-02	1.8E-02	6.4E-04	3.0E-02	1.0E-03	4.9E-02	2.1E-01	2.3E-01	2.1E+00	2.3E-02
Zinc	8.5E+00	4.7E-01	5.3E-01	2.7E-01	1.3E-02	2.6E-02	1.6E-01	9.0E-03	2.0E-01	7.5E+01	2.7E-03	2.6E+02	8.0E-04
Nitrogen, as Ammonia	1.3E+02	--	--	--	1.9E-01	--	--	--	1.9E-01	--	--	--	--
Sulfate	2.8E+01	--	--	--	4.1E-02	--	--	--	4.1E-02	--	--	--	--

Table - Background - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	Background

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-2 - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.4E-01	2.2E-03	5.3E-04	5.4E+00	1.3E+00	2.0E+00	4.9E-01
Bis(2-Ethylhexyl)phthalate	2.2E+01	3.1E-04	7.0E-03	5.6E+00	1.3E+02	6.0E+01	1.3E+03
Diphenyl ether	1.2E-01	2.9E-02	3.4E-03	5.2E+00	6.2E-01	2.4E-02	2.9E-03
Fluoranthene	9.4E-01	8.1E-03	7.6E-03	5.3E+00	4.9E+00	2.2E-01	2.0E-01
Phenanthrene	6.8E-01	2.0E-02	1.4E-02	5.2E+00	3.5E+00	4.3E-02	3.0E-02
Pyrene	6.6E-01	1.2E-02	7.7E-03	5.2E+00	3.4E+00	1.1E-01	7.5E-02
4,4'-DDD	3.9E-02	2.4E-03	9.5E-05	5.4E+00	2.1E-01	1.7E+00	6.7E-02
4,4'-DDE	4.9E-02	9.6E-04	4.7E-05	5.5E+00	2.7E-01	8.7E+00	4.2E-01
4,4'-DDT	2.7E-01	1.4E-03	3.9E-04	5.4E+00	1.5E+00	4.2E+00	1.1E+00
Aluminum	8.7E+03	5.7E-04	5.0E+00	8.6E-03	7.5E+01	5.3E-03	4.6E+01
Arsenic	6.7E+00	4.0E-02	2.7E-01	5.0E-02	3.3E-01	1.2E-01	7.9E-01
Cadmium	5.1E-01	2.9E-01	1.5E-01	2.5E-01	1.3E-01	2.7E-01	1.4E-01
Chromium	3.9E+01	8.2E-03	3.2E-01	--	4.0E+00	7.1E-03	2.8E-01
Copper	1.8E+01	2.8E-02	4.9E-01	1.9E-02	3.4E-01	1.2E-01	2.2E+00
Iron	1.1E+04	8.5E-04	9.3E+00	7.2E-03	7.9E+01	2.0E-02	2.2E+02
Lead	4.0E+01	1.3E-02	5.1E-01	4.3E-02	1.7E+00	6.2E-02	2.5E+00
Mercury	1.5E-01	--	--	3.5E-01	5.1E-02	1.1E-02	1.6E-03
Selenium	1.1E+00	2.0E-01	2.2E-01	1.9E-01	2.2E-01	1.9E-01	2.1E-01
Vanadium	2.4E+01	9.7E-04	2.3E-02	8.4E-03	2.0E-01	2.5E-03	5.8E-02
Zinc	4.9E+01	2.0E-02	9.6E-01	2.4E-02	1.2E+00	6.9E-03	3.3E-01
Chloride	7.9E+01	--	--	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	--	--	--	--

Table - EA-2 - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{inv} - Chemical concentration in invertebrates

C_{mam} - Chemical concentration in mammal tissue

C_{plant} - Chemical concentration in plant

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

CTE - Central Tendency Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-2 - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	2.9E-04	0.0E+00	0.0E+00	0.0E+00	2.9E-04	2.4E+01	1.2E-05	2.4E+02	1.2E-06
Benzaldehyde	1.9E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-03	0.0E+00	0.0E+00	0.0E+00	2.8E-03	4.3E+01	6.5E-05	8.6E+01	3.3E-05
Benzo(a)pyrene	2.4E-01	5.3E-04	1.3E+00	4.9E-01	3.5E-04	2.9E-05	3.8E-01	1.7E-02	4.0E-01	1.0E+00	4.0E-01	1.0E+01	4.0E-02
Bis(2-Ethylhexyl)phthalate	2.2E+01	7.0E-03	1.3E+02	1.3E+03	3.3E-02	3.9E-04	3.7E+01	4.6E+01	8.3E+01	1.8E+01	4.5E+00	1.8E+02	4.5E-01
Diphenyl ether	1.2E-01	3.4E-03	6.2E-01	2.9E-03	1.8E-04	1.9E-04	1.8E-01	1.0E-04	1.8E-01	3.0E+00	6.1E-02	3.0E+01	6.1E-03
Fluoranthene	9.4E-01	7.6E-03	4.9E+00	2.0E-01	1.4E-03	4.2E-04	1.5E+00	7.0E-03	1.5E+00	2.5E+01	5.9E-02	5.0E+01	2.9E-02
Phenanthrene	6.8E-01	1.4E-02	3.5E+00	3.0E-02	1.0E-03	7.7E-04	1.0E+00	1.0E-03	1.0E+00	7.0E-01	1.5E+00	7.0E+00	1.5E-01
Pyrene	6.6E-01	7.7E-03	3.4E+00	7.5E-02	9.7E-04	4.3E-04	1.0E+00	2.6E-03	1.0E+00	1.5E+01	6.8E-02	2.5E+01	4.1E-02
4,4'-DDD	3.9E-02	9.5E-05	2.1E-01	6.7E-02	5.7E-05	5.2E-06	6.2E-02	2.3E-03	6.5E-02	8.0E-01	8.1E-02	4.0E+00	1.6E-02
4,4'-DDE	4.9E-02	4.7E-05	2.7E-01	4.2E-01	7.2E-05	2.6E-06	8.0E-02	1.4E-02	9.4E-02	8.0E-01	1.2E-01	4.0E+00	2.4E-02
4,4'-DDT	2.7E-01	3.9E-04	1.5E+00	1.1E+00	4.0E-04	2.1E-05	4.3E-01	3.9E-02	4.7E-01	8.0E-01	5.9E-01	4.0E+00	1.2E-01
Aluminum	8.7E+03	5.0E+00	7.5E+01	4.6E+01	1.3E+01	2.8E-01	2.2E+01	1.6E+00	3.7E+01	1.9E+00	1.9E+01	1.9E+01	1.9E+00
Arsenic	6.7E+00	2.7E-01	3.3E-01	7.9E-01	9.8E-03	1.5E-02	9.9E-02	2.7E-02	1.5E-01	1.3E-01	1.2E+00	1.3E+00	1.2E-01
Cadmium	5.1E-01	1.5E-01	1.3E-01	1.4E-01	7.6E-04	8.2E-03	3.8E-02	4.8E-03	5.2E-02	1.9E+00	2.8E-02	7.1E+00	7.3E-03
Chromium	3.9E+01	3.2E-01	4.0E+00	2.8E-01	5.8E-02	1.8E-02	1.2E+00	9.5E-03	1.3E+00	2.4E+00	5.3E-01	4.1E+01	3.1E-02
Copper	1.8E+01	4.9E-01	3.4E-01	2.2E+00	2.6E-02	2.7E-02	1.0E-01	7.5E-02	2.3E-01	1.5E+01	1.5E-02	1.5E+02	1.5E-03
Iron	1.1E+04	9.3E+00	7.9E+01	2.2E+02	1.6E+01	5.1E-01	2.3E+01	7.3E+00	4.7E+01	--	--	--	--
Lead	4.0E+01	5.1E-01	1.7E+00	2.5E+00	5.9E-02	2.8E-02	5.1E-01	8.5E-02	6.8E-01	4.7E+00	1.5E-01	1.5E+02	4.4E-03
Mercury	1.5E-01	--	5.1E-02	1.6E-03	2.2E-04	--	1.5E-02	5.4E-05	1.5E-02	1.0E+00	1.5E-02	1.0E+01	1.5E-03
Selenium	1.1E+00	2.2E-01	2.2E-01	2.1E-01	1.6E-03	1.2E-02	6.4E-02	7.3E-03	8.5E-02	4.4E-01	1.9E-01	7.9E-01	1.1E-01
Vanadium	2.4E+01	2.3E-02	2.0E-01	5.8E-02	3.5E-02	1.3E-03	5.9E-02	2.0E-03	9.7E-02	2.1E-01	4.6E-01	2.1E+00	4.6E-02
Zinc	4.9E+01	9.6E-01	1.2E+00	3.3E-01	7.2E-02	5.3E-02	3.4E-01	1.1E-02	4.8E-01	7.5E+01	6.4E-03	2.6E+02	1.9E-03
Chloride	7.9E+01	--	--	--	1.2E-01	--	--	--	1.2E-01	--	--	--	--
Nitrogen, as Ammonia	4.4E+02	--	--	--	6.5E-01	--	--	--	6.5E-01	--	--	--	--

Table - EA-2 - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-4 - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.3E-01	2.2E-03	7.4E-04	5.4E+00	1.8E+00	2.0E+00	6.8E-01
Bis(2-Ethylhexyl)phthalate	9.0E+00	3.1E-04	2.8E-03	5.6E+00	5.0E+01	6.0E+01	5.4E+02
Fluoranthene	8.5E-01	8.1E-03	6.9E-03	5.3E+00	4.5E+00	2.2E-01	1.9E-01
Naphthalene	2.1E-01	9.6E-02	2.0E-02	5.2E+00	1.1E+00	3.0E-03	6.3E-04
Phenanthrene	6.9E-01	2.0E-02	1.4E-02	5.2E+00	3.6E+00	4.3E-02	3.0E-02
Pyrene	8.2E-01	1.2E-02	9.6E-03	5.2E+00	4.3E+00	1.1E-01	9.4E-02
4,4'-DDD	2.1E-02	2.4E-03	5.2E-05	5.4E+00	1.1E-01	1.7E+00	3.7E-02
4,4'-DDE	1.1E-02	9.6E-04	1.1E-05	5.5E+00	6.0E-02	8.7E+00	9.5E-02
4,4'-DDT	2.5E-02	1.4E-03	3.7E-05	5.4E+00	1.4E-01	4.2E+00	1.1E-01
Alpha-BHC	5.8E-03	5.1E-02	2.9E-04	5.1E+00	3.0E-02	9.1E-03	5.3E-05
Gamma-BHC/Lindane	1.9E-02	5.9E-02	1.1E-03	5.1E+00	1.0E-01	7.0E-03	1.4E-04
Aluminum	7.0E+03	5.7E-04	4.0E+00	8.6E-03	6.0E+01	5.3E-03	3.7E+01
Arsenic	7.6E+00	3.5E-02	2.7E-01	4.4E-02	3.4E-01	1.1E-01	8.6E-01
Cadmium	4.2E-01	3.2E-01	1.3E-01	2.6E-01	1.1E-01	3.0E-01	1.2E-01
Chromium	2.7E+02	8.2E-03	2.2E+00	--	4.0E+00	7.7E-03	2.1E+00
Chromium, Hexavalent	1.1E+01	8.2E-03	8.6E-02	6.3E-01	6.7E+00	7.7E-03	8.2E-02
Cobalt	5.0E+00	1.5E-03	7.5E-03	2.4E-02	1.2E-01	4.1E-03	2.1E-02
Copper	1.4E+01	3.2E-02	4.4E-01	2.2E-02	3.1E-01	1.3E-01	1.8E+00
Iron	9.0E+03	8.5E-04	7.6E+00	7.2E-03	6.5E+01	2.1E-02	1.9E+02
Lead	2.4E+01	1.8E-02	4.3E-01	5.2E-02	1.3E+00	7.2E-02	1.7E+00
Manganese	8.4E+01	1.6E-02	1.3E+00	1.0E-02	8.7E-01	4.1E-03	3.4E-01
Mercury	1.2E-01	--	--	5.6E-01	6.6E-02	1.1E-02	1.3E-03
Nickel	1.0E+01	3.6E-03	3.6E-02	9.5E-01	9.6E+00	5.0E-02	5.0E-01
Vanadium	1.7E+01	9.7E-04	1.6E-02	8.4E-03	1.4E-01	2.5E-03	4.1E-02
Zinc	2.3E+01	3.1E-02	6.9E-01	3.6E-02	8.1E-01	1.3E-02	3.0E-01
Chloride	5.4E+01	--	--	--	--	--	--
Cyanide, Total	5.8E+00	--	--	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	--	--	--	--
Sulfate	1.1E+03	--	--	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	--	--	--	--

Table - EA-4 - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-4 - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	6.8E-05	0.0E+00	0.0E+00	0.0E+00	6.8E-05	2.4E+01	2.8E-06	2.4E+02	2.8E-07
Benzaldehyde	2.4E-01	0.0E+00	0.0E+00	0.0E+00	3.5E-04	0.0E+00	0.0E+00	0.0E+00	3.5E-04	4.3E+01	8.2E-06	8.6E+01	4.1E-06
Benzo(a)pyrene	3.3E-01	7.4E-04	1.8E+00	6.8E-01	4.9E-04	4.1E-05	5.3E-01	2.3E-02	5.6E-01	1.0E+00	5.6E-01	1.0E+01	5.6E-02
Bis(2-Ethylhexyl)phthalate	9.0E+00	2.8E-03	5.0E+01	5.4E+02	1.3E-02	1.6E-04	1.5E+01	1.8E+01	3.3E+01	1.8E+01	1.8E+00	1.8E+02	1.8E-01
Fluoranthene	8.5E-01	6.9E-03	4.5E+00	1.9E-01	1.3E-03	3.8E-04	1.3E+00	6.3E-03	1.3E+00	2.5E+01	5.3E-02	5.0E+01	2.7E-02
Naphthalene	2.1E-01	2.0E-02	1.1E+00	6.3E-04	3.1E-04	1.1E-03	3.3E-01	2.2E-05	3.3E-01	3.0E+01	1.1E-02	3.0E+02	1.1E-03
Phenanthrene	6.9E-01	1.4E-02	3.6E+00	3.0E-02	1.0E-03	7.8E-04	1.1E+00	1.0E-03	1.1E+00	7.0E-01	1.5E+00	7.0E+00	1.5E-01
Pyrene	8.2E-01	9.6E-03	4.3E+00	9.4E-02	1.2E-03	5.3E-04	1.3E+00	3.2E-03	1.3E+00	1.5E+01	8.5E-02	2.5E+01	5.1E-02
4,4'-DDD	2.1E-02	5.2E-05	1.1E-01	3.7E-02	3.2E-05	2.9E-06	3.4E-02	1.3E-03	3.5E-02	8.0E-01	4.4E-02	4.0E+00	8.9E-03
4,4'-DDE	1.1E-02	1.1E-05	6.0E-02	9.5E-02	1.6E-05	5.8E-07	1.8E-02	3.3E-03	2.1E-02	8.0E-01	2.6E-02	4.0E+00	5.3E-03
4,4'-DDT	2.5E-02	3.7E-05	1.4E-01	1.1E-01	3.7E-05	2.0E-06	4.1E-02	3.7E-03	4.4E-02	8.0E-01	5.5E-02	4.0E+00	1.1E-02
Alpha-BHC	5.8E-03	2.9E-04	3.0E-02	5.3E-05	8.5E-06	1.6E-05	8.8E-03	1.8E-06	8.9E-03	5.0E+00	1.8E-03	2.0E+01	4.4E-04
Gamma-BHC/Lindane	1.9E-02	1.1E-03	1.0E-01	1.4E-04	2.9E-05	6.3E-05	3.0E-02	4.7E-06	3.0E-02	5.0E+00	6.0E-03	1.0E+01	3.0E-03
Aluminum	7.0E+03	4.0E+00	6.0E+01	3.7E+01	1.0E+01	2.2E-01	1.8E+01	1.3E+00	3.0E+01	1.9E+00	1.5E+01	1.9E+01	1.5E+00
Arsenic	7.6E+00	2.7E-01	3.4E-01	8.6E-01	1.1E-02	1.5E-02	1.0E-01	2.9E-02	1.6E-01	1.3E-01	1.2E+00	1.3E+00	1.2E-01
Cadmium	4.2E-01	1.3E-01	1.1E-01	1.2E-01	6.2E-04	7.4E-03	3.3E-02	4.3E-03	4.5E-02	1.9E+00	2.4E-02	7.1E+00	6.4E-03
Chromium	2.7E+02	2.2E+00	4.0E+00	2.1E+00	4.0E-01	1.2E-01	1.2E+00	7.2E-02	1.8E+00	2.4E+00	7.4E-01	4.1E+01	4.4E-02
Chromium, Hexavalent	1.1E+01	8.6E-02	6.7E+00	8.2E-02	1.6E-02	4.8E-03	2.0E+00	2.8E-03	2.0E+00	2.2E+01	9.1E-02	2.2E+01	9.1E-02
Cobalt	5.0E+00	7.5E-03	1.2E-01	2.1E-02	7.4E-03	4.1E-04	3.6E-02	7.0E-04	4.5E-02	--	--	--	--
Copper	1.4E+01	4.4E-01	3.1E-01	1.8E+00	2.0E-02	2.4E-02	9.2E-02	6.0E-02	2.0E-01	1.5E+01	1.3E-02	1.5E+02	1.3E-03
Iron	9.0E+03	7.6E+00	6.5E+01	1.9E+02	1.3E+01	4.2E-01	1.9E+01	6.4E+00	3.9E+01	--	--	--	--
Lead	2.4E+01	4.3E-01	1.3E+00	1.7E+00	3.6E-02	2.4E-02	3.7E-01	5.9E-02	4.9E-01	4.7E+00	1.1E-01	1.5E+02	3.2E-03
Manganese	8.4E+01	1.3E+00	8.7E-01	3.4E-01	1.2E-01	7.3E-02	2.6E-01	1.2E-02	4.7E-01	8.8E+01	5.3E-03	2.8E+02	1.6E-03
Mercury	1.2E-01	--	6.6E-02	1.3E-03	1.7E-04	--	2.0E-02	4.4E-05	2.0E-02	1.0E+00	2.0E-02	1.0E+01	2.0E-03
Nickel	1.0E+01	3.6E-02	9.6E+00	5.0E-01	1.5E-02	2.0E-03	2.8E+00	1.7E-02	2.9E+00	4.0E+01	7.2E-02	8.0E+01	3.6E-02
Vanadium	1.7E+01	1.6E-02	1.4E-01	4.1E-02	2.5E-02	9.0E-04	4.2E-02	1.4E-03	6.9E-02	2.1E-01	3.3E-01	2.1E+00	3.3E-02
Zinc	2.3E+01	6.9E-01	8.1E-01	3.0E-01	3.4E-02	3.8E-02	2.4E-01	1.0E-02	3.2E-01	7.5E+01	4.3E-03	2.6E+02	1.3E-03
Chloride	5.4E+01	--	--	--	7.9E-02	--	--	--	7.9E-02	--	--	--	--
Cyanide, Total	5.8E+00	--	--	--	8.5E-03	--	--	--	8.5E-03	--	--	--	--
Nitrogen, as Ammonia	2.6E+02	--	--	--	3.9E-01	--	--	--	3.9E-01	--	--	--	--
Sulfate	1.1E+03	--	--	--	1.6E+00	--	--	--	1.6E+00	--	--	--	--
C11-C22 Aromatics	3.2E+01	--	--	--	4.7E-02	--	--	--	4.7E-02	--	--	--	--
C19-C36 Aliphatics	4.2E+01	--	--	--	6.2E-02	--	--	--	6.2E-02	--	--	--	--

Table - EA-4 - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-5 - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	7.2E-02	2.2E-03	1.6E-04	5.4E+00	3.9E-01	2.0E+00	1.5E-01
Bis(2-Ethylhexyl)phthalate	3.1E+01	3.1E-04	9.8E-03	5.6E+00	1.7E+02	6.0E+01	1.9E+03
Diphenyl ether	3.7E-01	2.9E-02	1.1E-02	5.2E+00	1.9E+00	2.4E-02	9.1E-03
Fluoranthene	4.4E-01	8.1E-03	3.6E-03	5.3E+00	2.3E+00	2.2E-01	9.6E-02
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	2.6E-01	2.0E-02	5.3E-03	5.2E+00	1.3E+00	4.3E-02	1.1E-02
Pyrene	2.8E-01	1.2E-02	3.3E-03	5.2E+00	1.5E+00	1.1E-01	3.3E-02
4,4'-DDT	4.5E-02	1.4E-03	6.5E-05	5.4E+00	2.4E-01	4.2E+00	1.9E-01
Hexachlorobenzene	2.9E-02	4.5E-03	1.3E-04	5.3E+00	1.5E-01	6.0E-01	1.7E-02
Aluminum	1.1E+04	5.7E-04	6.2E+00	8.6E-03	9.3E+01	5.3E-03	5.7E+01
Antimony	3.4E-01	2.0E-03	6.9E-04	2.0E-01	6.8E-02	5.0E-02	1.7E-02
Arsenic	1.9E+01	1.6E-02	3.1E-01	2.2E-02	4.3E-01	8.7E-02	1.7E+00
Cadmium	5.2E-01	2.9E-01	1.5E-01	2.5E-01	1.3E-01	2.7E-01	1.4E-01
Chromium	6.6E+03	8.2E-03	5.5E+01	--	4.0E+00	1.2E-03	8.1E+00
Chromium, Hexavalent	7.9E+01	8.2E-03	6.5E-01	6.3E-01	5.0E+01	1.2E-03	9.6E-02
Copper	3.8E+01	1.6E-02	6.3E-01	1.0E-02	3.9E-01	1.1E-01	4.1E+00
Iron	1.4E+04	8.5E-04	1.2E+01	7.2E-03	1.0E+02	1.8E-02	2.6E+02
Lead	7.1E+01	8.0E-03	5.6E-01	3.3E-02	2.4E+00	5.1E-02	3.6E+00
Mercury	6.4E-01	--	--	2.5E-01	1.6E-01	1.1E-02	7.0E-03
Silver	1.0E+02	2.8E-03	2.9E-01	4.1E-01	4.2E+01	8.0E-04	8.2E-02
Thallium	1.9E+00	8.0E-04	1.5E-03	2.2E-02	4.2E-02	2.2E-02	4.2E-02
Tin	2.9E+03	6.0E-03	1.8E+01	--	--	4.0E+00	1.2E+04
Vanadium	3.9E+01	9.7E-04	3.8E-02	8.4E-03	3.3E-01	2.5E-03	9.6E-02
Zinc	1.7E+01	3.7E-02	6.2E-01	4.2E-02	7.2E-01	1.7E-02	2.9E-01
Cyanide, Total	6.5E+00	--	--	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	--	--	--	--
Sulfate	7.4E+01	--	--	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	--	--	--	--

Table - EA-5 - CTE - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-5 - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	8.2E-02	0.0E+00	0.0E+00	0.0E+00	1.2E-04	0.0E+00	0.0E+00	0.0E+00	1.2E-04	2.4E+01	5.0E-06	2.4E+02	5.0E-07
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00	0.0E+00	0.0E+00	1.8E-04	2.0E+00	8.8E-05	2.0E+01	8.8E-06
Benzaldehyde	1.2E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00	0.0E+00	0.0E+00	1.8E-04	4.3E+01	4.1E-06	8.6E+01	2.0E-06
Benzo(a)pyrene	7.2E-02	1.6E-04	3.9E-01	1.5E-01	1.1E-04	8.8E-06	1.2E-01	5.0E-03	1.2E-01	1.0E+00	1.2E-01	1.0E+01	1.2E-02
Bis(2-Ethylhexyl)phthalate	3.1E+01	9.8E-03	1.7E+02	1.9E+03	4.6E-02	5.4E-04	5.2E+01	6.4E+01	1.2E+02	1.8E+01	6.3E+00	1.8E+02	6.3E-01
Diphenyl ether	3.7E-01	1.1E-02	1.9E+00	9.1E-03	5.5E-04	5.9E-04	5.7E-01	3.1E-04	5.7E-01	3.0E+00	1.9E-01	3.0E+01	1.9E-02
Fluoranthene	4.4E-01	3.6E-03	2.3E+00	9.6E-02	6.5E-04	2.0E-04	6.9E-01	3.3E-03	6.9E-01	2.5E+01	2.8E-02	5.0E+01	1.4E-02
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	3.8E-04	0.0E+00	0.0E+00	0.0E+00	3.8E-04	7.3E-02	5.3E-03	7.3E-01	5.3E-04
Phenanthrene	2.6E-01	5.3E-03	1.3E+00	1.1E-02	3.8E-04	2.9E-04	3.9E-01	3.8E-04	4.0E-01	7.0E-01	5.6E-01	7.0E+00	5.6E-02
Pyrene	2.8E-01	3.3E-03	1.5E+00	3.3E-02	4.2E-04	1.8E-04	4.4E-01	1.1E-03	4.4E-01	1.5E+01	3.0E-02	2.5E+01	1.8E-02
4,4'-DDT	4.5E-02	6.5E-05	2.4E-01	1.9E-01	6.6E-05	3.6E-06	7.2E-02	6.5E-03	7.9E-02	8.0E-01	9.9E-02	4.0E+00	2.0E-02
Hexachlorobenzene	2.9E-02	1.3E-04	1.5E-01	1.7E-02	4.3E-05	7.2E-06	4.6E-02	5.9E-04	4.6E-02	3.2E-01	1.4E-01	1.6E+00	2.9E-02
Aluminum	1.1E+04	6.2E+00	9.3E+01	5.7E+01	1.6E+01	3.4E-01	2.8E+01	1.9E+00	4.6E+01	1.9E+00	2.4E+01	1.9E+01	2.4E+00
Antimony	3.4E-01	6.9E-04	6.8E-02	1.7E-02	5.0E-04	3.8E-05	2.0E-02	5.8E-04	2.1E-02	1.3E+01	1.6E-03	1.4E+01	1.5E-03
Arsenic	1.9E+01	3.1E-01	4.3E-01	1.7E+00	2.9E-02	1.7E-02	1.3E-01	5.8E-02	2.3E-01	1.3E-01	1.8E+00	1.3E+00	1.8E-01
Cadmium	5.2E-01	1.5E-01	1.3E-01	1.4E-01	7.7E-04	8.2E-03	3.8E-02	4.8E-03	5.2E-02	1.9E+00	2.8E-02	7.1E+00	7.3E-03
Chromium	6.6E+03	5.5E+01	4.0E+00	8.1E+00	9.8E+00	3.0E+00	1.2E+00	2.7E-01	1.4E+01	2.4E+00	5.9E+00	4.1E+01	3.5E-01
Chromium, Hexavalent	7.9E+01	6.5E-01	5.0E+01	9.6E-02	1.2E-01	3.6E-02	1.5E+01	3.3E-03	1.5E+01	2.2E+01	6.8E-01	2.2E+01	6.8E-01
Copper	3.8E+01	6.3E-01	3.9E-01	4.1E+00	5.6E-02	3.5E-02	1.1E-01	1.4E-01	3.5E-01	1.5E+01	2.3E-02	1.5E+02	2.3E-03
Iron	1.4E+04	1.2E+01	1.0E+02	2.6E+02	2.1E+01	6.6E-01	3.0E+01	8.8E+00	6.0E+01	--	--	--	--
Lead	7.1E+01	5.6E-01	2.4E+00	3.6E+00	1.0E-01	3.1E-02	7.0E-01	1.2E-01	9.6E-01	4.7E+00	2.0E-01	1.5E+02	6.2E-03
Mercury	6.4E-01	--	1.6E-01	7.0E-03	9.5E-04	--	4.7E-02	2.4E-04	4.9E-02	1.0E+00	4.8E-02	1.0E+01	4.8E-03
Silver	1.0E+02	2.9E-01	4.2E+01	8.2E-02	1.5E-01	1.6E-02	1.3E+01	2.8E-03	1.3E+01	3.6E+01	3.5E-01	7.2E+01	1.7E-01
Thallium	1.9E+00	1.5E-03	4.2E-02	4.2E-02	2.8E-03	8.2E-05	1.2E-02	1.4E-03	1.7E-02	4.6E-02	3.6E-01	4.6E-01	3.6E-02
Tin	2.9E+03	1.8E+01	--	1.2E+04	4.3E+00	9.7E-01	--	4.0E+02	4.0E+02	2.3E+01	1.7E+01	3.5E+01	1.2E+01
Vanadium	3.9E+01	3.8E-02	3.3E-01	9.6E-02	5.7E-02	2.1E-03	9.7E-02	3.3E-03	1.6E-01	2.1E-01	7.6E-01	2.1E+00	7.6E-02
Zinc	1.7E+01	6.2E-01	7.2E-01	2.9E-01	2.5E-02	3.4E-02	2.1E-01	9.9E-03	2.8E-01	7.5E+01	3.7E-03	2.6E+02	1.1E-03
Cyanide, Total	6.5E+00	--	--	--	9.6E-03	--	--	--	9.6E-03	--	--	--	--
Nitrogen, as Ammonia	4.1E+02	--	--	--	6.0E-01	--	--	--	6.0E-01	--	--	--	--
Sulfate	7.4E+01	--	--	--	1.1E-01	--	--	--	1.1E-01	--	--	--	--
C11-C22 Aromatics	4.5E+03	--	--	--	6.6E+00	--	--	--	6.6E+00	--	--	--	--
C19-C36 Aliphatics	3.4E+03	--	--	--	4.9E+00	--	--	--	4.9E+00	--	--	--	--
C9-C18 Aliphatics	4.9E+02	--	--	--	7.2E-01	--	--	--	7.2E-01	--	--	--	--

Table - EA-5 - CTE - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - CTE
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - RME - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.2E-02	2.2E-03	4.9E-05	5.4E+00	1.2E-01
Bis(2-Ethylhexyl)phthalate	3.1E-02	3.1E-04	9.7E-06	5.6E+00	1.7E-01
Fluoranthene	4.3E-02	8.1E-03	3.5E-04	5.3E+00	2.3E-01
Phenanthrene	3.5E-02	2.0E-02	7.2E-04	5.2E+00	1.8E-01
Pyrene	4.9E-02	1.2E-02	5.7E-04	5.2E+00	2.6E-01
Aluminum	1.3E+04	5.7E-04	7.5E+00	8.6E-03	1.1E+02
Arsenic	1.0E+01	2.8E-02	2.8E-01	3.6E-02	3.6E-01
Cadmium	2.6E-01	4.2E-01	1.1E-01	3.1E-01	8.1E-02
Chromium	1.0E+01	8.2E-03	8.2E-02	--	4.0E+00
Cobalt	2.9E+00	1.5E-03	4.3E-03	2.4E-02	7.1E-02
Copper	5.8E+00	6.0E-02	3.5E-01	4.7E-02	2.7E-01
Iron	1.2E+04	8.5E-04	1.0E+01	7.2E-03	8.6E+01
Lead	2.6E+01	1.7E-02	4.4E-01	5.1E-02	1.3E+00
Manganese	6.9E+01	1.6E-02	1.1E+00	1.2E-02	8.4E-01
Mercury	1.1E-01	2.6E-02	2.8E-03	6.5E-02	7.1E-03
Nickel	7.3E+00	5.7E-02	4.2E-01	9.5E-01	6.9E+00
Selenium	6.0E-01	2.4E-01	1.4E-01	2.7E-01	1.6E-01
Tin	3.5E+00	6.0E-03	2.1E-02	--	--
Vanadium	2.1E+01	9.7E-04	2.0E-02	8.4E-03	1.8E-01
Zinc	1.8E+01	3.6E-02	6.4E-01	4.1E-02	7.3E-01
Nitrogen, as Ammonia	2.0E+02	--	--	--	--
Sulfate	6.3E+01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/5/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - RME - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	4.5E-04	0.0E+00	0.0E+00	4.5E-04	--	--	--	--
Benzo(a)pyrene	2.2E-02	4.9E-05	1.2E-01	1.0E-04	4.9E-06	2.5E-02	2.5E-02	9.2E+02	2.8E-05	9.2E+03	2.8E-06
Bis(2-Ethylhexyl)phthalate	3.1E-02	9.7E-06	1.7E-01	1.4E-04	9.8E-07	3.7E-02	3.7E-02	1.1E+00	3.4E-02	1.1E+01	3.4E-03
Fluoranthene	4.3E-02	3.5E-04	2.3E-01	2.0E-04	3.5E-05	4.8E-02	4.9E-02	9.2E+02	5.3E-05	9.2E+03	5.3E-06
Phenanthrene	3.5E-02	7.2E-04	1.8E-01	1.6E-04	7.2E-05	3.9E-02	3.9E-02	9.2E+02	4.2E-05	9.2E+03	4.2E-06
Pyrene	4.9E-02	5.7E-04	2.6E-01	2.2E-04	5.8E-05	5.5E-02	5.5E-02	9.2E+02	6.0E-05	9.2E+03	6.0E-06
Aluminum	1.3E+04	7.5E+00	1.1E+02	5.9E+01	7.5E-01	2.4E+01	8.4E+01	1.1E+02	7.6E-01	1.1E+03	7.6E-02
Arsenic	1.0E+01	2.8E-01	3.6E-01	4.5E-02	2.8E-02	7.8E-02	1.5E-01	5.1E+00	3.0E-02	1.3E+01	1.2E-02
Cadmium	2.6E-01	1.1E-01	8.1E-02	1.2E-03	1.1E-02	1.7E-02	3.0E-02	1.5E+00	2.0E-02	5.5E+00	5.4E-03
Chromium	1.0E+01	8.2E-02	4.0E+00	4.5E-02	8.3E-03	8.6E-01	9.1E-01	2.7E+00	3.4E-01	1.1E+01	8.3E-02
Cobalt	2.9E+00	4.3E-03	7.1E-02	1.3E-02	4.4E-04	1.5E-02	2.9E-02	--	--	--	--
Copper	5.8E+00	3.5E-01	2.7E-01	2.6E-02	3.5E-02	5.9E-02	1.2E-01	1.9E+01	6.5E-03	3.7E+01	3.2E-03
Iron	1.2E+04	1.0E+01	8.6E+01	5.5E+01	1.0E+00	1.9E+01	7.4E+01	--	--	--	--
Lead	2.6E+01	4.4E-01	1.3E+00	1.2E-01	4.5E-02	2.8E-01	4.5E-01	4.7E+00	9.5E-02	8.3E+00	5.4E-02
Manganese	6.9E+01	1.1E+00	8.4E-01	3.1E-01	1.1E-01	1.8E-01	6.0E-01	9.8E+02	6.2E-04	9.8E+03	6.2E-05
Mercury	1.1E-01	2.8E-03	7.1E-03	5.0E-04	2.9E-04	1.5E-03	2.3E-03	4.5E-01	5.1E-03	9.0E-01	2.6E-03
Nickel	7.3E+00	4.2E-01	6.9E+00	3.3E-02	4.2E-02	1.5E+00	1.6E+00	7.7E+01	2.0E-02	1.1E+02	1.5E-02
Selenium	6.0E-01	1.4E-01	1.6E-01	2.7E-03	1.5E-02	3.4E-02	5.2E-02	4.4E-01	1.2E-01	5.2E-01	9.9E-02
Tin	3.5E+00	2.1E-02	--	1.6E-02	2.1E-03	--	1.8E-02	6.8E+00	2.7E-03	1.7E+01	1.1E-03
Vanadium	2.1E+01	2.0E-02	1.8E-01	9.5E-02	2.1E-03	3.8E-02	1.4E-01	1.1E+00	1.2E-01	1.1E+01	1.2E-02
Zinc	1.8E+01	6.4E-01	7.3E-01	8.2E-02	6.4E-02	1.6E-01	3.0E-01	1.5E+01	2.1E-02	1.3E+02	2.3E-03
Nitrogen, as Ammonia	2.0E+02	--	--	9.1E-01	--	--	9.1E-01	--	--	--	--
Sulfate	6.3E+01	--	--	2.9E-01	--	--	2.9E-01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/5/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-2 - RME - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.2E-03	3.3E-04	5.4E+00	8.1E-01
Bis(2-Ethylhexyl)phthalate	1.1E+02	3.1E-04	3.5E-02	5.6E+00	6.2E+02
Diphenyl ether	1.2E-01	2.9E-02	3.4E-03	5.2E+00	6.2E-01
Fluoranthene	4.0E-01	8.1E-03	3.2E-03	5.3E+00	2.1E+00
Phenanthrene	2.7E-01	2.0E-02	5.6E-03	5.2E+00	1.4E+00
Pyrene	3.1E-01	1.2E-02	3.6E-03	5.2E+00	1.6E+00
4,4'-DDD	3.9E-02	2.4E-03	9.5E-05	5.4E+00	2.1E-01
4,4'-DDE	4.9E-02	9.6E-04	4.7E-05	5.5E+00	2.7E-01
4,4'-DDT	6.8E-01	1.4E-03	9.9E-04	5.4E+00	3.7E+00
Aluminum	1.3E+04	5.7E-04	7.5E+00	8.6E-03	1.1E+02
Arsenic	8.8E+00	3.2E-02	2.8E-01	4.1E-02	3.6E-01
Cadmium	6.9E-01	2.5E-01	1.7E-01	2.3E-01	1.6E-01
Chromium	1.2E+02	8.2E-03	9.5E-01	--	4.0E+00
Copper	2.2E+01	2.4E-02	5.4E-01	1.6E-02	3.5E-01
Iron	2.2E+04	8.5E-04	1.9E+01	7.2E-03	1.6E+02
Lead	5.3E+01	1.0E-02	5.4E-01	3.9E-02	2.0E+00
Mercury	1.6E-01	--	--	1.7E-01	2.7E-02
Selenium	2.4E+00	1.5E-01	3.5E-01	1.3E-01	3.0E-01
Vanadium	2.9E+01	9.7E-04	2.8E-02	8.4E-03	2.5E-01
Zinc	7.0E+01	1.6E-02	1.1E+00	2.0E-02	1.4E+00
Chloride	2.4E+02	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-2 - RME - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	1.3E-03	0.0E+00	0.0E+00	1.3E-03	--	--	--	--
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	5.1E-03	0.0E+00	0.0E+00	5.1E-03	--	--	--	--
Benzo(a)pyrene	1.5E-01	3.3E-04	8.1E-01	9.6E-04	4.7E-05	2.4E-01	2.5E-01	9.2E+02	2.7E-04	9.2E+03	2.7E-05
Bis(2-Ethylhexyl)phthalate	1.1E+02	3.5E-02	6.2E+02	7.1E-01	4.9E-03	1.9E+02	1.9E+02	1.1E+00	1.7E+02	1.1E+01	1.7E+01
Diphenyl ether	1.2E-01	3.4E-03	6.2E-01	7.7E-04	4.9E-04	1.9E-01	1.9E-01	--	--	--	--
Fluoranthene	4.0E-01	3.2E-03	2.1E+00	2.5E-03	4.5E-04	6.3E-01	6.3E-01	9.2E+02	6.9E-04	9.2E+03	6.9E-05
Phenanthrene	2.7E-01	5.6E-03	1.4E+00	1.8E-03	8.0E-04	4.3E-01	4.3E-01	9.2E+02	4.7E-04	9.2E+03	4.7E-05
Pyrene	3.1E-01	3.6E-03	1.6E+00	2.0E-03	5.1E-04	4.8E-01	4.9E-01	9.2E+02	5.3E-04	9.2E+03	5.3E-05
4,4'-DDD	3.9E-02	9.5E-05	2.1E-01	2.5E-04	1.4E-05	6.3E-02	6.4E-02	1.3E+01	4.9E-03	1.3E+02	4.9E-04
4,4'-DDE	4.9E-02	4.7E-05	2.7E-01	3.1E-04	6.7E-06	8.1E-02	8.1E-02	1.3E+01	6.3E-03	1.3E+02	6.3E-04
4,4'-DDT	6.8E-01	9.9E-04	3.7E+00	4.4E-03	1.4E-04	1.1E+00	1.1E+00	1.3E+01	8.6E-02	1.3E+02	8.6E-03
Aluminum	1.3E+04	7.5E+00	1.1E+02	8.4E+01	1.1E+00	3.4E+01	1.2E+02	1.1E+02	1.1E+00	1.1E+03	1.1E-01
Arsenic	8.8E+00	2.8E-01	3.6E-01	5.7E-02	4.0E-02	1.1E-01	2.1E-01	5.1E+00	4.0E-02	1.3E+01	1.6E-02
Cadmium	6.9E-01	1.7E-01	1.6E-01	4.4E-03	2.4E-02	4.7E-02	7.6E-02	1.5E+00	5.0E-02	5.5E+00	1.4E-02
Chromium	1.2E+02	9.5E-01	4.0E+00	7.5E-01	1.4E-01	1.2E+00	2.1E+00	2.7E+00	7.7E-01	1.1E+01	1.9E-01
Copper	2.2E+01	5.4E-01	3.5E-01	1.4E-01	7.6E-02	1.1E-01	3.3E-01	1.9E+01	1.8E-02	3.7E+01	8.8E-03
Iron	2.2E+04	1.9E+01	1.6E+02	1.4E+02	2.7E+00	4.9E+01	2.0E+02	--	--	--	--
Lead	5.3E+01	5.4E-01	2.0E+00	3.4E-01	7.7E-02	6.1E-01	1.0E+00	4.7E+00	2.2E-01	8.3E+00	1.2E-01
Mercury	1.6E-01	--	2.7E-02	1.1E-03	--	8.3E-03	9.3E-03	4.5E-01	2.1E-02	9.0E-01	1.0E-02
Selenium	2.4E+00	3.5E-01	3.0E-01	1.5E-02	5.0E-02	9.1E-02	1.6E-01	4.4E-01	3.6E-01	5.2E-01	3.0E-01
Vanadium	2.9E+01	2.8E-02	2.5E-01	1.9E-01	4.1E-03	7.5E-02	2.7E-01	1.1E+00	2.4E-01	1.1E+01	2.4E-02
Zinc	7.0E+01	1.1E+00	1.4E+00	4.5E-01	1.6E-01	4.2E-01	1.0E+00	1.5E+01	7.1E-02	1.3E+02	7.8E-03
Chloride	2.4E+02	--	--	1.6E+00	--	--	1.6E+00	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	4.0E+00	--	--	4.0E+00	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-4 - RME - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.5E-01	2.2E-03	7.8E-04	5.4E+00	1.9E+00
Bis(2-Ethylhexyl)phthalate	3.0E+01	3.1E-04	9.4E-03	5.6E+00	1.7E+02
Fluoranthene	4.1E-01	8.1E-03	3.3E-03	5.3E+00	2.1E+00
Naphthalene	6.5E-02	9.6E-02	6.2E-03	5.2E+00	3.4E-01
Phenanthrene	1.4E-01	2.0E-02	2.9E-03	5.2E+00	7.3E-01
Pyrene	2.2E-01	1.2E-02	2.6E-03	5.2E+00	1.2E+00
4,4'-DDD	1.6E-02	2.4E-03	3.9E-05	5.4E+00	8.6E-02
4,4'-DDE	3.8E-03	9.6E-04	3.6E-06	5.5E+00	2.1E-02
4,4'-DDT	6.8E-02	1.4E-03	9.9E-05	5.4E+00	3.7E-01
Alpha-BHC	2.0E-03	5.1E-02	1.0E-04	5.1E+00	1.0E-02
Gamma-BHC/Lindane	1.2E-02	5.9E-02	7.2E-04	5.1E+00	6.3E-02
Aluminum	8.8E+03	5.7E-04	5.1E+00	8.6E-03	7.6E+01
Arsenic	9.1E+00	3.0E-02	2.8E-01	3.9E-02	3.6E-01
Cadmium	4.8E-01	2.9E-01	1.4E-01	2.5E-01	1.2E-01
Chromium	5.8E+02	8.2E-03	4.8E+00	--	4.0E+00
Chromium, Hexavalent	3.8E+01	8.2E-03	3.1E-01	--	4.0E+00
Cobalt	1.6E+01	1.5E-03	2.4E-02	2.4E-02	4.0E-01
Copper	2.7E+01	2.5E-02	6.8E-01	1.7E-02	4.5E-01
Iron	1.9E+04	8.5E-04	1.6E+01	7.2E-03	1.4E+02
Lead	4.3E+01	1.1E-02	4.9E-01	4.1E-02	1.8E+00
Manganese	1.7E+02	1.6E-02	2.7E+00	6.1E-03	1.0E+00
Mercury	1.4E-01	--	--	5.1E-01	7.3E-02
Nickel	2.5E+01	3.6E-03	9.1E-02	9.5E-01	2.4E+01
Vanadium	2.0E+01	9.7E-04	2.0E-02	8.4E-03	1.7E-01
Zinc	4.8E+01	1.9E-02	9.3E-01	2.3E-02	1.1E+00
Chloride	1.2E+02	--	--	--	--
Cyanide, Total	7.9E+00	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	--	--
Sulfate	1.0E+04	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	--	--

Table - EA-4 - RME - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-4 - RME - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	3.0E-04	0.0E+00	0.0E+00	3.0E-04	--	--	--	--
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	3.9E-03	0.0E+00	0.0E+00	3.9E-03	--	--	--	--
Benzo(a)pyrene	3.5E-01	7.8E-04	1.9E+00	2.3E-03	1.1E-04	5.7E-01	5.8E-01	9.2E+02	6.3E-04	9.2E+03	6.3E-05
Bis(2-Ethylhexyl)phthalate	3.0E+01	9.4E-03	1.7E+02	1.9E-01	1.3E-03	5.0E+01	5.1E+01	1.1E+00	4.6E+01	1.1E+01	4.6E+00
Fluoranthene	4.1E-01	3.3E-03	2.1E+00	2.6E-03	4.7E-04	6.5E-01	6.5E-01	9.2E+02	7.1E-04	9.2E+03	7.1E-05
Naphthalene	6.5E-02	6.2E-03	3.4E-01	4.2E-04	8.8E-04	1.0E-01	1.0E-01	5.4E+00	1.9E-02	5.4E+01	1.9E-03
Phenanthrene	1.4E-01	2.9E-03	7.3E-01	9.0E-04	4.1E-04	2.2E-01	2.2E-01	9.2E+02	2.4E-04	9.2E+03	2.4E-05
Pyrene	2.2E-01	2.6E-03	1.2E+00	1.4E-03	3.7E-04	3.5E-01	3.6E-01	9.2E+02	3.9E-04	9.2E+03	3.9E-05
4,4'-DDD	1.6E-02	3.9E-05	8.6E-02	1.0E-04	5.6E-06	2.6E-02	2.6E-02	1.3E+01	2.0E-03	1.3E+02	2.0E-04
4,4'-DDE	3.8E-03	3.6E-06	2.1E-02	2.4E-05	5.1E-07	6.2E-03	6.2E-03	1.3E+01	4.8E-04	1.3E+02	4.8E-05
4,4'-DDT	6.8E-02	9.9E-05	3.7E-01	4.4E-04	1.4E-05	1.1E-01	1.1E-01	1.3E+01	8.7E-03	1.3E+02	8.7E-04
Alpha-BHC	2.0E-03	1.0E-04	1.0E-02	1.3E-05	1.5E-05	3.2E-03	3.2E-03	2.0E+00	1.6E-03	2.0E+01	1.6E-04
Gamma-BHC/Lindane	1.2E-02	7.2E-04	6.3E-02	7.9E-05	1.0E-04	1.9E-02	1.9E-02	2.0E+00	9.7E-03	2.0E+01	9.7E-04
Aluminum	8.8E+03	5.1E+00	7.6E+01	5.6E+01	7.2E-01	2.3E+01	8.0E+01	1.1E+02	7.3E-01	1.1E+03	7.3E-02
Arsenic	9.1E+00	2.8E-01	3.6E-01	5.8E-02	3.9E-02	1.1E-01	2.0E-01	5.1E+00	4.0E-02	1.3E+01	1.6E-02
Cadmium	4.8E-01	1.4E-01	1.2E-01	3.1E-03	2.0E-02	3.6E-02	5.9E-02	1.5E+00	4.0E-02	5.5E+00	1.1E-02
Chromium	5.8E+02	4.8E+00	4.0E+00	3.7E+00	6.8E-01	1.2E+00	5.6E+00	2.7E+00	2.1E+00	1.1E+01	5.1E-01
Chromium, Hexavalent	3.8E+01	3.1E-01	4.0E+00	2.4E-01	4.4E-02	1.2E+00	1.5E+00	1.6E+00	9.1E-01	1.6E+01	9.1E-02
Cobalt	1.6E+01	2.4E-02	4.0E-01	1.0E-01	3.4E-03	1.2E-01	2.3E-01	--	--	--	--
Copper	2.7E+01	6.8E-01	4.5E-01	1.7E-01	9.6E-02	1.4E-01	4.1E-01	1.9E+01	2.2E-02	3.7E+01	1.1E-02
Iron	1.9E+04	1.6E+01	1.4E+02	1.2E+02	2.3E+00	4.2E+01	1.7E+02	--	--	--	--
Lead	4.3E+01	4.9E-01	1.8E+00	2.7E-01	7.0E-02	5.3E-01	8.7E-01	4.7E+00	1.9E-01	8.3E+00	1.1E-01
Manganese	1.7E+02	2.7E+00	1.0E+00	1.1E+00	3.8E-01	3.2E-01	1.8E+00	9.8E+02	1.8E-03	9.8E+03	1.8E-04
Mercury	1.4E-01	--	7.3E-02	9.2E-04	--	2.2E-02	2.3E-02	4.5E-01	5.1E-02	9.0E-01	2.6E-02
Nickel	2.5E+01	9.1E-02	2.4E+01	1.6E-01	1.3E-02	7.2E+00	7.4E+00	7.7E+01	9.6E-02	1.1E+02	6.9E-02
Vanadium	2.0E+01	2.0E-02	1.7E-01	1.3E-01	2.8E-03	5.2E-02	1.9E-01	1.1E+00	1.7E-01	1.1E+01	1.7E-02
Zinc	4.8E+01	9.3E-01	1.1E+00	3.1E-01	1.3E-01	3.4E-01	7.8E-01	1.5E+01	5.4E-02	1.3E+02	6.0E-03
Chloride	1.2E+02	--	--	7.7E-01	--	--	7.7E-01	--	--	--	--
Cyanide, Total	7.9E+00	--	--	5.0E-02	--	--	5.0E-02	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	2.3E+00	--	--	2.3E+00	--	--	--	--
Sulfate	1.0E+04	--	--	6.4E+01	--	--	6.4E+01	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	3.6E-01	--	--	3.6E-01	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	5.2E-01	--	--	5.2E-01	--	--	--	--

Table - EA-4 - RME - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-5 - RME - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	Dose soil (mg/Kg BW day)	Dose plant (mg/Kg BW day)	Dose Inv (mg/Kg BW day)	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	5.9E-04	0.0E+00	0.0E+00	5.9E-04	--	--	--	--
Aniline	1.2E-01	0.0E+00	0.0E+00	5.5E-04	0.0E+00	0.0E+00	5.5E-04	--	--	--	--
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	9.6E-04	0.0E+00	0.0E+00	9.6E-04	--	--	--	--
Benzo(a)pyrene	1.5E-01	3.4E-04	8.2E-01	6.9E-04	3.4E-05	1.8E-01	1.8E-01	9.2E+02	1.9E-04	9.2E+03	1.9E-05
Bis(2-Ethylhexyl)phthalate	1.0E+02	3.2E-02	5.8E+02	4.7E-01	3.3E-03	1.2E+02	1.2E+02	1.1E+00	1.1E+02	1.1E+01	1.1E+01
Diphenyl ether	1.9E+00	5.4E-02	9.8E+00	8.6E-03	5.5E-03	2.1E+00	2.1E+00	--	--	--	--
Fluoranthene	2.5E+00	2.0E-02	1.3E+01	1.1E-02	2.1E-03	2.8E+00	2.9E+00	9.2E+02	3.1E-03	9.2E+03	3.1E-04
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	1.2E-03	0.0E+00	0.0E+00	1.2E-03	--	--	--	--
Phenanthrene	1.5E-01	3.0E-03	7.5E-01	6.6E-04	3.0E-04	1.6E-01	1.6E-01	9.2E+02	1.8E-04	9.2E+03	1.8E-05
Pyrene	5.6E-01	6.6E-03	2.9E+00	2.6E-03	6.6E-04	6.3E-01	6.3E-01	9.2E+02	6.9E-04	9.2E+03	6.9E-05
4,4'-DDT	4.5E-02	6.5E-05	2.4E-01	2.0E-04	6.6E-06	5.2E-02	5.3E-02	1.3E+01	4.0E-03	1.3E+02	4.0E-04
Hexachlorobenzene	2.9E-02	1.3E-04	1.5E-01	1.3E-04	1.3E-05	3.3E-02	3.3E-02	2.9E+00	1.1E-02	2.9E+01	1.1E-03
Aluminum	2.0E+04	1.1E+01	1.7E+02	9.1E+01	1.2E+00	3.7E+01	1.3E+02	1.1E+02	1.2E+00	1.1E+03	1.2E-01
Antimony	3.4E-01	6.9E-04	6.8E-02	1.5E-03	7.0E-05	1.5E-02	1.6E-02	--	--	--	--
Arsenic	2.7E+01	3.2E-01	4.7E-01	1.2E-01	3.2E-02	1.0E-01	2.5E-01	5.1E+00	5.0E-02	1.3E+01	2.0E-02
Cadmium	4.2E-01	1.4E-01	1.1E-01	1.9E-03	1.4E-02	2.4E-02	4.0E-02	1.5E+00	2.6E-02	5.5E+00	7.2E-03
Chromium	2.6E+04	2.2E+02	4.0E+00	1.2E+02	2.2E+01	8.6E-01	1.4E+02	2.7E+00	5.3E+01	1.1E+01	1.3E+01
Chromium, Hexavalent	5.6E+02	4.6E+00	4.0E+00	2.5E+00	4.6E-01	8.6E-01	3.9E+00	1.6E+00	2.4E+00	1.6E+01	2.4E-01
Copper	9.7E+01	8.4E-01	4.6E-01	4.4E-01	8.5E-02	9.8E-02	6.3E-01	1.9E+01	3.4E-02	3.7E+01	1.7E-02
Iron	2.0E+04	1.7E+01	1.5E+02	9.2E+01	1.7E+00	3.1E+01	1.2E+02	--	--	--	--
Lead	9.3E+01	6.0E-01	2.8E+00	4.2E-01	6.1E-02	5.9E-01	1.1E+00	4.7E+00	2.3E-01	8.3E+00	1.3E-01
Mercury	1.9E+00	--	2.8E-01	8.8E-03	--	6.0E-02	6.9E-02	4.5E-01	1.5E-01	9.0E-01	7.6E-02
Silver	1.1E+03	3.1E+00	4.5E+02	5.0E+00	3.1E-01	9.6E+01	1.0E+02	1.2E+01	8.6E+00	1.2E+02	8.6E-01
Thallium	7.4E+00	5.9E-03	1.7E-01	3.4E-02	6.0E-04	3.6E-02	7.0E-02	6.1E-01	1.1E-01	6.1E+00	1.1E-02
Tin	2.6E+04	1.6E+02	--	1.2E+02	1.6E+01	--	1.3E+02	6.8E+00	2.0E+01	1.7E+01	7.9E+00
Vanadium	6.9E+01	6.7E-02	5.8E-01	3.1E-01	6.8E-03	1.2E-01	4.4E-01	1.1E+00	4.0E-01	1.1E+01	4.0E-02
Zinc	3.1E+01	8.0E-01	9.4E-01	1.4E-01	8.0E-02	2.0E-01	4.2E-01	1.5E+01	2.9E-02	1.3E+02	3.2E-03
Cyanide, Total	6.5E+00	--	--	3.0E-02	--	--	3.0E-02	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	3.4E+00	--	--	3.4E+00	--	--	--	--
Sulfate	2.3E+02	--	--	1.0E+00	--	--	1.0E+00	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	3.4E+01	--	--	3.4E+01	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	2.2E+01	--	--	2.2E+01	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	3.5E+00	--	--	3.5E+00	--	--	--	--

Table - EA-5 - RME - Robin - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water, soil, plants, and invertebrates were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - Body Weight
C_{inv} - Chemical concentration in invertebrate tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ- Hazard Quotient
Inv - Invertebrate
LOAEL - Lowest Observed Adverse Effects Levels
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Levels
TRV - Toxicity Reference Value

Table - EA-5 - RME - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.2E-03	3.4E-04	5.4E+00	8.2E-01
Bis(2-Ethylhexyl)phthalate	1.0E+02	3.1E-04	3.2E-02	5.6E+00	5.8E+02
Diphenyl ether	1.9E+00	2.9E-02	5.4E-02	5.2E+00	9.8E+00
Fluoranthene	2.5E+00	8.1E-03	2.0E-02	5.3E+00	1.3E+01
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	1.5E-01	2.0E-02	3.0E-03	5.2E+00	7.5E-01
Pyrene	5.6E-01	1.2E-02	6.6E-03	5.2E+00	2.9E+00
4,4'-DDT	4.5E-02	1.4E-03	6.5E-05	5.4E+00	2.4E-01
Hexachlorobenzene	2.9E-02	4.5E-03	1.3E-04	5.3E+00	1.5E-01
Aluminum	2.0E+04	5.7E-04	1.1E+01	8.6E-03	1.7E+02
Antimony	3.4E-01	2.0E-03	6.9E-04	2.0E-01	6.8E-02
Arsenic	2.7E+01	1.2E-02	3.2E-01	1.8E-02	4.7E-01
Cadmium	4.2E-01	3.2E-01	1.4E-01	2.7E-01	1.1E-01
Chromium	2.6E+04	8.2E-03	2.2E+02	--	4.0E+00
Chromium, Hexavalent	5.6E+02	8.2E-03	4.6E+00	--	4.0E+00
Copper	9.7E+01	8.6E-03	8.4E-01	4.7E-03	4.6E-01
Iron	2.0E+04	8.5E-04	1.7E+01	7.2E-03	1.5E+02
Lead	9.3E+01	6.5E-03	6.0E-01	3.0E-02	2.8E+00
Mercury	1.9E+00	--	--	1.4E-01	2.8E-01
Silver	1.1E+03	2.8E-03	3.1E+00	4.1E-01	4.5E+02
Thallium	7.4E+00	8.0E-04	5.9E-03	2.2E-02	1.7E-01
Tin	2.6E+04	6.0E-03	1.6E+02	--	--
Vanadium	6.9E+01	9.7E-04	6.7E-02	8.4E-03	5.8E-01
Zinc	3.1E+01	2.6E-02	8.0E-01	3.0E-02	9.4E-01
Cyanide, Total	6.5E+00	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	--	--
Sulfate	2.3E+02	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	--	--

Table - EA-5 - RME - Robin - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	American Robin
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Central Pond - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		1.1E-02	6.1E+02	6.7E+00	1.1E-01	1.2E-03	1.1E-01	1.2E-03
2,4,4-Trimethyl-2-pentene		8.8E-03	6.0E+02	5.3E+00	3.2E-01	2.8E-03	3.2E-01	2.8E-03
Acetone		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Methyl Tertbutyl Ether		1.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		6.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenol		2.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene		1.4E-01	6.3E+02	8.8E+01	4.2E-01	5.8E-02	4.2E-01	5.8E-02
Fluoranthene		2.9E-01	6.2E+02	1.8E+02	8.0E-01	2.3E-01	8.0E-01	2.3E-01
Phenanthrene		2.1E-01	6.1E+02	1.3E+02	3.0E-01	6.4E-02	3.0E-01	6.4E-02
Pyrene		2.3E-01	6.1E+02	1.4E+02	5.1E-01	1.2E-01	5.1E-01	1.2E-01
Aluminum	2.1E-01		8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	4.9E-02	4.6E+01	1.8E-02	8.4E-01	1.8E-02	8.4E-01	1.8E-02	8.4E-01
Beryllium		9.4E-02	9.0E-03	8.5E-04	9.0E-03	8.5E-04	9.0E-03	8.5E-04
Chromium		1.4E+02	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent		2.7E-01	1.0E-01	2.7E-02	1.0E-01	2.7E-02	1.0E-01	2.7E-02
Lead		5.1E+01	6.6E-02	3.4E+00	6.6E-02	3.4E+00	6.6E-02	3.4E+00
Manganese	7.0E-01	5.9E+02	3.0E-03	1.8E+00	3.0E-03	1.8E+00	3.0E-03	1.8E+00
Tin		2.2E+00	--	--	--	--	--	--
Silver	1.5E-05		4.1E-01	--	4.1E-01	--	4.1E-01	--
Vanadium		1.7E+01	8.4E-03	1.4E-01	8.4E-03	1.4E-01	8.4E-03	1.4E-01
Bromide	1.3E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		2.4E+01	--	--	--	--	--	--
Nitrite as N	7.5E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	3.5E+01	--	--	--	--	--	--
Sulfate		1.2E+03	--	--	--	--	--	--

Table - Central Pond - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Central Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Central Pond - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	1.1E-02	6.7E+00	1.2E-03	1.2E-03	--	1.5E-06	8.6E-02	7.6E-06	7.6E-06	8.6E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	8.8E-03	5.3E+00	2.8E-03	2.8E-03	--	1.2E-06	6.8E-02	1.8E-05	1.8E-05	6.8E-02	--	--	--	--
Acetone	--	1.2E-01	--	--	--	--	1.6E-05	--	--	--	1.6E-05	8.4E+03	1.9E-09	8.4E+04	1.9E-10
Methyl Tertbutyl Ether	--	1.7E-03	--	--	--	--	2.3E-07	--	--	--	2.3E-07	--	--	--	--
3 & 4 Methylphenol	--	6.1E+00	--	--	--	--	8.2E-04	--	--	--	8.2E-04	--	--	--	--
Acetophenone	--	2.6E-01	--	--	--	--	3.5E-05	--	--	--	3.5E-05	--	--	--	--
Benzaldehyde	--	1.9E+00	--	--	--	--	2.6E-04	--	--	--	2.6E-04	--	--	--	--
Phenol	--	2.2E+00	--	--	--	--	3.0E-04	--	--	--	3.0E-04	--	--	--	--
Benzo(b)fluoranthene	--	1.4E-01	8.8E+01	5.8E-02	5.8E-02	--	1.9E-05	1.1E+00	3.7E-04	3.7E-04	1.1E+00	9.2E+02	1.2E-03	9.2E+03	1.2E-04
Fluoranthene	--	2.9E-01	1.8E+02	2.3E-01	2.3E-01	--	3.9E-05	2.3E+00	1.5E-03	1.5E-03	2.3E+00	9.2E+02	2.5E-03	9.2E+03	2.5E-04
Phenanthrene	--	2.1E-01	1.3E+02	6.4E-02	6.4E-02	--	2.8E-05	1.6E+00	4.1E-04	4.1E-04	1.6E+00	9.2E+02	1.8E-03	9.2E+03	1.8E-04
Pyrene	--	2.3E-01	1.4E+02	1.2E-01	1.2E-01	--	3.1E-05	1.8E+00	7.6E-04	7.6E-04	1.8E+00	9.2E+02	2.0E-03	9.2E+03	2.0E-04
Aluminum	2.1E-01	--	--	--	--	1.9E-03	--	--	--	--	1.9E-03	1.1E+02	1.7E-05	1.1E+03	1.7E-06
Barium	4.9E-02	4.6E+01	8.4E-01	8.4E-01	8.4E-01	4.3E-04	6.2E-03	1.1E-02	5.3E-03	5.3E-03	2.8E-02	4.2E+01	6.7E-04	8.3E+01	3.4E-04
Beryllium	--	9.4E-02	8.5E-04	8.5E-04	8.5E-04	--	1.3E-05	1.1E-05	5.4E-06	5.4E-06	3.4E-05	3.7E-03	9.3E-03	3.7E-02	9.3E-04
Chromium	--	1.4E+02	4.0E+00	4.0E+00	4.0E+00	--	1.9E-02	5.1E-02	2.6E-02	2.6E-02	1.2E-01	2.7E+00	4.5E-02	1.1E+01	1.1E-02
Chromium, Hexavalent	--	2.7E-01	2.7E-02	2.7E-02	2.7E-02	--	3.6E-05	3.5E-04	1.7E-04	1.7E-04	7.3E-04	1.6E+00	4.4E-04	1.6E+01	4.4E-05
Lead	--	5.1E+01	3.4E+00	3.4E+00	3.4E+00	--	6.9E-03	4.3E-02	2.2E-02	2.2E-02	9.3E-02	4.7E+00	2.0E-02	8.3E+00	1.1E-02
Manganese	7.0E-01	5.9E+02	1.8E+00	1.8E+00	1.8E+00	6.2E-03	8.0E-02	2.2E-02	1.1E-02	1.1E-02	1.3E-01	9.8E+02	1.3E-04	9.8E+03	1.3E-05
Tin	--	2.2E+00	--	--	--	--	3.0E-04	--	--	--	3.0E-04	6.8E+00	4.4E-05	1.7E+01	1.8E-05
Silver	1.5E-05	--	--	--	--	1.3E-07	--	--	--	--	1.3E-07	1.2E+01	1.1E-08	1.2E+02	1.1E-09
Vanadium	--	1.7E+01	1.4E-01	1.4E-01	1.4E-01	--	2.3E-03	1.8E-03	9.1E-04	9.1E-04	5.9E-03	1.1E+00	5.4E-03	1.1E+01	5.4E-04
Bromide	1.3E-01	--	--	--	--	1.2E-03	--	--	--	--	1.2E-03	--	--	--	--
Chloride	--	2.4E+01	--	--	--	--	3.2E-03	--	--	--	3.2E-03	--	--	--	--
Nitrite as N	7.5E-02	--	--	--	--	6.6E-04	--	--	--	--	6.6E-04	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	3.5E+01	--	--	--	2.5E-01	4.7E-03	--	--	--	2.5E-01	--	--	--	--
Sulfate	--	1.2E+03	--	--	--	--	1.6E-01	--	--	--	1.6E-01	--	--	--	--

Table - Central Pond - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Central Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Lower South Ditch - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.0E-02	1.1E+00	2.2E-02	1.1E-01	2.2E-03	1.1E-01	2.2E-03
2,4,4-Trimethyl-2-pentene	--	3.5E-03	1.1E+00	3.7E-03	3.2E-01	1.1E-03	3.2E-01	1.1E-03
Acetaldehyde	--	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	6.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	--	2.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--
Benzaldehyde	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-04	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	3.4E-03	6.0E+02	1.2E+00	7.0E+02	1.0E+00	6.0E+02	1.0E+00	6.0E+02
Di-n-octylphthalate	--	1.5E-01	1.2E+00	1.8E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenyl ether	--	2.6E+00	1.1E+00	2.8E+00	2.1E-01	5.5E-01	2.1E-01	5.5E-01
Diphenylamine	--	9.5E-02	1.1E+00	1.0E-01	8.6E-01	8.1E-02	8.6E-01	8.1E-02
N-Nitrosodi-n-propylamine	6.6E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
4,4`-DDT	--	6.2E-02	1.1E+00	7.0E-02	1.7E+00	1.0E-01	1.7E+00	1.0E-01
Hexachlorobenzene	--	3.7E-02	1.1E+00	4.1E-02	9.0E-02	3.3E-03	9.0E-02	3.3E-03
Aluminum	1.9E+01	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	2.7E-02	1.7E+01	1.8E-02	3.2E-01	1.8E-02	3.2E-01	1.8E-02	3.2E-01
Beryllium	8.4E-04	1.5E+00	9.0E-03	1.3E-02	9.0E-03	1.3E-02	9.0E-03	1.3E-02
Cadmium	--	1.0E+00	4.6E-01	4.7E-01	4.6E-01	4.7E-01	4.6E-01	4.7E-01
Chromium	3.3E+00	2.8E+03	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	2.6E+01	1.0E-01	2.6E+00	1.0E-01	2.6E+00	1.0E-01	2.6E+00
Cobalt	3.7E-02	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	1.7E-02	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	7.9E+00	--	7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	9.4E-04	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.8E+00	--	1.1E-02	--	1.1E-02	--	1.1E-02	--
Mercury	--	2.9E-01	2.8E+00	8.2E-01	2.8E+00	8.2E-01	2.8E+00	8.2E-01
Nickel	--	2.0E+01	8.2E-01	1.6E+01	8.2E-01	1.6E+01	8.2E-01	1.6E+01
Silver	1.7E-05	6.2E+01	4.1E-01	2.5E+01	4.1E-01	2.5E+01	4.1E-01	2.5E+01
Tin	--	1.6E+00	--	--	--	--	--	--
Vanadium	--	1.1E+01	8.4E-03	9.3E-02	8.4E-03	9.3E-02	8.4E-03	9.3E-02
Bromide	4.0E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.7E+02	1.4E+02	--	--	--	--	--	--

Table - Lower South Ditch - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Nitrite as N	2.1E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.5E+02	--	--	--	--	--	--
Sulfate	--	8.3E+02	--	--	--	--	--	--
Hydrazine	8.0E-05	2.4E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4,4'-Isopropylidenediphenol	9.6E-04	--	1.1E+00	--	1.2E+00	--	1.2E+00	--
4-Nonylphenol (Tech.)	1.4E-02	--	1.1E+00	--	6.5E-03	--	6.5E-03	--
Kempore (Azodicarbonamide)	1.2E+00	--	--	--	--	--	--	--
C11-C22 Aromatics	--	9.4E+03	--	--	--	--	--	--
C19-C36 Aliphatics	--	6.4E+03	--	--	--	--	--	--
C9-C18 Aliphatics	--	7.7E+02	--	--	--	--	--	--
EPH, Total	--	1.7E+04	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Lower South Ditch - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.0E-02	2.2E-02	2.2E-03	2.2E-03	--	6.0E-07	6.1E-05	3.1E-06	3.1E-06	6.8E-05	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.5E-03	3.7E-03	1.1E-03	1.1E-03	--	1.0E-07	1.1E-05	1.6E-06	1.6E-06	1.4E-05	--	--	--	--
Acetaldehyde	--	6.3E-02	--	--	--	--	1.9E-06	--	--	--	1.9E-06	--	--	--	--
Acetone	--	1.2E-01	--	--	--	--	3.6E-06	--	--	--	3.6E-06	8.4E+03	4.3E-10	8.4E+04	4.3E-11
Formaldehyde	--	6.0E-01	--	--	--	--	1.8E-05	--	--	--	1.8E-05	--	--	--	--
Aniline	--	2.3E-01	--	--	--	--	6.9E-06	--	--	--	6.9E-06	--	--	--	--
Azobenzene	5.3E-04	--	--	--	--	1.0E-06	--	--	--	--	1.0E-06	--	--	--	--
Benzaldehyde	--	1.2E-01	--	--	--	--	3.6E-06	--	--	--	3.6E-06	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	--	--	--	3.0E-07	--	--	--	--	3.0E-07	9.2E+02	3.2E-10	9.2E+03	3.2E-11
Bis(2-Ethylhexyl)phthalate	3.4E-03	6.0E+02	7.0E+02	6.0E+02	6.0E+02	6.8E-06	1.8E-02	2.0E+00	8.5E-01	8.5E-01	3.7E+00	1.1E+00	3.4E+00	1.1E+01	3.4E-01
Di-n-octylphthalate	--	1.5E-01	1.8E-01	1.5E-01	1.5E-01	--	4.5E-06	5.0E-04	2.1E-04	2.1E-04	9.3E-04	1.1E+00	8.4E-04	1.1E+01	8.4E-05
Diphenyl ether	--	2.6E+00	2.8E+00	5.5E-01	5.5E-01	--	7.8E-05	7.9E-03	7.8E-04	7.8E-04	9.6E-03	--	--	--	--
Diphenylamine	--	9.5E-02	1.0E-01	8.1E-02	8.1E-02	--	2.8E-06	2.9E-04	1.2E-04	1.2E-04	5.2E-04	--	--	--	--
N-Nitrosodi-n-propylamine	6.6E-06	--	--	--	--	1.3E-08	--	--	--	--	1.3E-08	--	--	--	--
4,4`-DDT	--	6.2E-02	7.0E-02	1.0E-01	1.0E-01	--	1.9E-06	2.0E-04	1.5E-04	1.5E-04	4.9E-04	1.3E+01	3.8E-05	1.3E+02	3.8E-06
Hexachlorobenzene	--	3.7E-02	4.1E-02	3.3E-03	3.3E-03	--	1.1E-06	1.2E-04	4.7E-06	4.7E-06	1.3E-04	2.9E+00	4.4E-05	2.9E+01	4.4E-06
Aluminum	1.9E+01	--	--	--	--	3.7E-02	--	--	--	--	3.7E-02	1.1E+02	3.4E-04	1.1E+03	3.4E-05
Barium	2.7E-02	1.7E+01	3.2E-01	3.2E-01	3.2E-01	5.3E-05	5.2E-04	9.0E-04	4.5E-04	4.5E-04	2.4E-03	4.2E+01	5.7E-05	8.3E+01	2.8E-05
Beryllium	8.4E-04	1.5E+00	1.3E-02	1.3E-02	1.3E-02	1.7E-06	4.4E-05	3.7E-05	1.9E-05	1.9E-05	1.2E-04	3.7E-03	3.2E-02	3.7E-02	3.2E-03
Cadmium	--	1.0E+00	4.7E-01	4.7E-01	4.7E-01	--	3.1E-05	1.3E-03	6.7E-04	6.7E-04	2.7E-03	1.5E+00	1.8E-03	5.5E+00	4.9E-04
Chromium	3.3E+00	2.8E+03	4.0E+00	4.0E+00	4.0E+00	6.5E-03	8.3E-02	1.1E-02	5.7E-03	5.7E-03	1.1E-01	2.7E+00	4.2E-02	1.1E+01	1.0E-02
Chromium, Hexavalent	--	2.6E+01	2.6E+00	2.6E+00	2.6E+00	--	7.7E-04	7.3E-03	3.6E-03	3.6E-03	1.5E-02	1.6E+00	9.3E-03	1.6E+01	9.3E-04
Cobalt	3.7E-02	--	--	--	--	7.2E-05	--	--	--	--	7.2E-05	--	--	--	--
Copper	1.7E-02	--	--	--	--	3.2E-05	--	--	--	--	3.2E-05	1.9E+01	1.8E-06	3.7E+01	8.8E-07
Iron	7.9E+00	--	--	--	--	1.6E-02	--	--	--	--	1.6E-02	--	--	--	--
Lead	9.4E-04	--	--	--	--	1.9E-06	--	--	--	--	1.9E-06	4.7E+00	3.9E-07	8.3E+00	2.2E-07
Manganese	1.8E+00	--	--	--	--	3.5E-03	--	--	--	--	3.5E-03	9.8E+02	3.6E-06	9.8E+03	3.6E-07
Mercury	--	2.9E-01	8.2E-01	8.2E-01	8.2E-01	--	8.7E-06	2.3E-03	1.2E-03	1.2E-03	4.7E-03	4.5E-01	1.0E-02	9.0E-01	5.2E-03
Nickel	--	2.0E+01	1.6E+01	1.6E+01	1.6E+01	--	5.9E-04	4.6E-02	2.3E-02	2.3E-02	9.2E-02	7.7E+01	1.2E-03	1.1E+02	8.6E-04
Silver	1.7E-05	6.2E+01	2.5E+01	2.5E+01	2.5E+01	3.3E-08	1.9E-03	7.2E-02	3.6E-02	3.6E-02	1.5E-01	1.2E+01	1.2E-02	1.2E+02	1.2E-03
Tin	--	1.6E+00	--	--	--	--	4.8E-05	--	--	--	4.8E-05	6.8E+00	7.1E-06	1.7E+01	2.8E-06
Vanadium	--	1.1E+01	9.3E-02	9.3E-02	9.3E-02	--	3.3E-04	2.6E-04	1.3E-04	1.3E-04	8.6E-04	1.1E+00	7.8E-04	1.1E+01	7.8E-05
Bromide	4.0E-01	--	--	--	--	7.9E-04	--	--	--	--	7.9E-04	--	--	--	--
Chloride	1.7E+02	1.4E+02	--	--	--	3.4E-01	4.2E-03	--	--	--	3.4E-01	--	--	--	--
Nitrite as N	2.1E-02	--	--	--	--	4.0E-05	--	--	--	--	4.0E-05	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.5E+02	--	--	--	1.4E-01	7.6E-03	--	--	--	1.5E-01	--	--	--	--
Sulfate	--	8.3E+02	--	--	--	--	2.5E-02	--	--	--	2.5E-02	--	--	--	--

Table - Lower South Ditch - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Hydrazine	8.0E-05	2.4E-03	--	--	--	1.6E-07	7.2E-08	--	--	--	2.3E-07	--	--	--	--
4,4'-Isopropylidenediphenol	9.6E-04	--	--	--	--	1.9E-06	--	--	--	--	1.9E-06	--	--	--	--
4-Nonylphenol (Tech.)	1.4E-02	--	--	--	--	2.7E-05	--	--	--	--	2.7E-05	--	--	--	--
Kempore (Azodicarbonamide)	1.2E+00	--	--	--	--	2.4E-03	--	--	--	--	2.4E-03	--	--	--	--
C11-C22 Aromatics	--	9.4E+03	--	--	--	--	2.8E-01	--	--	--	2.8E-01	--	--	--	--
C19-C36 Aliphatics	--	6.4E+03	--	--	--	--	1.9E-01	--	--	--	1.9E-01	--	--	--	--
C9-C18 Aliphatics	--	7.7E+02	--	--	--	--	2.3E-02	--	--	--	2.3E-02	--	--	--	--
EPH, Total	--	1.7E+04	--	--	--	--	5.1E-01	--	--	--	5.1E-01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - North Pond - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.0E-03	2.3E+00	4.6E-03	1.1E-01	2.2E-04	1.1E-01	2.2E-04
Acetone	--	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	--	7.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)anthracene	1.2E-04	--	2.4E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	1.7E-04	--	2.4E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	--	3.7E+00	2.5E+00	9.2E+00	1.0E+00	3.7E+00	1.0E+00	3.7E+00
Carbazole	--	1.6E-01	2.3E+00	3.7E-01	5.6E-01	8.9E-02	5.6E-01	8.9E-02
Caprolactam	3.3E-04	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Pyrene	3.9E-04	--	2.3E+00	--	5.1E-01	--	5.1E-01	--
Aluminum	2.2E-01	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	1.3E+01	1.3E-01	1.7E+00	1.3E-01	1.7E+00	1.3E-01	1.7E+00
Barium	4.1E-02	6.2E+01	1.8E-02	1.1E+00	1.8E-02	1.1E+00	1.8E-02	1.1E+00
Beryllium	--	5.3E-01	9.0E-03	4.8E-03	9.0E-03	4.8E-03	9.0E-03	4.8E-03
Cadmium	--	2.2E+00	4.6E-01	1.0E+00	4.6E-01	1.0E+00	4.6E-01	1.0E+00
Chromium	--	7.8E+02	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	9.0E-01	1.0E-01	9.0E-02	1.0E-01	9.0E-02	1.0E-01	9.0E-02
Copper	--	6.8E+01	1.6E+00	1.1E+02	1.6E+00	1.1E+02	1.6E+00	1.1E+02
Iron	2.9E+00	2.3E+04	7.2E-03	1.7E+02	7.2E-03	1.7E+02	7.2E-03	1.7E+02
Lead	1.3E-03	1.1E+02	6.6E-02	7.3E+00	6.6E-02	7.3E+00	6.6E-02	7.3E+00
Manganese	4.9E-01	1.3E+03	1.1E-02	1.4E+01	1.1E-02	1.4E+01	1.1E-02	1.4E+01
Silver	2.2E-05	--	4.1E-01	--	4.1E-01	--	4.1E-01	--
Thallium	--	8.2E-01	--	--	1.0E+00	8.2E-01	1.0E+00	8.2E-01
Tin	--	1.1E+01	--	--	--	--	--	--
Vanadium	--	2.6E+01	8.4E-03	2.2E-01	8.4E-03	2.2E-01	8.4E-03	2.2E-01
Zinc	--	3.6E+02	2.6E-02	9.4E+00	2.6E-02	9.4E+00	2.6E-02	9.4E+00

Table - North Pond - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Bromide	6.5E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	3.2E+02	3.2E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	--	2.3E+01	--	--	--	--	--	--
Sulfate	--	2.7E+02	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - North Pond - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.0E-03	4.6E-03	2.2E-04	2.2E-04	--	2.4E-06	5.2E-04	1.2E-05	1.2E-05	5.5E-04	--	--	--	--
Acetone	--	3.3E-01	--	--	--	--	4.0E-04	--	--	--	4.0E-04	8.4E+03	4.7E-08	8.4E+04	4.7E-09
Carbon disulfide	--	7.3E-03	--	--	--	--	8.8E-06	--	--	--	8.8E-06	--	--	--	--
Benzo(a)anthracene	1.2E-04	--	--	--	--	9.5E-06	--	--	--	--	9.5E-06	9.2E+02	1.0E-08	9.2E+03	1.0E-09
Benzo(a)pyrene	1.7E-04	--	--	--	--	1.3E-05	--	--	--	--	1.3E-05	9.2E+02	1.5E-08	9.2E+03	1.5E-09
Bis(2-Ethylhexyl)phthalate	--	3.7E+00	9.2E+00	3.7E+00	3.7E+00	--	4.4E-03	1.0E+00	2.1E-01	2.1E-01	1.5E+00	1.1E+00	1.3E+00	1.1E+01	1.3E-01
Carbazole	--	1.6E-01	3.7E-01	8.9E-02	8.9E-02	--	1.9E-04	4.2E-02	5.1E-03	5.1E-03	5.2E-02	--	--	--	--
Caprolactam	3.3E-04	--	--	--	--	2.6E-05	--	--	--	--	2.6E-05	--	--	--	--
Pyrene	3.9E-04	--	--	--	--	3.1E-05	--	--	--	--	3.1E-05	9.2E+02	3.3E-08	9.2E+03	3.3E-09
Aluminum	2.2E-01	--	--	--	--	1.7E-02	--	--	--	--	1.7E-02	1.1E+02	1.6E-04	1.1E+03	1.6E-05
Arsenic	--	1.3E+01	1.7E+00	1.7E+00	1.7E+00	--	1.6E-02	1.9E-01	9.4E-02	9.4E-02	3.9E-01	5.1E+00	7.6E-02	1.3E+01	3.0E-02
Barium	4.1E-02	6.2E+01	1.1E+00	1.1E+00	1.1E+00	3.2E-03	7.4E-02	1.3E-01	6.4E-02	6.4E-02	3.3E-01	4.2E+01	8.0E-03	8.3E+01	4.0E-03
Beryllium	--	5.3E-01	4.8E-03	4.8E-03	4.8E-03	--	6.4E-04	5.4E-04	2.7E-04	2.7E-04	1.7E-03	3.7E-03	4.6E-01	3.7E-02	4.6E-02
Cadmium	--	2.2E+00	1.0E+00	1.0E+00	1.0E+00	--	2.6E-03	1.1E-01	5.7E-02	5.7E-02	2.3E-01	1.5E+00	1.5E-01	5.5E+00	4.2E-02
Chromium	--	7.8E+02	4.0E+00	4.0E+00	4.0E+00	--	9.4E-01	4.5E-01	2.3E-01	2.3E-01	1.8E+00	2.7E+00	6.8E-01	1.1E+01	1.7E-01
Chromium, Hexavalent	--	9.0E-01	9.0E-02	9.0E-02	9.0E-02	--	1.1E-03	1.0E-02	5.1E-03	5.1E-03	2.2E-02	1.6E+00	1.3E-02	1.6E+01	1.3E-03
Copper	--	6.8E+01	1.1E+02	1.1E+02	1.1E+02	--	8.2E-02	1.3E+01	6.4E+00	6.4E+00	2.6E+01	1.9E+01	1.4E+00	3.7E+01	6.9E-01
Iron	2.9E+00	2.3E+04	1.7E+02	1.7E+02	1.7E+02	2.3E-01	2.8E+01	1.9E+01	9.4E+00	9.4E+00	6.5E+01	--	--	--	--
Lead	1.3E-03	1.1E+02	7.3E+00	7.3E+00	7.3E+00	1.0E-04	1.3E-01	8.2E-01	4.1E-01	4.1E-01	1.8E+00	4.7E+00	3.8E-01	8.3E+00	2.2E-01
Manganese	4.9E-01	1.3E+03	1.4E+01	1.4E+01	1.4E+01	3.9E-02	1.5E+00	1.5E+00	7.7E-01	7.7E-01	4.6E+00	9.8E+02	4.7E-03	9.8E+03	4.7E-04
Silver	2.2E-05	--	--	--	--	1.7E-06	--	--	--	--	1.7E-06	1.2E+01	1.5E-07	1.2E+02	1.5E-08
Thallium	--	8.2E-01	--	8.2E-01	8.2E-01	--	9.8E-04	--	4.7E-02	4.7E-02	9.4E-02	6.1E-01	1.5E-01	6.1E+00	1.5E-02
Tin	--	1.1E+01	--	--	--	--	1.3E-02	--	--	--	1.3E-02	6.8E+00	1.9E-03	1.7E+01	7.8E-04
Vanadium	--	2.6E+01	2.2E-01	2.2E-01	2.2E-01	--	3.1E-02	2.5E-02	1.2E-02	1.2E-02	8.1E-02	1.1E+00	7.3E-02	1.1E+01	7.3E-03
Zinc	--	3.6E+02	9.4E+00	9.4E+00	9.4E+00	--	4.3E-01	1.1E+00	5.3E-01	5.3E-01	2.6E+00	1.5E+01	1.8E-01	1.3E+02	2.0E-02
Bromide	6.5E-01	--	--	--	--	5.1E-02	--	--	--	--	5.1E-02	--	--	--	--
Chloride	3.2E+02	3.2E+02	--	--	--	2.5E+01	3.8E-01	--	--	--	2.6E+01	--	--	--	--
Nitrogen, as Ammonia	--	2.3E+01	--	--	--	--	2.8E-02	--	--	--	2.8E-02	--	--	--	--
Sulfate	--	2.7E+02	--	--	--	--	3.2E-01	--	--	--	3.2E-01	--	--	--	--

Table - North Pond - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	North Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Off-PWD - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.0E-02	2.1E+00	1.2E-01	1.1E-01	6.5E-03	1.1E-01	6.5E-03
2,4,4-Trimethyl-2-pentene		8.0E-03	2.1E+00	1.6E-02	3.2E-01	2.6E-03	3.2E-01	2.6E-03
Formaldehyde		6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	2.5E-03		0.0E+00	--	0.0E+00	--	0.0E+00	--
3 & 4 Methylphenol	7.6E-04		0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)anthracene	2.0E-03		2.1E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	2.3E-03		2.2E+00	--	2.2E-01	--	2.2E-01	--
Benzo(b)fluoranthene	4.0E-03		2.1E+00	--	4.2E-01	--	4.2E-01	--
Benzo(ghi)perylene	2.6E-03		2.2E+00	--	4.7E-02	--	4.7E-02	--
Benzo(k)fluoranthene	2.6E-03		2.2E+00	--	2.9E-01	--	2.9E-01	--
Chrysene	2.7E-03		2.1E+00	--	4.4E-01	--	4.4E-01	--
Dibenz(a,h)anthracene	1.2E-03		2.2E+00	--	3.8E-01	--	3.8E-01	--
Indeno(1,2,3-cd)pyrene	4.0E-03		2.2E+00	--	2.8E-01	--	2.8E-01	--
Phenanthrene	1.3E-03		2.1E+00	--	3.0E-01	--	3.0E-01	--
Pyrene	6.3E-03		2.1E+00	--	5.1E-01	--	5.1E-01	--
4-Chlorophenyl phenyl ether		6.1E-02	2.1E+00	1.3E-01	7.9E-02	4.8E-03	7.9E-02	4.8E-03
Carbazole		5.1E-02	2.1E+00	1.0E-01	5.6E-01	2.9E-02	5.6E-01	2.9E-02
Diphenyl ether		8.6E-01	2.1E+00	1.8E+00	2.1E-01	1.8E-01	2.1E-01	1.8E-01
Diphenylmethanone		2.0E-01	2.1E+00	4.2E-01	1.6E+00	3.2E-01	1.6E+00	3.2E-01
Aluminum	1.3E+00		8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	4.1E-02	1.6E+01	1.8E-02	2.9E-01	1.8E-02	2.9E-01	1.8E-02	2.9E-01
Chromium	9.3E-02	2.4E+03	--	4.0E+00	--	4.0E+00	--	4.0E+00
Iron	2.5E+01		7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	4.3E-03		6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.3E+00		1.1E-02	--	1.1E-02	--	1.1E-02	--
Zinc	9.5E-02		2.6E-02	--	2.6E-02	--	2.6E-02	--
Arsenic		1.4E+01	1.3E-01	1.8E+00	1.3E-01	1.8E+00	1.3E-01	1.8E+00
Beryllium		1.4E+00	9.0E-03	1.3E-02	9.0E-03	1.3E-02	9.0E-03	1.3E-02
Copper		3.9E+01	1.6E+00	6.4E+01	1.6E+00	6.4E+01	1.6E+00	6.4E+01
Silver		4.1E+01	4.1E-01	1.7E+01	4.1E-01	1.7E+01	4.1E-01	1.7E+01
Vanadium		1.5E+01	8.4E-03	1.3E-01	8.4E-03	1.3E-01	8.4E-03	1.3E-01
Bromide	2.0E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--
Nitrite as N	2.0E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	6.0E+01	5.4E+02	--	--	--	--	--	--

Table - Off-PWD - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Chloride		2.4E+02	--	--	--	--	--	--
Sulfate		1.5E+03	--	--	--	--	--	--
Hydrazine		1.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Off-PWD - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	6.0E-02	1.2E-01	6.5E-03	6.5E-03	--	6.2E-06	1.2E-03	3.2E-05	3.2E-05	1.3E-03	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	8.0E-03	1.6E-02	2.6E-03	2.6E-03	--	8.3E-07	1.6E-04	1.3E-05	1.3E-05	1.9E-04	--	--	--	--
Formaldehyde	--	6.1E-01	--	--	--	--	6.3E-05	--	--	--	6.3E-05	--	--	--	--
Carbon disulfide	2.5E-03	--	--	--	--	1.7E-05	--	--	--	--	1.7E-05	--	--	--	--
3 & 4 Methylphenol	7.6E-04	--	--	--	--	5.2E-06	--	--	--	--	5.2E-06	--	--	--	--
Benzo(a)anthracene	2.0E-03	--	--	--	--	1.4E-05	--	--	--	--	1.4E-05	9.2E+02	1.5E-08	9.2E+03	1.5E-09
Benzo(a)pyrene	2.3E-03	--	--	--	--	1.5E-05	--	--	--	--	1.5E-05	9.2E+02	1.7E-08	9.2E+03	1.7E-09
Benzo(b)fluoranthene	4.0E-03	--	--	--	--	2.7E-05	--	--	--	--	2.7E-05	9.2E+02	3.0E-08	9.2E+03	3.0E-09
Benzo(ghi)perylene	2.6E-03	--	--	--	--	1.8E-05	--	--	--	--	1.8E-05	9.2E+02	1.9E-08	9.2E+03	1.9E-09
Benzo(k)fluoranthene	2.6E-03	--	--	--	--	1.8E-05	--	--	--	--	1.8E-05	9.2E+02	1.9E-08	9.2E+03	1.9E-09
Chrysene	2.7E-03	--	--	--	--	1.9E-05	--	--	--	--	1.9E-05	9.2E+02	2.0E-08	9.2E+03	2.0E-09
Dibenz(a,h)anthracene	1.2E-03	--	--	--	--	8.2E-06	--	--	--	--	8.2E-06	9.2E+02	8.9E-09	9.2E+03	8.9E-10
Indeno(1,2,3-cd)pyrene	4.0E-03	--	--	--	--	2.7E-05	--	--	--	--	2.7E-05	9.2E+02	3.0E-08	9.2E+03	3.0E-09
Phenanthrene	1.3E-03	--	--	--	--	8.8E-06	--	--	--	--	8.8E-06	9.2E+02	9.6E-09	9.2E+03	9.6E-10
Pyrene	6.3E-03	--	--	--	--	4.3E-05	--	--	--	--	4.3E-05	9.2E+02	4.7E-08	9.2E+03	4.7E-09
4-Chlorophenyl phenyl ether	--	6.1E-02	1.3E-01	4.8E-03	4.8E-03	--	6.3E-06	1.2E-03	2.4E-05	2.4E-05	1.3E-03	--	--	--	--
Carbazole	--	5.1E-02	1.0E-01	2.9E-02	2.9E-02	--	5.3E-06	1.0E-03	1.4E-04	1.4E-04	1.3E-03	--	--	--	--
Diphenyl ether	--	8.6E-01	1.8E+00	1.8E-01	1.8E-01	--	8.9E-05	1.7E-02	9.0E-04	9.0E-04	1.9E-02	--	--	--	--
Diphenylmethanone	--	2.0E-01	4.2E-01	3.2E-01	3.2E-01	--	2.1E-05	4.1E-03	1.5E-03	1.5E-03	7.2E-03	--	--	--	--
Aluminum	1.3E+00	--	--	--	--	8.6E-03	--	--	--	--	8.6E-03	1.1E+02	7.8E-05	1.1E+03	7.8E-06
Barium	4.1E-02	1.6E+01	2.9E-01	2.9E-01	2.9E-01	2.8E-04	1.7E-03	2.9E-03	1.4E-03	1.4E-03	7.6E-03	4.2E+01	1.8E-04	8.3E+01	9.2E-05
Chromium	9.3E-02	2.4E+03	4.0E+00	4.0E+00	4.0E+00	6.3E-04	2.5E-01	3.9E-02	2.0E-02	2.0E-02	3.3E-01	2.7E+00	1.2E-01	1.1E+01	3.0E-02
Iron	2.5E+01	--	--	--	--	1.7E-01	--	--	--	--	1.7E-01	--	--	--	--
Lead	4.3E-03	--	--	--	--	2.9E-05	--	--	--	--	2.9E-05	4.7E+00	6.2E-06	8.3E+00	3.5E-06
Manganese	1.3E+00	--	--	--	--	8.7E-03	--	--	--	--	8.7E-03	9.8E+02	8.9E-06	9.8E+03	8.9E-07
Zinc	9.5E-02	--	--	--	--	6.4E-04	--	--	--	--	6.4E-04	1.5E+01	4.4E-05	1.3E+02	4.9E-06
Arsenic	--	1.4E+01	1.8E+00	1.8E+00	1.8E+00	--	1.4E-03	1.7E-02	8.7E-03	8.7E-03	3.6E-02	5.1E+00	7.1E-03	1.3E+01	2.8E-03
Beryllium	--	1.4E+00	1.3E-02	1.3E-02	1.3E-02	--	1.4E-04	1.2E-04	6.2E-05	6.2E-05	3.9E-04	3.7E-03	1.1E-01	3.7E-02	1.1E-02
Copper	--	3.9E+01	6.4E+01	6.4E+01	6.4E+01	--	4.0E-03	6.3E-01	3.1E-01	3.1E-01	1.3E+00	1.9E+01	6.8E-02	3.7E+01	3.4E-02
Silver	--	4.1E+01	1.7E+01	1.7E+01	1.7E+01	--	4.2E-03	1.6E-01	8.2E-02	8.2E-02	3.3E-01	1.2E+01	2.8E-02	1.2E+02	2.8E-03
Vanadium	--	1.5E+01	1.3E-01	1.3E-01	1.3E-01	--	1.6E-03	1.2E-03	6.2E-04	6.2E-04	4.0E-03	1.1E+00	3.7E-03	1.1E+01	3.7E-04
Bromide	2.0E-01	--	--	--	--	1.4E-03	--	--	--	--	1.4E-03	--	--	--	--
Nitrite as N	2.0E-02	--	--	--	--	1.4E-04	--	--	--	--	1.4E-04	--	--	--	--
Nitrogen, as Ammonia	6.0E+01	5.4E+02	--	--	--	4.1E-01	5.6E-02	--	--	--	4.6E-01	--	--	--	--
Chloride	--	2.4E+02	--	--	--	--	2.5E-02	--	--	--	2.5E-02	--	--	--	--
Sulfate	--	1.5E+03	--	--	--	--	1.6E-01	--	--	--	1.6E-01	--	--	--	--
Hydrazine	--	1.3E-03	--	--	--	--	1.3E-07	--	--	--	1.3E-07	--	--	--	--

Table - Off-PWD - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Off-PWD

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - On PWD/WDW - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	3.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	6.3E+00	3.5E+00	2.2E+01	1.0E+00	6.3E+00	1.0E+00	6.3E+00
Benzene	4.4E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Barium	3.8E+01	1.8E-02	6.8E-01	1.8E-02	6.8E-01	1.8E-02	6.8E-01
Beryllium	6.1E-01	9.0E-03	5.5E-03	9.0E-03	5.5E-03	9.0E-03	5.5E-03
Cadmium	9.4E-01	4.6E-01	4.3E-01	4.6E-01	4.3E-01	4.6E-01	4.3E-01
Chromium	3.0E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Lead	7.6E+01	6.6E-02	5.0E+00	6.6E-02	5.0E+00	6.6E-02	5.0E+00
Mercury	3.4E-01	2.8E+00	9.8E-01	2.8E+00	9.8E-01	2.8E+00	9.8E-01
Vanadium	2.7E+01	8.4E-03	2.3E-01	8.4E-03	2.3E-01	8.4E-03	2.3E-01

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - On PWD/WDW - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	3.4E-01	--	--	--	2.0E-04	--	--	--	2.0E-04	8.4E+03	2.4E-08	8.4E+04	2.4E-09
Bis(2-Ethylhexyl)phthalate	6.3E+00	2.2E+01	6.3E+00	6.3E+00	3.8E-03	1.2E+00	1.8E-01	1.8E-01	1.6E+00	1.1E+00	1.5E+00	1.1E+01	1.5E-01
Benzene	4.4E+00	--	--	--	2.6E-03	--	--	--	2.6E-03	--	--	--	--
Barium	3.8E+01	6.8E-01	6.8E-01	6.8E-01	2.3E-02	3.9E-02	1.9E-02	1.9E-02	1.0E-01	4.2E+01	2.4E-03	8.3E+01	1.2E-03
Beryllium	6.1E-01	5.5E-03	5.5E-03	5.5E-03	3.7E-04	3.1E-04	1.6E-04	1.6E-04	9.9E-04	3.7E-03	2.7E-01	3.7E-02	2.7E-02
Cadmium	9.4E-01	4.3E-01	4.3E-01	4.3E-01	5.7E-04	2.5E-02	1.2E-02	1.2E-02	5.0E-02	1.5E+00	3.3E-02	5.5E+00	9.0E-03
Chromium	3.0E+01	4.0E+00	4.0E+00	4.0E+00	1.8E-02	2.3E-01	1.1E-01	1.1E-01	4.7E-01	2.7E+00	1.7E-01	1.1E+01	4.3E-02
Lead	7.6E+01	5.0E+00	5.0E+00	5.0E+00	4.5E-02	2.8E-01	1.4E-01	1.4E-01	6.1E-01	4.7E+00	1.3E-01	8.3E+00	7.4E-02
Mercury	3.4E-01	9.8E-01	9.8E-01	9.8E-01	2.1E-04	5.5E-02	2.8E-02	2.8E-02	1.1E-01	4.5E-01	2.5E-01	9.0E-01	1.2E-01
Vanadium	2.7E+01	2.3E-01	2.3E-01	2.3E-01	1.6E-02	1.3E-02	6.4E-03	6.4E-03	4.2E-02	1.1E+00	3.8E-02	1.1E+01	3.8E-03

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Storm Water Detention Basin - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		7.8E-03	6.1E+02	4.8E+00	1.1E-01	8.4E-04	1.1E-01	8.4E-04
2,4,4-Trimethyl-2-pentene		3.9E-03	6.0E+02	2.4E+00	3.2E-01	1.3E-03	3.2E-01	1.3E-03
Acetone		1.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		4.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.3E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		3.1E+00	6.6E+02	2.0E+03	1.0E+00	3.1E+00	1.0E+00	3.1E+00
Phenol		1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
N-Nitrosodiphenylamine	7.4E-06		6.2E+02	--	1.7E+00	--	1.7E+00	--
Benzo(a)pyrene		2.2E-01	6.3E+02	1.4E+02	2.2E-01	4.9E-02	2.2E-01	4.9E-02
Arsenic		1.2E+01	1.3E-01	1.5E+00	1.3E-01	1.5E+00	1.3E-01	1.5E+00
Barium	2.6E-02	5.1E+01	1.8E-02	9.3E-01	1.8E-02	9.3E-01	1.8E-02	9.3E-01
Beryllium		1.2E-01	9.0E-03	1.1E-03	9.0E-03	1.1E-03	9.0E-03	1.1E-03
Chromium		5.0E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Vanadium		2.2E+01	8.4E-03	1.8E-01	8.4E-03	1.8E-01	8.4E-03	1.8E-01
Chloride		1.3E+01	--	--	--	--	--	--
Nitrite as N	2.6E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	2.2E+01	--	--	--	--	--	--
Sulfate		1.9E+03	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Storm Water Detention Basin - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	7.8E-03	4.8E+00	8.4E-04	8.4E-04	--	1.3E-06	7.4E-02	6.5E-06	6.5E-06	7.4E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.9E-03	2.4E+00	1.3E-03	1.3E-03	--	6.4E-07	3.7E-02	9.8E-06	9.8E-06	3.7E-02	--	--	--	--
Acetone	--	1.5E-01	--	--	--	--	2.5E-05	--	--	--	2.5E-05	8.4E+03	2.9E-09	8.4E+04	2.9E-10
3 & 4 Methylphenol	--	4.0E+00	--	--	--	--	6.6E-04	--	--	--	6.6E-04	--	--	--	--
Acetophenone	--	1.6E-01	--	--	--	--	2.6E-05	--	--	--	2.6E-05	--	--	--	--
Benzaldehyde	--	1.3E+00	--	--	--	--	2.1E-04	--	--	--	2.1E-04	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	3.1E+00	2.0E+03	3.1E+00	3.1E+00	--	5.1E-04	3.2E+01	2.4E-02	2.4E-02	3.2E+01	1.1E+00	2.9E+01	1.1E+01	2.9E+00
Phenol	--	1.9E+00	--	--	--	--	3.1E-04	--	--	--	3.1E-04	--	--	--	--
N-Nitrosodiphenylamine	7.4E-06	--	--	--	--	8.0E-08	--	--	--	--	8.0E-08	--	--	--	--
Benzo(a)pyrene	--	2.2E-01	1.4E+02	4.9E-02	4.9E-02	--	3.6E-05	2.2E+00	3.8E-04	3.8E-04	2.2E+00	9.2E+02	2.4E-03	9.2E+03	2.4E-04
Arsenic	--	1.2E+01	1.5E+00	1.5E+00	1.5E+00	--	2.0E-03	2.4E-02	1.2E-02	1.2E-02	5.0E-02	5.1E+00	9.7E-03	1.3E+01	3.9E-03
Barium	2.6E-02	5.1E+01	9.3E-01	9.3E-01	9.3E-01	2.8E-04	8.4E-03	1.4E-02	7.2E-03	7.2E-03	3.8E-02	4.2E+01	9.0E-04	8.3E+01	4.5E-04
Beryllium	--	1.2E-01	1.1E-03	1.1E-03	1.1E-03	--	2.0E-05	1.7E-05	8.4E-06	8.4E-06	5.4E-05	3.7E-03	1.4E-02	3.7E-02	1.4E-03
Chromium	--	5.0E+01	4.0E+00	4.0E+00	4.0E+00	--	8.2E-03	6.2E-02	3.1E-02	3.1E-02	1.3E-01	2.7E+00	4.9E-02	1.1E+01	1.2E-02
Vanadium	--	2.2E+01	1.8E-01	1.8E-01	1.8E-01	--	3.6E-03	2.9E-03	1.4E-03	1.4E-03	9.4E-03	1.1E+00	8.5E-03	1.1E+01	8.5E-04
Chloride	--	1.3E+01	--	--	--	--	2.1E-03	--	--	--	2.1E-03	--	--	--	--
Nitrite as N	2.6E-02	--	--	--	--	2.8E-04	--	--	--	--	2.8E-04	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	2.2E+01	--	--	--	8.1E-02	3.6E-03	--	--	--	8.5E-02	--	--	--	--
Sulfate	--	1.9E+03	--	--	--	--	3.1E-01	--	--	--	3.1E-01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Upper South Ditch - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	3.7E-02	2.3E+00	8.5E-02	1.1E-01	4.0E-03	1.1E-01	4.0E-03
2,4,4-Trimethyl-2-pentene	--	3.0E-03	2.3E+00	6.9E-03	3.2E-01	9.7E-04	3.2E-01	9.7E-04
4-iso-Propyltoluene	--	2.6E-03	2.3E+00	5.9E-03	2.6E-01	6.9E-04	2.6E-01	6.9E-04
Acetaldehyde	--	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	1.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol	--	3.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone	--	9.0E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	2.4E+00	--	2.2E-01	--	2.2E-01	--
Benzaldehyde	--	6.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	3.4E-03	2.1E+02	2.5E+00	5.2E+02	1.0E+00	2.1E+02	1.0E+00	2.1E+02
Caprolactam	--	5.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Diphenyl ether	--	2.2E-01	2.3E+00	5.0E-01	2.1E-01	4.7E-02	2.1E-01	4.7E-02
Di-n-octylphthalate	--	1.5E-01	2.5E+00	3.8E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenylmethanone	--	3.1E-02	2.3E+00	7.1E-02	1.6E+00	4.8E-02	1.6E+00	4.8E-02
N-Nitrosodi-n-propylamine	6.6E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Phenol	--	9.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aluminum	1.9E+01	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	1.0E+01	1.3E-01	1.3E+00	1.3E-01	1.3E+00	1.3E-01	1.3E+00
Barium	2.7E-02	7.0E+01	1.8E-02	1.3E+00	1.8E-02	1.3E+00	1.8E-02	1.3E+00
Beryllium	8.4E-04	7.1E-01	9.0E-03	6.4E-03	9.0E-03	6.4E-03	9.0E-03	6.4E-03
Chromium	3.3E+00	9.3E+02	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	2.5E+01	1.0E-01	2.5E+00	1.0E-01	2.5E+00	1.0E-01	2.5E+00
Cobalt	3.7E-02	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	1.7E-02	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	7.9E+00	1.4E+04	7.2E-03	1.0E+02	7.2E-03	1.0E+02	7.2E-03	1.0E+02
Lead	9.4E-04	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.8E+00	--	1.1E-02	--	1.1E-02	--	1.1E-02	--
Silver	1.7E-05	1.9E+01	4.1E-01	7.8E+00	4.1E-01	7.8E+00	4.1E-01	7.8E+00
Vanadium	--	1.5E+01	8.4E-03	1.2E-01	8.4E-03	1.2E-01	8.4E-03	1.2E-01
Bromide	4.0E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.7E+02	1.4E+02	--	--	--	--	--	--
Nitrite as N	2.1E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.2E+02	--	--	--	--	--	--

Table - Upper South Ditch - RME - Heron - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Sulfate	--	7.0E+02	--	--	--	--	--	--
Hydrazine	8.0E-05	9.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Upper South Ditch - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	3.7E-02	8.5E-02	4.0E-03	4.0E-03	--	1.4E-06	3.0E-04	7.1E-06	7.1E-06	3.2E-04	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.0E-03	6.9E-03	9.7E-04	9.7E-04	--	1.1E-07	2.4E-05	1.7E-06	1.7E-06	2.8E-05	--	--	--	--
4-iso-Propyltoluene	--	2.6E-03	5.9E-03	6.9E-04	6.9E-04	--	9.7E-08	2.1E-05	1.2E-06	1.2E-06	2.4E-05	--	--	--	--
Acetaldehyde	--	8.3E-02	--	--	--	--	3.1E-06	--	--	--	3.1E-06	--	--	--	--
Formaldehyde	--	1.1E+00	--	--	--	--	4.1E-05	--	--	--	4.1E-05	--	--	--	--
3 & 4 Methylphenol	--	3.0E+00	--	--	--	--	1.1E-04	--	--	--	1.1E-04	--	--	--	--
Acetophenone	--	9.0E-02	--	--	--	--	3.4E-06	--	--	--	3.4E-06	--	--	--	--
Azobenzene	5.3E-04	--	--	--	--	1.3E-06	--	--	--	--	1.3E-06	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	--	--	--	3.7E-07	--	--	--	--	3.7E-07	9.2E+02	4.0E-10	9.2E+03	4.0E-11
Benzaldehyde	--	6.2E-01	--	--	--	--	2.3E-05	--	--	--	2.3E-05	--	--	--	--
Bis(2-Ethylhexyl)phthalate	3.4E-03	2.1E+02	5.2E+02	2.1E+02	2.1E+02	8.4E-06	7.9E-03	1.9E+00	3.7E-01	3.7E-01	2.6E+00	1.1E+00	2.4E+00	1.1E+01	2.4E-01
Caprolactam	--	5.3E-02	--	--	--	--	2.0E-06	--	--	--	2.0E-06	--	--	--	--
Diphenyl ether	--	2.2E-01	5.0E-01	4.7E-02	4.7E-02	--	8.2E-06	1.8E-03	8.3E-05	8.3E-05	2.0E-03	--	--	--	--
Di-n-octylphthalate	--	1.5E-01	3.8E-01	1.5E-01	1.5E-01	--	5.6E-06	1.3E-03	2.7E-04	2.7E-04	1.9E-03	1.1E+00	1.7E-03	1.1E+01	1.7E-04
Diphenylmethanone	--	3.1E-02	7.1E-02	4.8E-02	4.8E-02	--	1.1E-06	2.5E-04	8.5E-05	8.5E-05	4.3E-04	--	--	--	--
N-Nitrosodi-n-propylamine	6.6E-06	--	--	--	--	1.6E-08	--	--	--	--	1.6E-08	--	--	--	--
Phenol	--	9.6E-01	--	--	--	--	3.6E-05	--	--	--	3.6E-05	--	--	--	--
Aluminum	1.9E+01	--	--	--	--	4.6E-02	--	--	--	--	4.6E-02	1.1E+02	4.2E-04	1.1E+03	4.2E-05
Arsenic	--	1.0E+01	1.3E+00	1.3E+00	1.3E+00	--	3.8E-04	4.5E-03	2.3E-03	2.3E-03	9.4E-03	5.1E+00	1.8E-03	1.3E+01	7.3E-04
Barium	2.7E-02	7.0E+01	1.3E+00	1.3E+00	1.3E+00	6.6E-05	2.6E-03	4.6E-03	2.3E-03	2.3E-03	1.2E-02	4.2E+01	2.8E-04	8.3E+01	1.4E-04
Beryllium	8.4E-04	7.1E-01	6.4E-03	6.4E-03	6.4E-03	2.1E-06	2.7E-05	2.3E-05	1.1E-05	1.1E-05	7.4E-05	3.7E-03	2.0E-02	3.7E-02	2.0E-03
Chromium	3.3E+00	9.3E+02	4.0E+00	4.0E+00	4.0E+00	8.2E-03	3.5E-02	1.4E-02	7.1E-03	7.1E-03	7.1E-02	2.7E+00	2.6E-02	1.1E+01	6.5E-03
Chromium, Hexavalent	--	2.5E+01	2.5E+00	2.5E+00	2.5E+00	--	9.4E-04	8.9E-03	4.4E-03	4.4E-03	1.9E-02	1.6E+00	1.1E-02	1.6E+01	1.1E-03
Cobalt	3.7E-02	--	--	--	--	9.0E-05	--	--	--	--	9.0E-05	--	--	--	--
Copper	1.7E-02	--	--	--	--	4.1E-05	--	--	--	--	4.1E-05	1.9E+01	2.2E-06	3.7E+01	1.1E-06
Iron	7.9E+00	1.4E+04	1.0E+02	1.0E+02	1.0E+02	2.0E-02	5.2E-01	3.6E-01	1.8E-01	1.8E-01	1.3E+00	--	--	--	--
Lead	9.4E-04	--	--	--	--	2.3E-06	--	--	--	--	2.3E-06	4.7E+00	4.9E-07	8.3E+00	2.8E-07
Manganese	1.8E+00	--	--	--	--	4.4E-03	--	--	--	--	4.4E-03	9.8E+02	4.5E-06	9.8E+03	4.5E-07
Silver	1.7E-05	1.9E+01	7.8E+00	7.8E+00	7.8E+00	4.2E-08	7.1E-04	2.8E-02	1.4E-02	1.4E-02	5.6E-02	1.2E+01	4.7E-03	1.2E+02	4.7E-04
Vanadium	--	1.5E+01	1.2E-01	1.2E-01	1.2E-01	--	5.4E-04	4.3E-04	2.2E-04	2.2E-04	1.4E-03	1.1E+00	1.3E-03	1.1E+01	1.3E-04
Bromide	4.0E-01	--	--	--	--	9.9E-04	--	--	--	--	9.9E-04	--	--	--	--
Chloride	1.7E+02	1.4E+02	--	--	--	4.2E-01	5.2E-03	--	--	--	4.3E-01	--	--	--	--
Nitrite as N	2.1E-02	--	--	--	--	5.0E-05	--	--	--	--	5.0E-05	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.2E+02	--	--	--	1.8E-01	8.1E-03	--	--	--	1.9E-01	--	--	--	--
Sulfate	--	7.0E+02	--	--	--	--	2.6E-02	--	--	--	2.6E-02	--	--	--	--
Hydrazine	8.0E-05	9.1E-04	--	--	--	2.0E-07	3.4E-08	--	--	--	2.3E-07	--	--	--	--

Table - Upper South Ditch - RME - Heron - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Green Heron
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates, fish, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Table Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

RME - Reasonable Maximum Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Central Pond - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Central Pond

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
2,4,4-Trimethyl-1-pentene		1.10E-02	6.10E+02	6.71E+00
2,4,4-Trimethyl-2-pentene		8.80E-03	6.05E+02	5.32E+00
Acetone		1.20E-01	0.00E+00	0.00E+00
Methyl Tertbutyl Ether		1.70E-03	0.00E+00	0.00E+00
3 & 4 Methylphenol		6.10E+00	0.00E+00	0.00E+00
Acetophenone		2.60E-01	0.00E+00	0.00E+00
Benzaldehyde		1.90E+00	0.00E+00	0.00E+00
Phenol		2.20E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene		1.40E-01	6.28E+02	8.79E+01
Fluoranthene		2.90E-01	6.18E+02	1.79E+02
Phenanthrene		2.10E-01	6.09E+02	1.28E+02
Pyrene		2.30E-01	6.14E+02	1.41E+02
Aluminum	2.10E-01		8.60E-03	--
Barium	4.90E-02	4.60E+01	1.82E-02	8.37E-01
Beryllium		9.40E-02	9.00E-03	8.46E-04
Chromium		1.40E+02	--	4.00E+00
Chromium, Hexavalent		2.70E-01	1.00E-01	2.70E-02
Lead		5.10E+01	6.60E-02	3.37E+00
Manganese	7.00E-01	5.90E+02	2.97E-03	1.75E+00
Tin		2.20E+00	--	--
Silver	1.50E-05		4.09E-01	--
Vanadium		1.70E+01	8.40E-03	1.43E-01
Bromide	1.30E-01		0.00E+00	--
Chloride		2.40E+01	--	--
Nitrite as N	7.50E-02		--	--
Nitrogen, as Ammonia	2.80E+01	3.50E+01	--	--
Sulfate		1.20E+03	--	--

Table - Central Pond - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Central Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in sediment
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table - Central Pond - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	1.10E-02	6.71E+00	--	1.03E-04	4.36E+00	4.4E+00	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	8.80E-03	5.32E+00	--	8.24E-05	3.46E+00	3.5E+00	--	--	--	--
Acetone	--	1.20E-01	0.00E+00	--	1.12E-03	0.00E+00	1.1E-03	8.43E+03	1.3E-07	8.43E+04	1.3E-08
Methyl Tertbutyl Ether	--	1.70E-03	0.00E+00	--	1.59E-05	0.00E+00	1.6E-05	--	--	--	--
3 & 4 Methylphenol	--	6.10E+00	0.00E+00	--	5.71E-02	0.00E+00	5.7E-02	--	--	--	--
Acetophenone	--	2.60E-01	0.00E+00	--	2.44E-03	0.00E+00	2.4E-03	--	--	--	--
Benzaldehyde	--	1.90E+00	0.00E+00	--	1.78E-02	0.00E+00	1.8E-02	--	--	--	--
Phenol	--	2.20E+00	0.00E+00	--	2.06E-02	0.00E+00	2.1E-02	--	--	--	--
Benzo(b)fluoranthene	--	1.40E-01	8.79E+01	--	1.31E-03	5.72E+01	5.7E+01	9.20E+02	6.2E-02	9.20E+03	6.2E-03
Fluoranthene	--	2.90E-01	1.79E+02	--	2.72E-03	1.17E+02	1.2E+02	9.20E+02	1.3E-01	9.20E+03	1.3E-02
Phenanthrene	--	2.10E-01	1.28E+02	--	1.97E-03	8.31E+01	8.3E+01	9.20E+02	9.0E-02	9.20E+03	9.0E-03
Pyrene	--	2.30E-01	1.41E+02	--	2.15E-03	9.19E+01	9.2E+01	9.20E+02	1.0E-01	9.20E+03	1.0E-02
Aluminum	2.10E-01	--	--	4.16E-02	--	--	4.2E-02	1.10E+02	3.8E-04	1.10E+03	3.8E-05
Barium	4.90E-02	4.60E+01	8.37E-01	9.71E-03	4.31E-01	5.45E-01	9.9E-01	4.17E+01	2.4E-02	8.33E+01	1.2E-02
Beryllium	--	9.40E-02	8.46E-04	--	8.80E-04	5.50E-04	1.4E-03	3.70E-03	3.9E-01	3.70E-02	3.9E-02
Chromium	--	1.40E+02	4.00E+00	--	1.31E+00	2.60E+00	3.9E+00	2.70E+00	1.4E+00	1.10E+01	3.6E-01
Chromium, Hexavalent	--	2.70E-01	2.70E-02	--	2.53E-03	1.76E-02	2.0E-02	1.64E+00	1.2E-02	1.64E+01	1.2E-03
Lead	--	5.10E+01	3.37E+00	--	4.78E-01	2.19E+00	2.7E+00	4.70E+00	5.7E-01	8.28E+00	3.2E-01
Manganese	7.00E-01	5.90E+02	1.75E+00	1.39E-01	5.53E+00	1.14E+00	6.8E+00	9.77E+02	7.0E-03	9.77E+03	7.0E-04
Tin	--	2.20E+00	--	--	2.06E-02	--	2.1E-02	6.80E+00	3.0E-03	1.69E+01	1.2E-03
Silver	1.50E-05	--	--	2.97E-06	--	--	3.0E-06	1.18E+01	2.5E-07	1.18E+02	2.5E-08
Vanadium	--	1.70E+01	1.43E-01	--	1.59E-01	9.29E-02	2.5E-01	1.10E+00	2.3E-01	1.10E+01	2.3E-02
Bromide	1.30E-01	--	--	2.58E-02	--	--	2.6E-02	--	--	--	--
Chloride	--	2.40E+01	--	--	2.25E-01	--	2.2E-01	--	--	--	--
Nitrite as N	7.50E-02	--	--	1.49E-02	--	--	1.5E-02	--	--	--	--
Nitrogen, as Ammonia	2.80E+01	3.50E+01	--	5.55E+00	3.28E-01	--	5.9E+00	--	--	--	--
Sulfate	--	1.20E+03	--	--	1.12E+01	--	1.1E+01	--	--	--	--

Table - Central Pond - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Central Pond

[a] - Doses for surface water (sw), sediment, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in sediment
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{inv} - Chemical concentration in fish tissue
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
mg/L - milligrams per liter
mg/kg - milligrams per kilogram
BW - body weight
TRV - Toxicity Reference Value
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level
HQ - Hazard Quotient

Table - Lower South Ditch - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-02	1.08E+00	2.16E-02
2,4,4-Trimethyl-2-pentene	--	3.50E-03	1.07E+00	3.75E-03
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00
Acetone	--	1.20E-01	0.00E+00	0.00E+00
Formaldehyde	--	6.00E-01	0.00E+00	0.00E+00
Aniline	--	2.30E-01	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00
Benzo(a)pyrene	1.50E-04	--	1.12E+00	--
Bis(2-Ethylhexyl)phthalate	3.43E-03	6.02E+02	1.16E+00	7.00E+02
Di-n-octylphthalate	--	1.50E-01	1.18E+00	1.77E-01
Diphenyl ether	--	2.60E+00	1.07E+00	2.79E+00
Diphenylamine	--	9.50E-02	1.08E+00	1.02E-01
N-Nitrosodi-n-propylamine	6.56E-06	--	0.00E+00	--
4,4`-DDT	--	6.20E-02	1.13E+00	7.01E-02
Hexachlorobenzene	--	3.70E-02	1.11E+00	4.09E-02
Aluminum	1.89E+01	--	8.60E-03	--
Barium	2.67E-02	1.74E+01	1.82E-02	3.16E-01
Beryllium	8.41E-04	1.45E+00	9.00E-03	1.31E-02
Cadmium	--	1.03E+00	4.59E-01	4.71E-01
Chromium	3.32E+00	2.76E+03	--	4.00E+00
Chromium, Hexavalent	--	2.56E+01	1.00E-01	2.56E+00
Cobalt	3.65E-02	--	2.44E-02	--
Copper	1.65E-02	--	1.65E+00	--
Iron	7.93E+00	--	7.20E-03	--
Lead	9.41E-04	--	6.60E-02	--
Manganese	1.79E+00	--	1.08E-02	--
Mercury	--	2.90E-01	2.84E+00	8.23E-01
Nickel	--	1.96E+01	8.18E-01	1.60E+01
Silver	1.70E-05	6.20E+01	4.09E-01	2.54E+01
Tin	--	1.60E+00	--	--
Vanadium	--	1.11E+01	8.40E-03	9.32E-02
Bromide	4.01E-01	--	0.00E+00	--

Table - Lower South Ditch - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Chloride	1.72E+02	1.40E+02	--	--
Nitrite as N	2.05E-02	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.52E+02	--	--
Sulfate	--	8.30E+02	--	--
Hydrazine	8.00E-05	2.40E-03	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	9.60E-04	--	1.09E+00	--
4-Nonylphenol (Tech.)	1.39E-02	--	1.12E+00	--
Kempore (Azodicarbonamide)	1.21E+00	--	--	--
C11-C22 Aromatics	--	9.40E+03	--	--
C19-C36 Aliphatics	--	6.40E+03	--	--
C9-C18 Aliphatics	--	7.70E+02	--	--
EPH, Total	--	1.70E+04	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Lower South Ditch - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-02	2.16E-02	--	4.16E-05	3.12E-03	3.2E-03	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.50E-03	3.75E-03	--	7.29E-06	5.42E-04	5.5E-04	--	--	--	--
Acetaldehyde	--	6.30E-02	0.00E+00	--	1.31E-04	0.00E+00	1.3E-04	--	--	--	--
Acetone	--	1.20E-01	0.00E+00	--	2.50E-04	0.00E+00	2.5E-04	8.43E+03	3.0E-08	8.43E+04	3.0E-09
Formaldehyde	--	6.00E-01	0.00E+00	--	1.25E-03	0.00E+00	1.2E-03	--	--	--	--
Aniline	--	2.30E-01	0.00E+00	--	4.79E-04	0.00E+00	4.8E-04	--	--	--	--
Azobenzene	5.30E-04	--	--	2.34E-05	--	--	2.3E-05	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	--	2.50E-04	0.00E+00	2.5E-04	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	--	6.61E-06	--	--	6.6E-06	9.20E+02	7.2E-09	9.20E+03	7.2E-10
Bis(2-Ethylhexyl)phthalate	3.43E-03	6.02E+02	7.00E+02	1.51E-04	1.25E+00	1.01E+02	1.0E+02	1.10E+00	9.3E+01	1.10E+01	9.3E+00
Di-n-octylphthalate	--	1.50E-01	1.77E-01	--	3.12E-04	2.56E-02	2.6E-02	1.11E+00	2.3E-02	1.11E+01	2.3E-03
Diphenyl ether	--	2.60E+00	2.79E+00	--	5.41E-03	4.03E-01	4.1E-01	--	--	--	--
Diphenylamine	--	9.50E-02	1.02E-01	--	1.98E-04	1.48E-02	1.5E-02	--	--	--	--
N-Nitrosodi-n-propylamine	6.56E-06	--	--	2.89E-07	--	--	2.9E-07	--	--	--	--
4,4`-DDT	--	6.20E-02	7.01E-02	--	1.29E-04	1.01E-02	1.0E-02	1.30E+01	7.9E-04	1.30E+02	7.9E-05
Hexachlorobenzene	--	3.70E-02	4.09E-02	--	7.70E-05	5.92E-03	6.0E-03	2.90E+00	2.1E-03	2.90E+01	2.1E-04
Aluminum	1.89E+01	--	--	8.30E-01	--	--	8.3E-01	1.10E+02	7.6E-03	1.10E+03	7.6E-04
Barium	2.67E-02	1.74E+01	3.16E-01	1.18E-03	3.61E-02	4.56E-02	8.3E-02	4.17E+01	2.0E-03	8.33E+01	1.0E-03
Beryllium	8.41E-04	1.45E+00	1.31E-02	3.70E-05	3.02E-03	1.89E-03	5.0E-03	3.70E-03	1.3E+00	3.70E-02	1.3E-01
Cadmium	--	1.03E+00	4.71E-01	--	2.14E-03	6.81E-02	7.0E-02	1.50E+00	4.7E-02	5.50E+00	1.3E-02
Chromium	3.32E+00	2.76E+03	4.00E+00	1.46E-01	5.75E+00	5.78E-01	6.5E+00	2.70E+00	2.4E+00	1.10E+01	5.9E-01
Chromium, Hexavalent	--	2.56E+01	2.56E+00	--	5.33E-02	3.70E-01	4.2E-01	1.64E+00	2.6E-01	1.64E+01	2.6E-02
Cobalt	3.65E-02	--	--	1.61E-03	--	--	1.6E-03	--	--	--	--
Copper	1.65E-02	--	--	7.27E-04	--	--	7.3E-04	1.85E+01	3.9E-05	3.70E+01	2.0E-05
Iron	7.93E+00	--	--	3.49E-01	--	--	3.5E-01	--	--	--	--
Lead	9.41E-04	--	--	4.14E-05	--	--	4.1E-05	4.70E+00	8.8E-06	8.28E+00	5.0E-06
Manganese	1.79E+00	--	--	7.86E-02	--	--	7.9E-02	9.77E+02	8.0E-05	9.77E+03	8.0E-06
Mercury	--	2.90E-01	8.23E-01	--	6.04E-04	1.19E-01	1.2E-01	4.50E-01	2.7E-01	9.00E-01	1.3E-01
Nickel	--	1.96E+01	1.60E+01	--	4.08E-02	2.32E+00	2.4E+00	7.74E+01	3.0E-02	1.07E+02	2.2E-02
Silver	1.70E-05	6.20E+01	2.54E+01	7.49E-07	1.29E-01	3.67E+00	3.8E+00	1.18E+01	3.2E-01	1.18E+02	3.2E-02
Tin	--	1.60E+00	--	--	3.33E-03	--	3.3E-03	6.80E+00	4.9E-04	1.69E+01	2.0E-04
Vanadium	--	1.11E+01	9.32E-02	--	2.31E-02	1.35E-02	3.7E-02	1.10E+00	3.3E-02	1.10E+01	3.3E-03
Bromide	4.01E-01	--	--	1.77E-02	--	--	1.8E-02	--	--	--	--
Chloride	1.72E+02	1.40E+02	--	7.56E+00	2.91E-01	--	7.9E+00	--	--	--	--
Nitrite as N	2.05E-02	--	--	9.03E-04	--	--	9.0E-04	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.52E+02	--	3.21E+00	5.25E-01	--	3.7E+00	--	--	--	--
Sulfate	--	8.30E+02	--	--	1.73E+00	--	1.7E+00	--	--	--	--

Table - Lower South Ditch - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Hydrazine	8.00E-05	2.40E-03	0.00E+00	3.52E-06	5.00E-06	0.00E+00	8.5E-06	--	--	--	--
4,4'-Isopropylidenediphenol	9.60E-04	--	--	4.23E-05	--	--	4.2E-05	--	--	--	--
4-Nonylphenol (Tech.)	1.39E-02	--	--	6.12E-04	--	--	6.1E-04	--	--	--	--
Kempore (Azodicarbonamide)	1.21E+00	--	--	5.31E-02	--	--	5.3E-02	--	--	--	--
C11-C22 Aromatics	--	9.40E+03	--	--	1.96E+01	--	2.0E+01	--	--	--	--
C19-C36 Aliphatics	--	6.40E+03	--	--	1.33E+01	--	1.3E+01	--	--	--	--
C9-C18 Aliphatics	--	7.70E+02	--	--	1.60E+00	--	1.6E+00	--	--	--	--
EPH, Total	--	1.70E+04	--	--	3.54E+01	--	3.5E+01	--	--	--	--

Notes:
[a] - Doses for surface water (sw), sediment and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - North Pond - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-03	2.30E+00	4.61E-03
Acetone	--	3.30E-01	0.00E+00	0.00E+00
Carbon disulfide	--	7.30E-03	0.00E+00	0.00E+00
Benzo(a)anthracene	1.20E-04	--	2.37E+00	--
Benzo(a)pyrene	1.70E-04	--	2.39E+00	--
Bis(2-Ethylhexyl)phthalate	--	3.70E+00	2.48E+00	9.19E+00
Carbazole	--	1.60E-01	2.29E+00	3.66E-01
Caprolactam	3.30E-04	--	0.00E+00	--
Pyrene	3.90E-04	--	2.32E+00	--
Aluminum	2.20E-01	--	8.60E-03	--
Arsenic	--	1.30E+01	1.27E-01	1.65E+00
Barium	4.10E-02	6.20E+01	1.82E-02	1.13E+00
Beryllium	--	5.30E-01	9.00E-03	4.77E-03
Cadmium	--	2.20E+00	4.59E-01	1.01E+00
Chromium	--	7.80E+02	--	4.00E+00
Chromium, Hexavalent	--	9.00E-01	1.00E-01	9.00E-02
Copper	--	6.80E+01	1.65E+00	1.12E+02
Iron	2.90E+00	2.30E+04	7.20E-03	1.66E+02
Lead	1.30E-03	1.10E+02	6.60E-02	7.26E+00
Manganese	4.90E-01	1.25E+03	1.08E-02	1.35E+01
Silver	2.20E-05	--	4.09E-01	--
Thallium	--	8.20E-01	--	--
Tin	--	1.10E+01	--	--
Vanadium	--	2.60E+01	8.40E-03	2.18E-01
Zinc	--	3.60E+02	2.60E-02	9.36E+00
Bromide	6.50E-01	--	0.00E+00	--
Chloride	3.20E+02	3.20E+02	--	--
Nitrogen, as Ammonia	--	2.30E+01	--	--
Sulfate	--	2.70E+02	--	--

Notes:
RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - North Pond - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-03	4.61E-03	--	2.50E-05	4.00E-03	4.0E-03	--	--	--	--
Acetone	--	3.30E-01	0.00E+00	--	4.12E-03	0.00E+00	4.1E-03	8.43E+03	4.9E-07	8.43E+04	4.9E-08
Carbon disulfide	--	7.30E-03	0.00E+00	--	9.12E-05	0.00E+00	9.1E-05	--	--	--	--
Benzo(a)anthracene	1.20E-04	--	--	3.17E-05	--	--	3.2E-05	9.20E+02	3.4E-08	9.20E+03	3.4E-09
Benzo(a)pyrene	1.70E-04	--	--	4.49E-05	--	--	4.5E-05	9.20E+02	4.9E-08	9.20E+03	4.9E-09
Bis(2-Ethylhexyl)phthalate	--	3.70E+00	9.19E+00	--	4.62E-02	7.97E+00	8.0E+00	1.10E+00	7.3E+00	1.10E+01	7.3E-01
Carbazole	--	1.60E-01	3.66E-01	--	2.00E-03	3.17E-01	3.2E-01	--	--	--	--
Caprolactam	3.30E-04	--	--	8.72E-05	--	--	8.7E-05	--	--	--	--
Pyrene	3.90E-04	--	--	1.03E-04	--	--	1.0E-04	9.20E+02	1.1E-07	9.20E+03	1.1E-08
Aluminum	2.20E-01	--	--	5.82E-02	--	--	5.8E-02	1.10E+02	5.3E-04	1.10E+03	5.3E-05
Arsenic	--	1.30E+01	1.65E+00	--	1.62E-01	1.43E+00	1.6E+00	5.14E+00	3.1E-01	1.28E+01	1.2E-01
Barium	4.10E-02	6.20E+01	1.13E+00	1.08E-02	7.74E-01	9.79E-01	1.8E+00	4.17E+01	4.2E-02	8.33E+01	2.1E-02
Beryllium	--	5.30E-01	4.77E-03	--	6.62E-03	4.14E-03	1.1E-02	3.70E-03	2.9E+00	3.70E-02	2.9E-01
Cadmium	--	2.20E+00	1.01E+00	--	2.75E-02	8.76E-01	9.0E-01	1.50E+00	6.0E-01	5.50E+00	1.6E-01
Chromium	--	7.80E+02	4.00E+00	--	9.74E+00	3.47E+00	1.3E+01	2.70E+00	4.9E+00	1.10E+01	1.2E+00
Chromium, Hexavalent	--	9.00E-01	9.00E-02	--	1.12E-02	7.81E-02	8.9E-02	1.64E+00	5.4E-02	1.64E+01	5.4E-03
Copper	--	6.80E+01	1.12E+02	--	8.49E-01	9.71E+01	9.8E+01	1.85E+01	5.3E+00	3.70E+01	2.6E+00
Iron	2.90E+00	2.30E+04	1.66E+02	7.67E-01	2.87E+02	1.44E+02	4.3E+02	--	--	--	--
Lead	1.30E-03	1.10E+02	7.26E+00	3.44E-04	1.37E+00	6.30E+00	7.7E+00	4.70E+00	1.6E+00	8.28E+00	9.3E-01
Manganese	4.90E-01	1.25E+03	1.35E+01	1.30E-01	1.56E+01	1.17E+01	2.7E+01	9.77E+02	2.8E-02	9.77E+03	2.8E-03
Silver	2.20E-05	--	--	5.82E-06	--	--	5.8E-06	1.18E+01	4.9E-07	1.18E+02	4.9E-08
Thallium	--	8.20E-01	--	--	1.02E-02	--	1.0E-02	6.10E-01	1.7E-02	6.10E+00	1.7E-03
Tin	--	1.10E+01	--	--	1.37E-01	--	1.4E-01	6.80E+00	2.0E-02	1.69E+01	8.1E-03
Vanadium	--	2.60E+01	2.18E-01	--	3.25E-01	1.89E-01	5.1E-01	1.10E+00	4.7E-01	1.10E+01	4.7E-02
Zinc	--	3.60E+02	9.36E+00	--	4.50E+00	8.12E+00	1.3E+01	1.45E+01	8.7E-01	1.31E+02	9.6E-02
Bromide	6.50E-01	--	--	1.72E-01	--	--	1.7E-01	--	--	--	--
Chloride	3.20E+02	3.20E+02	--	8.46E+01	4.00E+00	--	8.9E+01	--	--	--	--
Nitrogen, as Ammonia	--	2.30E+01	--	--	2.87E-01	--	2.9E-01	--	--	--	--
Sulfate	--	2.70E+02	--	--	3.37E+00	--	3.4E+00	--	--	--	--

Table - North Pond - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	North Pond

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Off-PWD - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Off-PWD

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
2,4,4-Trimethyl-1-pentene		6.00E-02	2.07E+00	1.24E-01
2,4,4-Trimethyl-2-pentene		8.00E-03	2.06E+00	1.65E-02
Formaldehyde		6.10E-01	0.00E+00	0.00E+00
Carbon disulfide	2.50E-03		0.00E+00	--
3 & 4 Methylphenol	7.60E-04		0.00E+00	--
Benzo(a)anthracene	2.00E-03		2.13E+00	--
Benzo(a)pyrene	2.27E-03		2.15E+00	--
Benzo(b)fluoranthene	4.00E-03		2.13E+00	--
Benzo(ghi)perylene	2.59E-03		2.18E+00	--
Benzo(k)fluoranthene	2.60E-03		2.15E+00	--
Chrysene	2.74E-03		2.14E+00	--
Dibenz(a,h)anthracene	1.20E-03		2.19E+00	--
Indeno(1,2,3-cd)pyrene	4.00E-03		2.18E+00	--
Phenanthrene	1.30E-03		2.07E+00	--
Pyrene	6.33E-03		2.09E+00	--
4-Chlorophenyl phenyl ether		6.10E-02	2.08E+00	1.27E-01
Carbazole		5.10E-02	2.06E+00	1.05E-01
Diphenyl ether		8.60E-01	2.06E+00	1.77E+00
Diphenylmethanone		2.00E-01	2.11E+00	4.22E-01
Aluminum	1.27E+00		8.60E-03	--
Barium	4.10E-02	1.60E+01	1.82E-02	2.91E-01
Chromium	9.26E-02	2.40E+03	--	4.00E+00
Iron	2.53E+01		7.20E-03	--
Lead	4.28E-03		6.60E-02	--
Manganese	1.28E+00		1.08E-02	--
Zinc	9.49E-02		2.60E-02	--
Arsenic		1.40E+01	1.27E-01	1.78E+00
Beryllium		1.40E+00	9.00E-03	1.26E-02
Copper		3.90E+01	1.65E+00	6.42E+01
Silver		4.10E+01	4.09E-01	1.68E+01
Vanadium		1.50E+01	8.40E-03	1.26E-01
Bromide	1.99E-01		0.00E+00	--
Nitrite as N	2.00E-02		--	--
Nitrogen, as Ammonia	5.97E+01	5.40E+02	--	--

Table - Off-PWD - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Off-PWD

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Chloride		2.40E+02	--	--
Sulfate		1.50E+03	--	--
Hydrazine		1.30E-03	0.00E+00	0.00E+00

Notes:
RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - Off-PWD - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	6.00E-02	1.24E-01	--	4.31E-04	6.20E-02	6.2E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	8.00E-03	1.65E-02	--	5.74E-05	8.21E-03	8.3E-03	--	--	--	--
Formaldehyde	--	6.10E-01	0.00E+00	--	4.38E-03	0.00E+00	4.4E-03	--	--	--	--
Carbon disulfide	2.50E-03	--	--	3.80E-04	--	--	3.8E-04	--	--	--	--
3 & 4 Methylphenol	7.60E-04	--	--	1.16E-04	--	--	1.2E-04	--	--	--	--
Benzo(a)anthracene	2.00E-03	--	--	3.04E-04	--	--	3.0E-04	9.20E+02	3.3E-07	9.20E+03	3.3E-08
Benzo(a)pyrene	2.27E-03	--	--	3.45E-04	--	--	3.5E-04	9.20E+02	3.8E-07	9.20E+03	3.8E-08
Benzo(b)fluoranthene	4.00E-03	--	--	6.08E-04	--	--	6.1E-04	9.20E+02	6.6E-07	9.20E+03	6.6E-08
Benzo(ghi)perylene	2.59E-03	--	--	3.94E-04	--	--	3.9E-04	9.20E+02	4.3E-07	9.20E+03	4.3E-08
Benzo(k)fluoranthene	2.60E-03	--	--	3.95E-04	--	--	4.0E-04	9.20E+02	4.3E-07	9.20E+03	4.3E-08
Chrysene	2.74E-03	--	--	4.16E-04	--	--	4.2E-04	9.20E+02	4.5E-07	9.20E+03	4.5E-08
Dibenz(a,h)anthracene	1.20E-03	--	--	1.82E-04	--	--	1.8E-04	9.20E+02	2.0E-07	9.20E+03	2.0E-08
Indeno(1,2,3-cd)pyrene	4.00E-03	--	--	6.08E-04	--	--	6.1E-04	9.20E+02	6.6E-07	9.20E+03	6.6E-08
Phenanthrene	1.30E-03	--	--	1.98E-04	--	--	2.0E-04	9.20E+02	2.1E-07	9.20E+03	2.1E-08
Pyrene	6.33E-03	--	--	9.62E-04	--	--	9.6E-04	9.20E+02	1.0E-06	9.20E+03	1.0E-07
4-Chlorophenyl phenyl ether	--	6.10E-02	1.27E-01	--	4.38E-04	6.33E-02	6.4E-02	--	--	--	--
Carbazole	--	5.10E-02	1.05E-01	--	3.66E-04	5.23E-02	5.3E-02	--	--	--	--
Diphenyl ether	--	8.60E-01	1.77E+00	--	6.18E-03	8.84E-01	8.9E-01	--	--	--	--
Diphenylmethanone	--	2.00E-01	4.22E-01	--	1.44E-03	2.10E-01	2.1E-01	--	--	--	--
Aluminum	1.27E+00	--	--	1.92E-01	--	--	1.9E-01	1.10E+02	1.8E-03	1.10E+03	1.8E-04
Barium	4.10E-02	1.60E+01	2.91E-01	6.23E-03	1.15E-01	1.45E-01	2.7E-01	4.17E+01	6.4E-03	8.33E+01	3.2E-03
Chromium	9.26E-02	2.40E+03	4.00E+00	1.41E-02	1.72E+01	1.99E+00	1.9E+01	2.70E+00	7.1E+00	1.10E+01	1.7E+00
Iron	2.53E+01	--	--	3.85E+00	--	--	3.9E+00	--	--	--	--
Lead	4.28E-03	--	--	6.51E-04	--	--	6.5E-04	4.70E+00	1.4E-04	8.28E+00	7.9E-05
Manganese	1.28E+00	--	--	1.94E-01	--	--	1.9E-01	9.77E+02	2.0E-04	9.77E+03	2.0E-05
Zinc	9.49E-02	--	--	1.44E-02	--	--	1.4E-02	1.45E+01	9.9E-04	1.31E+02	1.1E-04
Arsenic	--	1.40E+01	1.78E+00	--	1.01E-01	8.87E-01	9.9E-01	5.14E+00	1.9E-01	1.28E+01	7.7E-02
Beryllium	--	1.40E+00	1.26E-02	--	1.01E-02	6.28E-03	1.6E-02	3.70E-03	4.4E+00	3.70E-02	4.4E-01
Copper	--	3.90E+01	6.42E+01	--	2.80E-01	3.20E+01	3.2E+01	1.85E+01	1.7E+00	3.70E+01	8.7E-01
Silver	--	4.10E+01	1.68E+01	--	2.94E-01	8.36E+00	8.7E+00	1.18E+01	7.3E-01	1.18E+02	7.3E-02
Vanadium	--	1.50E+01	1.26E-01	--	1.08E-01	6.28E-02	1.7E-01	1.10E+00	1.6E-01	1.10E+01	1.6E-02
Bromide	1.99E-01	--	--	3.02E-02	--	--	3.0E-02	--	--	--	--
Nitrite as N	2.00E-02	--	--	3.04E-03	--	--	3.0E-03	--	--	--	--
Nitrogen, as Ammonia	5.97E+01	5.40E+02	--	9.07E+00	3.88E+00	--	1.3E+01	--	--	--	--
Chloride	--	2.40E+02	--	--	1.72E+00	--	1.7E+00	--	--	--	--
Sulfate	--	1.50E+03	--	--	1.08E+01	--	1.1E+01	--	--	--	--
Hydrazine	--	1.30E-03	0.00E+00	--	9.34E-06	0.00E+00	9.3E-06	--	--	--	--

Table - Off-PWD - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Off-PWD

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - On PWD/WDW - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	On PWD/WDW

Chemical	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Acetone	3.40E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	6.30E+00	3.49E+00	2.20E+01
Benzene	4.40E+00	0.00E+00	0.00E+00
Barium	3.76E+01	1.82E-02	6.84E-01
Beryllium	6.10E-01	9.00E-03	5.49E-03
Cadmium	9.43E-01	4.59E-01	4.33E-01
Chromium	2.96E+01	--	4.00E+00
Lead	7.57E+01	6.60E-02	5.00E+00
Mercury	3.44E-01	2.84E+00	9.76E-01
Vanadium	2.70E+01	8.40E-03	2.27E-01

Notes:
RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - On PWD/WDW - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
Acetone	3.40E-01	0.00E+00	4.25E-03	0.00E+00	4.2E-03	8.43E+03	5.0E-07	8.43E+04	5.0E-08
Bis(2-Ethylhexyl)phthalate	6.30E+00	2.20E+01	7.87E-02	1.91E+01	1.9E+01	1.10E+00	1.7E+01	1.10E+01	1.7E+00
Benzene	4.40E+00	0.00E+00	5.50E-02	0.00E+00	5.5E-02	--	--	--	--
Barium	3.76E+01	6.84E-01	4.70E-01	5.93E-01	1.1E+00	4.17E+01	2.6E-02	8.33E+01	1.3E-02
Beryllium	6.10E-01	5.49E-03	7.62E-03	4.76E-03	1.2E-02	3.70E-03	3.3E+00	3.70E-02	3.3E-01
Cadmium	9.43E-01	4.33E-01	1.18E-02	3.75E-01	3.9E-01	1.50E+00	2.6E-01	5.50E+00	7.0E-02
Chromium	2.96E+01	4.00E+00	3.70E-01	3.47E+00	3.8E+00	2.70E+00	1.4E+00	1.10E+01	3.5E-01
Lead	7.57E+01	5.00E+00	9.45E-01	4.33E+00	5.3E+00	4.70E+00	1.1E+00	8.28E+00	6.4E-01
Mercury	3.44E-01	9.76E-01	4.30E-03	8.46E-01	8.5E-01	4.50E-01	1.9E+00	9.00E-01	9.5E-01
Vanadium	2.70E+01	2.27E-01	3.37E-01	1.97E-01	5.3E-01	1.10E+00	4.9E-01	1.10E+01	4.9E-02

Notes:
[a] - Doses for surface water (sw), sediment and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Storm Water Detention Basin - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene		7.80E-03	6.10E+02	4.76E+00
2,4,4-Trimethyl-2-pentene		3.90E-03	6.05E+02	2.36E+00
Acetone		1.50E-01	0.00E+00	0.00E+00
3 & 4 Methylphenol		4.00E+00	0.00E+00	0.00E+00
Acetophenone		1.60E-01	0.00E+00	0.00E+00
Benzaldehyde		1.30E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		3.10E+00	6.57E+02	2.04E+03
Phenol		1.90E+00	0.00E+00	0.00E+00
N-Nitrosodiphenylamine	7.40E-06		6.23E+02	--
Benzo(a)pyrene		2.20E-01	6.33E+02	1.39E+02
Arsenic		1.20E+01	1.27E-01	1.52E+00
Barium	2.60E-02	5.10E+01	1.82E-02	9.28E-01
Beryllium		1.20E-01	9.00E-03	1.08E-03
Chromium		5.00E+01	--	4.00E+00
Vanadium		2.20E+01	8.40E-03	1.85E-01
Chloride		1.30E+01	--	--
Nitrite as N	2.60E-02		--	--
Nitrogen, as Ammonia	7.50E+00	2.20E+01	--	--
Sulfate		1.90E+03	--	--

Notes:

RME - Reasonable Maximum Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in sediment
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - Storm Water Detention Basin - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	7.80E-03	4.76E+00	--	8.93E-05	3.78E+00	3.8E+00	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.90E-03	2.36E+00	--	4.46E-05	1.88E+00	1.9E+00	--	--	--	--
Acetone	--	1.50E-01	0.00E+00	--	1.72E-03	0.00E+00	1.7E-03	8.43E+03	2.0E-07	8.43E+04	2.0E-08
3 & 4 Methylphenol	--	4.00E+00	0.00E+00	--	4.58E-02	0.00E+00	4.6E-02	--	--	--	--
Acetophenone	--	1.60E-01	0.00E+00	--	1.83E-03	0.00E+00	1.8E-03	--	--	--	--
Benzaldehyde	--	1.30E+00	0.00E+00	--	1.49E-02	0.00E+00	1.5E-02	--	--	--	--
Bis(2-Ethylhexyl)phthalate	--	3.10E+00	2.04E+03	--	3.55E-02	1.62E+03	1.6E+03	1.10E+00	1.5E+03	1.10E+01	1.5E+02
Phenol	--	1.90E+00	0.00E+00	--	2.18E-02	0.00E+00	2.2E-02	--	--	--	--
N-Nitrosodiphenylamine	7.40E-06	--	--	1.79E-06	--	--	1.8E-06	--	--	--	--
Benzo(a)pyrene	--	2.20E-01	1.39E+02	--	2.52E-03	1.11E+02	1.1E+02	9.20E+02	1.2E-01	9.20E+03	1.2E-02
Arsenic	--	1.20E+01	1.52E+00	--	1.37E-01	1.21E+00	1.3E+00	5.14E+00	2.6E-01	1.28E+01	1.1E-01
Barium	2.60E-02	5.10E+01	9.28E-01	6.30E-03	5.84E-01	7.38E-01	1.3E+00	4.17E+01	3.2E-02	8.33E+01	1.6E-02
Beryllium	--	1.20E-01	1.08E-03	--	1.37E-03	8.59E-04	2.2E-03	3.70E-03	6.0E-01	3.70E-02	6.0E-02
Chromium	--	5.00E+01	4.00E+00	--	5.72E-01	3.18E+00	3.8E+00	2.70E+00	1.4E+00	1.10E+01	3.4E-01
Vanadium	--	2.20E+01	1.85E-01	--	2.52E-01	1.47E-01	4.0E-01	1.10E+00	3.6E-01	1.10E+01	3.6E-02
Chloride	--	1.30E+01	--	--	1.49E-01	--	1.5E-01	--	--	--	--
Nitrite as N	2.60E-02	--	--	6.30E-03	--	--	6.3E-03	--	--	--	--
Nitrogen, as Ammonia	7.50E+00	2.20E+01	--	1.82E+00	2.52E-01	--	2.1E+00	--	--	--	--
Sulfate	--	1.90E+03	--	--	2.18E+01	--	2.2E+01	--	--	--	--

Notes:

[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.

[b] - Total Dose is the sum of all doses.

[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.

[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Upper South Ditch - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	3.70E-02	2.30E+00	8.52E-02
2,4,4-Trimethyl-2-pentene	--	3.00E-03	2.29E+00	6.86E-03
4-iso-Propyltoluene	--	2.60E-03	2.29E+00	5.95E-03
Acetaldehyde	--	8.30E-02	0.00E+00	0.00E+00
Formaldehyde	--	1.09E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol	--	3.00E+00	0.00E+00	0.00E+00
Acetophenone	--	9.00E-02	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--
Benzo(a)pyrene	1.50E-04	--	2.39E+00	--
Benzaldehyde	--	6.20E-01	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	3.43E-03	2.10E+02	2.48E+00	5.21E+02
Caprolactam	--	5.30E-02	0.00E+00	0.00E+00
Diphenyl ether	--	2.20E-01	2.29E+00	5.04E-01
Di-n-octylphthalate	--	1.50E-01	2.51E+00	3.77E-01
Diphenylmethanone	--	3.05E-02	2.34E+00	7.15E-02
N-Nitrosodi-n-propylamine	6.56E-06	--	0.00E+00	--
Phenol	--	9.60E-01	0.00E+00	0.00E+00
Aluminum	1.89E+01	--	8.60E-03	--
Arsenic	--	1.00E+01	1.27E-01	1.27E+00
Barium	2.67E-02	7.05E+01	1.82E-02	1.28E+00
Beryllium	8.41E-04	7.12E-01	9.00E-03	6.41E-03
Chromium	3.32E+00	9.26E+02	--	4.00E+00
Chromium, Hexavalent	--	2.50E+01	1.00E-01	2.50E+00
Cobalt	3.65E-02	--	2.44E-02	--
Copper	1.65E-02	--	1.65E+00	--
Iron	7.93E+00	1.39E+04	7.20E-03	1.00E+02
Lead	9.41E-04	--	6.60E-02	--
Manganese	1.79E+00	--	1.08E-02	--
Silver	1.70E-05	1.90E+01	4.09E-01	7.75E+00
Vanadium	--	1.45E+01	8.40E-03	1.22E-01
Bromide	4.01E-01	--	0.00E+00	--
Chloride	1.72E+02	1.40E+02	--	--
Nitrite as N	2.05E-02	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.15E+02	--	--

Table - Upper South Ditch - RME - Marsh Wren - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

Chemical	**C_{sw} (mg/L)**	**C_{sed} (mg/kg)**	**BAF Invertebrates**	**C_{inv} (mg/kg)**
Sulfate	--	7.00E+02	--	--
Hydrazine	8.00E-05	9.10E-04	0.00E+00	0.00E+00

Notes:
RME - Reasonable Maximum Exposure
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Table - Upper South Ditch - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{inv} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day)	TRV NOAEL	NOAEL Based Total HQ	TRV LOAEL	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	3.70E-02	8.52E-02	--	9.63E-05	1.54E-02	1.5E-02	--	--	--	--
2,4,4-Trimethyl-2-pentene	--	3.00E-03	6.86E-03	--	7.81E-06	1.24E-03	1.2E-03	--	--	--	--
4-iso-Propyltoluene	--	2.60E-03	5.95E-03	--	6.76E-06	1.07E-03	1.1E-03	--	--	--	--
Acetaldehyde	--	8.30E-02	0.00E+00	--	2.16E-04	0.00E+00	2.2E-04	--	--	--	--
Formaldehyde	--	1.09E+00	0.00E+00	--	2.84E-03	0.00E+00	2.8E-03	--	--	--	--
3 & 4 Methylphenol	--	3.00E+00	0.00E+00	--	7.81E-03	0.00E+00	7.8E-03	--	--	--	--
Acetophenone	--	9.00E-02	0.00E+00	--	2.34E-04	0.00E+00	2.3E-04	--	--	--	--
Azobenzene	5.30E-04	--	--	2.92E-05	--	--	2.9E-05	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	--	8.26E-06	--	--	8.3E-06	9.20E+02	9.0E-09	9.20E+03	9.0E-10
Benzaldehyde	--	6.20E-01	0.00E+00	--	1.61E-03	0.00E+00	1.6E-03	--	--	--	--
Bis(2-Ethylhexyl)phthalate	3.43E-03	2.10E+02	5.21E+02	1.89E-04	5.46E-01	9.42E+01	9.5E+01	1.10E+00	8.6E+01	1.10E+01	8.6E+00
Caprolactam	--	5.30E-02	0.00E+00	--	1.38E-04	0.00E+00	1.4E-04	--	--	--	--
Diphenyl ether	--	2.20E-01	5.04E-01	--	5.72E-04	9.10E-02	9.2E-02	--	--	--	--
Di-n-octylphthalate	--	1.50E-01	3.77E-01	--	3.90E-04	6.81E-02	6.9E-02	1.11E+00	6.2E-02	1.11E+01	6.2E-03
Diphenylmethanone	--	3.05E-02	7.15E-02	--	7.94E-05	1.29E-02	1.3E-02	--	--	--	--
N-Nitrosodi-n-propylamine	6.56E-06	--	--	3.61E-07	--	--	3.6E-07	--	--	--	--
Phenol	--	9.60E-01	0.00E+00	--	2.50E-03	0.00E+00	2.5E-03	--	--	--	--
Aluminum	1.89E+01	--	--	1.04E+00	--	--	1.0E+00	1.10E+02	9.5E-03	1.10E+03	9.5E-04
Arsenic	--	1.00E+01	1.27E+00	--	2.60E-02	2.30E-01	2.6E-01	5.14E+00	5.0E-02	1.28E+01	2.0E-02
Barium	2.67E-02	7.05E+01	1.28E+00	1.47E-03	1.83E-01	2.32E-01	4.2E-01	4.17E+01	1.0E-02	8.33E+01	5.0E-03
Beryllium	8.41E-04	7.12E-01	6.41E-03	4.63E-05	1.85E-03	1.16E-03	3.1E-03	3.70E-03	8.3E-01	3.70E-02	8.3E-02
Chromium	3.32E+00	9.26E+02	4.00E+00	1.83E-01	2.41E+00	7.23E-01	3.3E+00	2.70E+00	1.2E+00	1.10E+01	3.0E-01
Chromium, Hexavalent	--	2.50E+01	2.50E+00	--	6.50E-02	4.52E-01	5.2E-01	1.64E+00	3.2E-01	1.64E+01	3.2E-02
Cobalt	3.65E-02	--	--	2.01E-03	--	--	2.0E-03	--	--	--	--
Copper	1.65E-02	--	--	9.09E-04	--	--	9.1E-04	1.85E+01	4.9E-05	3.70E+01	2.5E-05
Iron	7.93E+00	1.39E+04	1.00E+02	4.37E-01	3.62E+01	1.81E+01	5.5E+01	--	--	--	--
Lead	9.41E-04	--	--	5.18E-05	--	--	5.2E-05	4.70E+00	1.1E-05	8.28E+00	6.3E-06
Manganese	1.79E+00	--	--	9.83E-02	--	--	9.8E-02	9.77E+02	1.0E-04	9.77E+03	1.0E-05
Silver	1.70E-05	1.90E+01	7.75E+00	9.36E-07	4.93E-02	1.40E+00	1.4E+00	1.18E+01	1.2E-01	1.18E+02	1.2E-02
Vanadium	--	1.45E+01	1.22E-01	--	3.78E-02	2.21E-02	6.0E-02	1.10E+00	5.4E-02	1.10E+01	5.4E-03
Bromide	4.01E-01	--	--	2.21E-02	--	--	2.2E-02	--	--	--	--
Chloride	1.72E+02	1.40E+02	--	9.46E+00	3.64E-01	--	9.8E+00	--	--	--	--
Nitrite as N	2.05E-02	--	--	1.13E-03	--	--	1.1E-03	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.15E+02	--	4.01E+00	5.60E-01	--	4.6E+00	--	--	--	--
Sulfate	--	7.00E+02	--	--	1.82E+00	--	1.8E+00	--	--	--	--
Hydrazine	8.00E-05	9.10E-04	0.00E+00	4.41E-06	2.37E-06	0.00E+00	6.8E-06	--	--	--	--

Table - Upper South Ditch - RME - Marsh Wren - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Marsh Wren
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

Notes:
[a] - Doses for surface water (sw), sediment, and invertebrates were calculated using the equations in Attachment 5-2.
[b] - Total Dose is the sum of all doses.
[c] - NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] - NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

RME - Reasonable Maximum Exposure
BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Central Pond - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		1.1E-02	1.8E-02	2.0E-04	1.0E+00	1.1E-02	1.1E-01	1.2E-03	1.1E-01	1.2E-03
2,4,4-Trimethyl-2-pentene		8.8E-03	3.8E-02	3.3E-04	1.0E+00	9.0E-03	3.2E-01	2.8E-03	3.2E-01	2.8E-03
Acetone		1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Methyl Tertbutyl Ether		1.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		6.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenol		2.2E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(b)fluoranthene		1.4E-01	3.5E-03	4.9E-04	1.1E+00	1.5E-01	4.2E-01	5.8E-02	4.2E-01	5.8E-02
Fluoranthene		2.9E-01	8.1E-03	2.3E-03	1.1E+00	3.0E-01	8.0E-01	2.3E-01	8.0E-01	2.3E-01
Phenanthrene		2.1E-01	2.0E-02	4.3E-03	1.0E+00	2.2E-01	3.0E-01	6.4E-02	3.0E-01	6.4E-02
Pyrene		2.3E-01	1.2E-02	2.7E-03	1.0E+00	2.4E-01	5.1E-01	1.2E-01	5.1E-01	1.2E-01
Aluminum	2.1E-01		5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	4.9E-02	4.6E+01	3.1E-02	1.4E+00	1.8E-02	8.4E-01	1.8E-02	8.4E-01	1.8E-02	8.4E-01
Beryllium		9.4E-02	2.0E-03	1.9E-04	9.0E-03	8.5E-04	9.0E-03	8.5E-04	9.0E-03	8.5E-04
Chromium		1.4E+02	8.2E-03	1.1E+00	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent		2.7E-01	8.2E-03	2.2E-03	1.0E-01	2.7E-02	1.0E-01	2.7E-02	1.0E-01	2.7E-02
Lead		5.1E+01	3.5E-02	1.8E+00	6.6E-02	3.4E+00	6.6E-02	3.4E+00	6.6E-02	3.4E+00
Manganese	7.0E-01	5.9E+02	1.6E-02	9.3E+00	4.4E-02	2.6E+01	4.4E-02	2.6E+01	4.4E-02	2.6E+01
Tin		2.2E+00	6.0E-03	1.3E-02	--	--	--	--	--	--
Silver	1.5E-05		2.8E-03	--	4.1E-01	--	4.1E-01	--	4.1E-01	--
Vanadium		1.7E+01	9.7E-04	1.6E-02	8.4E-03	1.4E-01	8.4E-03	1.4E-01	8.4E-03	1.4E-01
Bromide	1.3E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride		2.4E+01	--	--	--	--	--	--	--	--
Nitrite as N	7.5E-02		--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	3.5E+01	--	--	--	--	--	--	--	--
Sulfate		1.2E+03	--	--	--	--	--	--	--	--

Table - Central Pond - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Central Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Central Pond - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Central Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	1.1E-02	2.0E-04	1.1E-02	1.2E-03	1.2E-03	--	3.4E-06	1.5E-05	1.1E-04	5.5E-06	5.5E-06	1.4E-04	4.1E-01	3.3E-04	4.1E+00	3.3E-05
2,4,4-Trimethyl-2-pentene	--	8.8E-03	3.3E-04	9.0E-03	2.8E-03	2.8E-03	--	2.7E-06	2.5E-05	8.4E-05	1.3E-05	1.3E-05	1.4E-04	4.1E-01	3.4E-04	4.1E+00	3.4E-05
Acetone	--	1.2E-01	--	--	--	--	--	3.7E-05	--	--	--	--	3.7E-05	2.0E+01	1.9E-06	1.0E+02	3.7E-07
Methyl Tertbutyl Ether	--	1.7E-03	--	--	--	--	--	5.3E-07	--	--	--	--	5.3E-07	--	--	--	--
3 & 4 Methylphenol	--	6.1E+00	--	--	--	--	--	1.9E-03	--	--	--	--	1.9E-03	1.0E+02	1.9E-05	1.0E+03	1.9E-06
Acetophenone	--	2.6E-01	--	--	--	--	--	8.1E-05	--	--	--	--	8.1E-05	8.0E+02	1.0E-07	8.0E+03	1.0E-08
Benzaldehyde	--	1.9E+00	--	--	--	--	--	5.9E-04	--	--	--	--	5.9E-04	4.3E+01	1.4E-05	8.6E+01	6.9E-06
Phenol	--	2.2E+00	--	--	--	--	--	6.9E-04	--	--	--	--	6.9E-04	4.0E+01	1.7E-05	5.4E+01	1.3E-05
Benzo(b)fluoranthene	--	1.4E-01	4.9E-04	1.5E-01	5.8E-02	5.8E-02	--	4.4E-05	3.7E-05	1.4E-03	2.7E-04	2.7E-04	2.0E-03	1.0E+00	2.0E-03	1.0E+01	2.0E-04
Fluoranthene	--	2.9E-01	2.3E-03	3.0E-01	2.3E-01	2.3E-01	--	9.0E-05	1.7E-04	2.8E-03	1.1E-03	1.1E-03	5.3E-03	2.5E+01	2.1E-04	5.0E+01	1.1E-04
Phenanthrene	--	2.1E-01	4.3E-03	2.2E-01	6.4E-02	6.4E-02	--	6.5E-05	3.2E-04	2.0E-03	3.0E-04	3.0E-04	3.0E-03	7.0E-01	4.3E-03	7.0E+00	4.3E-04
Pyrene	--	2.3E-01	2.7E-03	2.4E-01	1.2E-01	1.2E-01	--	7.2E-05	2.0E-04	2.2E-03	5.5E-04	5.5E-04	3.6E-03	1.5E+01	2.4E-04	2.5E+01	1.4E-04
Aluminum	2.1E-01	--	--	--	--	--	1.4E-02	--	--	--	--	--	1.4E-02	1.9E+00	7.1E-03	1.9E+01	7.1E-04
Barium	4.9E-02	4.6E+01	1.4E+00	8.4E-01	8.4E-01	8.4E-01	3.2E-03	1.4E-02	1.1E-01	7.8E-03	3.9E-03	3.9E-03	1.4E-01	5.2E+01	2.7E-03	1.2E+02	1.2E-03
Beryllium	--	9.4E-02	1.9E-04	8.5E-04	8.5E-04	8.5E-04	--	2.9E-05	1.4E-05	7.9E-06	3.9E-06	3.9E-06	5.9E-05	5.3E-01	1.1E-04	5.3E-01	1.1E-04
Chromium	--	1.4E+02	1.1E+00	4.0E+00	4.0E+00	4.0E+00	--	4.4E-02	8.6E-02	3.7E-02	1.9E-02	1.9E-02	2.0E-01	2.4E+00	8.5E-02	4.1E+01	5.0E-03
Chromium, Hexavalent	--	2.7E-01	2.2E-03	2.7E-02	2.7E-02	2.7E-02	--	8.4E-05	1.6E-04	2.5E-04	1.3E-04	1.3E-04	7.5E-04	2.2E+01	3.4E-05	2.2E+01	3.4E-05
Lead	--	5.1E+01	1.8E+00	3.4E+00	3.4E+00	3.4E+00	--	1.6E-02	1.3E-01	3.1E-02	1.6E-02	1.6E-02	2.1E-01	4.7E+00	4.5E-02	1.5E+02	1.4E-03
Manganese	7.0E-01	5.9E+02	9.3E+00	2.6E+01	2.6E+01	2.6E+01	4.6E-02	1.8E-01	7.0E-01	2.4E-01	1.2E-01	1.2E-01	1.4E+00	8.8E+01	1.6E-02	2.8E+02	5.0E-03
Tin	--	2.2E+00	1.3E-02	--	--	--	--	6.9E-04	9.8E-04	--	--	--	1.7E-03	2.3E+01	7.1E-05	3.5E+01	4.8E-05
Silver	1.5E-05	--	--	--	--	--	9.8E-07	--	--	--	--	--	9.8E-07	3.6E+01	2.7E-08	7.2E+01	1.4E-08
Vanadium	--	1.7E+01	1.6E-02	1.4E-01	1.4E-01	1.4E-01	--	5.3E-03	1.2E-03	1.3E-03	6.6E-04	6.6E-04	9.2E-03	2.1E-01	4.4E-02	2.1E+00	4.4E-03
Bromide	1.3E-01	--	--	--	--	--	8.5E-03	--	--	--	--	--	8.5E-03	--	--	--	--
Chloride	--	2.4E+01	--	--	--	--	--	7.5E-03	--	--	--	--	7.5E-03	--	--	--	--
Nitrite as N	7.5E-02	--	--	--	--	--	4.9E-03	--	--	--	--	--	4.9E-03	--	--	--	--
Nitrogen, as Ammonia	2.8E+01	3.5E+01	--	--	--	--	1.8E+00	1.1E-02	--	--	--	--	1.8E+00	--	--	--	--
Sulfate	--	1.2E+03	--	--	--	--	--	3.7E-01	--	--	--	--	3.7E-01	--	--	--	--

Table - Central Pond - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Central Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Lower South Ditch - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.0E-02	1.8E-02	3.6E-04	1.0E+00	2.1E-02	1.1E-01	2.2E-03	1.1E-01	2.2E-03
2,4,4-Trimethyl-2-pentene	--	3.5E-03	3.8E-02	1.3E-04	1.0E+00	3.6E-03	3.2E-01	1.1E-03	3.2E-01	1.1E-03
Acetaldehyde	--	6.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetone	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	6.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	--	2.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--	--	--
Benzaldehyde	--	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-04	--	2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	3.4E-03	6.0E+02	3.1E-04	1.9E-01	1.1E+00	6.7E+02	1.0E+00	6.0E+02	1.0E+00	6.0E+02
Di-n-octylphthalate	--	1.5E-01	1.6E-04	2.4E-05	1.1E+00	1.7E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenyl ether	--	2.6E+00	2.9E-02	7.4E-02	1.0E+00	2.7E+00	2.1E-01	5.5E-01	2.1E-01	5.5E-01
Diphenylamine	--	9.5E-02	7.3E-02	7.0E-03	1.0E+00	9.8E-02	8.6E-01	8.1E-02	8.6E-01	8.1E-02
N-Nitrosodi-n-propylamine	6.6E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
4,4`-DDT	--	6.2E-02	1.4E-03	9.0E-05	1.1E+00	6.7E-02	1.7E+00	1.0E-01	1.7E+00	1.0E-01
Hexachlorobenzene	--	3.7E-02	4.5E-03	1.7E-04	1.1E+00	3.9E-02	9.0E-02	3.3E-03	9.0E-02	3.3E-03
Aluminum	1.9E+01	--	5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	2.7E-02	1.7E+01	3.1E-02	5.4E-01	1.8E-02	3.2E-01	1.8E-02	3.2E-01	1.8E-02	3.2E-01
Beryllium	8.4E-04	1.5E+00	2.0E-03	2.9E-03	9.0E-03	1.3E-02	9.0E-03	1.3E-02	9.0E-03	1.3E-02
Cadmium	--	1.0E+00	5.6E-02	5.7E-02	4.6E-01	4.7E-01	4.6E-01	4.7E-01	4.6E-01	4.7E-01
Chromium	3.3E+00	2.8E+03	8.2E-03	2.3E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	2.6E+01	8.2E-03	2.1E-01	1.0E-01	2.6E+00	1.0E-01	2.6E+00	1.0E-01	2.6E+00
Cobalt	3.7E-02	--	1.5E-03	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	1.7E-02	--	4.1E-02	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	7.9E+00	--	8.5E-04	--	7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	9.4E-04	--	3.5E-02	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.8E+00	--	1.6E-02	--	4.4E-02	--	4.4E-02	--	4.4E-02	--
Mercury	--	2.9E-01	2.6E-02	7.5E-03	2.8E+00	8.2E-01	2.8E+00	8.2E-01	2.8E+00	8.2E-01
Nickel	--	2.0E+01	4.7E-02	9.2E-01	8.2E-01	1.6E+01	8.2E-01	1.6E+01	8.2E-01	1.6E+01
Silver	1.7E-05	6.2E+01	2.8E-03	1.7E-01	4.1E-01	2.5E+01	4.1E-01	2.5E+01	4.1E-01	2.5E+01
Tin	--	1.6E+00	6.0E-03	9.6E-03	--	--	--	--	--	--
Vanadium	--	1.1E+01	9.7E-04	1.1E-02	8.4E-03	9.3E-02	8.4E-03	9.3E-02	8.4E-03	9.3E-02
Bromide	4.0E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.7E+02	1.4E+02	--	--	--	--	--	--	--	--

Table - Lower South Ditch - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Nitrite as N	2.1E-02	--	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.5E+02	--	--	--	--	--	--	--	--
Sulfate	--	8.3E+02	--	--	--	--	--	--	--	--
Hydrazine	8.0E-05	2.4E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4,4'-Isopropylidenediphenol	9.6E-04	--	9.3E-02	--	1.0E+00	--	1.2E+00	--	1.2E+00	--
4-Nonylphenol (Tech.)	1.4E-02	--	2.9E-03	--	1.1E+00	--	6.5E-03	--	6.5E-03	--
Kempore (Azodicarbonamid	1.2E+00	--	--	--	--	--	--	--	--	--
C11-C22 Aromatics	--	9.4E+03	--	--	--	--	--	--	--	--
C19-C36 Aliphatics	--	6.4E+03	--	--	--	--	--	--	--	--
C9-C18 Aliphatics	--	7.7E+02	--	--	--	--	--	--	--	--
EPH, Total	--	1.7E+04	--	--	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Lower South Ditch - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.0E-02	3.6E-04	2.1E-02	2.2E-03	2.2E-03	--	1.4E-06	6.0E-06	4.3E-05	2.2E-06	2.2E-06	5.5E-05	4.1E-01	1.3E-04	4.1E+00	1.3E-05
2,4,4-Trimethyl-2-pentene	--	3.5E-03	1.3E-04	3.6E-03	1.1E-03	1.1E-03	--	2.4E-07	2.2E-06	7.4E-06	1.2E-06	1.2E-06	1.2E-05	4.1E-01	3.0E-05	4.1E+00	3.0E-06
Acetaldehyde	--	6.3E-02	--	--	--	--	--	4.4E-06	--	--	--	--	4.4E-06	2.4E+01	1.8E-07	2.4E+02	1.8E-08
Acetone	--	1.2E-01	--	--	--	--	--	8.3E-06	--	--	--	--	8.3E-06	2.0E+01	4.2E-07	1.0E+02	8.3E-08
Formaldehyde	--	6.0E-01	--	--	--	--	--	4.2E-05	--	--	--	--	4.2E-05	1.0E-01	4.2E-04	1.0E+00	4.2E-05
Aniline	--	2.3E-01	--	--	--	--	--	1.6E-05	--	--	--	--	1.6E-05	2.0E+00	8.0E-06	2.0E+01	8.0E-07
Azobenzene	5.3E-04	--	--	--	--	--	7.7E-06	--	--	--	--	--	7.7E-06	--	--	--	--
Benzaldehyde	--	1.2E-01	--	--	--	--	--	8.3E-06	--	--	--	--	8.3E-06	4.3E+01	1.9E-07	8.6E+01	9.7E-08
Benzo(a)pyrene	1.5E-04	--	--	--	--	--	2.2E-06	--	--	--	--	--	2.2E-06	1.0E+00	2.2E-06	1.0E+01	2.2E-07
Bis(2-Ethylhexyl)phthalate	3.4E-03	6.0E+02	1.9E-01	6.7E+02	6.0E+02	6.0E+02	5.0E-05	4.2E-02	3.1E-03	1.4E+00	6.2E-01	6.2E-01	2.7E+00	1.8E+01	1.5E-01	1.8E+02	1.5E-02
Di-n-octylphthalate	--	1.5E-01	2.4E-05	1.7E-01	1.5E-01	1.5E-01	--	1.0E-05	4.0E-07	3.5E-04	1.6E-04	1.6E-04	6.7E-04	1.0E+02	6.7E-06	4.0E+02	1.7E-06
Diphenyl ether	--	2.6E+00	7.4E-02	2.7E+00	5.5E-01	5.5E-01	--	1.8E-04	1.2E-03	5.5E-03	5.7E-04	5.7E-04	8.1E-03	3.0E+00	2.7E-03	3.0E+01	2.7E-04
Diphenylamine	--	9.5E-02	7.0E-03	9.8E-02	8.1E-02	8.1E-02	--	6.6E-06	1.2E-04	2.0E-04	8.4E-05	8.4E-05	4.9E-04	3.3E+01	1.5E-05	3.3E+02	1.5E-06
N-Nitrosodi-n-propylamine	6.6E-06	--	--	--	--	--	9.6E-08	--	--	--	--	--	9.6E-08	7.3E-02	1.3E-06	7.3E-01	1.3E-07
4,4`-DDT	--	6.2E-02	9.0E-05	6.7E-02	1.0E-01	1.0E-01	--	4.3E-06	1.5E-06	1.4E-04	1.1E-04	1.1E-04	3.6E-04	8.0E-01	4.5E-04	4.0E+00	9.0E-05
Hexachlorobenzene	--	3.7E-02	1.7E-04	3.9E-02	3.3E-03	3.3E-03	--	2.6E-06	2.8E-06	8.1E-05	3.4E-06	3.4E-06	9.4E-05	3.2E-01	2.9E-04	1.6E+00	5.8E-05
Aluminum	1.9E+01	--	--	--	--	--	2.7E-01	--	--	--	--	--	2.7E-01	1.9E+00	1.4E-01	1.9E+01	1.4E-02
Barium	2.7E-02	1.7E+01	5.4E-01	3.2E-01	3.2E-01	3.2E-01	3.9E-04	1.2E-03	9.0E-03	6.5E-04	3.3E-04	3.3E-04	1.2E-02	5.2E+01	2.3E-04	1.2E+02	1.0E-04
Beryllium	8.4E-04	1.5E+00	2.9E-03	1.3E-02	1.3E-02	1.3E-02	1.2E-05	1.0E-04	4.8E-05	2.7E-05	1.4E-05	1.4E-05	2.2E-04	5.3E-01	4.0E-04	5.3E-01	4.0E-04
Cadmium	--	1.0E+00	5.7E-02	4.7E-01	4.7E-01	4.7E-01	--	7.1E-05	9.5E-04	9.8E-04	4.9E-04	4.9E-04	3.0E-03	1.9E+00	1.6E-03	7.1E+00	4.2E-04
Chromium	3.3E+00	2.8E+03	2.3E+01	4.0E+00	4.0E+00	4.0E+00	4.8E-02	1.9E-01	3.8E-01	8.3E-03	4.1E-03	4.1E-03	6.3E-01	2.4E+00	2.6E-01	4.1E+01	1.6E-02
Chromium, Hexavalent	--	2.6E+01	2.1E-01	2.6E+00	2.6E+00	2.6E+00	--	1.8E-03	3.5E-03	5.3E-03	2.6E-03	2.6E-03	1.6E-02	2.2E+01	7.2E-04	2.2E+01	7.2E-04
Cobalt	3.7E-02	--	--	--	--	--	5.3E-04	--	--	--	--	--	5.3E-04	--	--	--	--
Copper	1.7E-02	--	--	--	--	--	2.4E-04	--	--	--	--	--	2.4E-04	1.5E+01	1.6E-05	1.5E+02	1.6E-06
Iron	7.9E+00	--	--	--	--	--	1.2E-01	--	--	--	--	--	1.2E-01	--	--	--	--
Lead	9.4E-04	--	--	--	--	--	1.4E-05	--	--	--	--	--	1.4E-05	4.7E+00	2.9E-06	1.5E+02	8.9E-08
Manganese	1.8E+00	--	--	--	--	--	2.6E-02	--	--	--	--	--	2.6E-02	8.8E+01	3.0E-04	2.8E+02	9.2E-05
Mercury	--	2.9E-01	7.5E-03	8.2E-01	8.2E-01	8.2E-01	--	2.0E-05	1.2E-04	1.7E-03	8.5E-04	8.5E-04	3.5E-03	1.0E+00	3.5E-03	1.0E+01	3.5E-04
Nickel	--	2.0E+01	9.2E-01	1.6E+01	1.6E+01	1.6E+01	--	1.4E-03	1.5E-02	3.3E-02	1.7E-02	1.7E-02	8.3E-02	4.0E+01	2.1E-03	8.0E+01	1.0E-03
Silver	1.7E-05	6.2E+01	1.7E-01	2.5E+01	2.5E+01	2.5E+01	2.5E-07	4.3E-03	2.9E-03	5.2E-02	2.6E-02	2.6E-02	1.1E-01	3.6E+01	3.1E-03	7.2E+01	1.5E-03
Tin	--	1.6E+00	9.6E-03	--	--	--	--	1.1E-04	1.6E-04	--	--	--	2.7E-04	2.3E+01	1.2E-05	3.5E+01	7.7E-06
Vanadium	--	1.1E+01	1.1E-02	9.3E-02	9.3E-02	9.3E-02	--	7.7E-04	1.8E-04	1.9E-04	9.6E-05	9.6E-05	1.3E-03	2.1E-01	6.3E-03	2.1E+00	6.3E-04
Bromide	4.0E-01	--	--	--	--	--	5.8E-03	--	--	--	--	--	5.8E-03	--	--	--	--
Chloride	1.7E+02	1.4E+02	--	--	--	--	2.5E+00	9.7E-03	--	--	--	--	2.5E+00	--	--	--	--
Nitrite as N	2.1E-02	--	--	--	--	--	3.0E-04	--	--	--	--	--	3.0E-04	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.5E+02	--	--	--	--	1.1E+00	1.7E-02	--	--	--	--	1.1E+00	--	--	--	--
Sulfate	--	8.3E+02	--	--	--	--	--	5.7E-02	--	--	--	--	5.7E-02	--	--	--	--
Hydrazine	8.0E-05	2.4E-03	--	--	--	--	1.2E-06	1.7E-07	--	--	--	--	1.3E-06	2.5E+00	5.3E-07	5.0E+00	2.7E-07
4,4'-Isopropylidenediphenol	9.6E-04	--	--	--	--	--	1.4E-05	--	--	--	--	--	1.4E-05	--	--	--	--
4-Nonylphenol (Tech.)	1.4E-02	--	--	--	--	--	2.0E-04	--	--	--	--	--	2.0E-04	5.0E+00	4.1E-05	5.0E+01	4.1E-06
Kempore (Azodicarbonamid	1.2E+00	--	--	--	--	--	1.8E-02	--	--	--	--	--	1.8E-02	--	--	--	--
C11-C22 Aromatics	--	9.4E+03	--	--	--	--	--	6.5E-01	--	--	--	--	6.5E-01	--	--	--	--

Table - Lower South Ditch - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Lower South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
C19-C36 Aliphatics	--	6.4E+03	--	--	--	--	--	4.4E-01	--	--	--	--	4.4E-01	--	--	--	--
C9-C18 Aliphatics	--	7.7E+02	--	--	--	--	--	5.3E-02	--	--	--	--	5.3E-02	--	--	--	--
EPH, Total	--	1.7E+04	--	--	--	--	--	1.2E+00	--	--	--	--	1.2E+00	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - North Pond - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.0E-03	1.8E-02	3.6E-05	1.0E+00	2.1E-03	1.1E-01	2.2E-04	1.1E-01	2.2E-04
Acetone	--	3.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	--	7.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)anthracene	1.2E-04	--	3.6E-03	--	1.1E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	1.7E-04	--	2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Bis(2-Ethylhexyl)phthalate	--	3.7E+00	3.1E-04	1.2E-03	1.1E+00	4.1E+00	1.0E+00	3.7E+00	1.0E+00	3.7E+00
Carbazole	--	1.6E-01	5.5E-02	8.8E-03	1.0E+00	1.6E-01	5.6E-01	8.9E-02	5.6E-01	8.9E-02
Caprolactam	3.3E-04	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Pyrene	3.9E-04	--	1.2E-02	--	1.0E+00	--	5.1E-01	--	5.1E-01	--
Aluminum	2.2E-01	--	5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	1.3E+01	2.8E-02	3.6E-01	1.3E-01	1.7E+00	1.3E-01	1.7E+00	1.3E-01	1.7E+00
Barium	4.1E-02	6.2E+01	3.1E-02	1.9E+00	1.8E-02	1.1E+00	1.8E-02	1.1E+00	1.8E-02	1.1E+00
Beryllium	--	5.3E-01	2.0E-03	1.1E-03	9.0E-03	4.8E-03	9.0E-03	4.8E-03	9.0E-03	4.8E-03
Cadmium	--	2.2E+00	5.6E-02	1.2E-01	4.6E-01	1.0E+00	4.6E-01	1.0E+00	4.6E-01	1.0E+00
Chromium	--	7.8E+02	8.2E-03	6.4E+00	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	9.0E-01	8.2E-03	7.4E-03	1.0E-01	9.0E-02	1.0E-01	9.0E-02	1.0E-01	9.0E-02
Copper	--	6.8E+01	4.1E-02	2.8E+00	1.6E+00	1.1E+02	1.6E+00	1.1E+02	1.6E+00	1.1E+02
Iron	2.9E+00	2.3E+04	8.5E-04	2.0E+01	7.2E-03	1.7E+02	7.2E-03	1.7E+02	7.2E-03	1.7E+02
Lead	1.3E-03	1.1E+02	3.5E-02	3.8E+00	6.6E-02	7.3E+00	6.6E-02	7.3E+00	6.6E-02	7.3E+00
Manganese	4.9E-01	1.3E+03	1.6E-02	2.0E+01	4.4E-02	5.5E+01	4.4E-02	5.5E+01	4.4E-02	5.5E+01
Silver	2.2E-05	--	2.8E-03	--	4.1E-01	--	4.1E-01	--	4.1E-01	--
Thallium	--	8.2E-01	8.0E-04	6.6E-04	--	--	1.0E+00	8.2E-01	1.0E+00	8.2E-01
Tin	--	1.1E+01	6.0E-03	6.6E-02	--	--	--	--	--	--
Vanadium	--	2.6E+01	9.7E-04	2.5E-02	8.4E-03	2.2E-01	8.4E-03	2.2E-01	8.4E-03	2.2E-01
Zinc	--	3.6E+02	5.0E-02	1.8E+01	2.6E-02	9.4E+00	2.6E-02	9.4E+00	2.6E-02	9.4E+00
Bromide	6.5E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	3.2E+02	3.2E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	--	2.3E+01	--	--	--	--	--	--	--	--
Sulfate	--	2.7E+02	--	--	--	--	--	--	--	--

Table - North Pond - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	North Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
BAF - Bioaccumulation Factor
C_{amphib} - Chemical concentration in amphibians
C_{fish} - Chemical concentration in fish
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - North Pond - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	North Pond

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	2.0E-03	3.6E-05	2.1E-03	2.2E-04	2.2E-04	--	9.2E-07	4.0E-06	2.9E-05	1.5E-06	1.5E-06	3.7E-05	4.1E-01	8.9E-05	4.1E+00	8.9E-06
Acetone	--	3.3E-01	--	--	--	--	--	1.5E-04	--	--	--	--	1.5E-04	2.0E+01	7.6E-06	1.0E+02	1.5E-06
Carbon disulfide	--	7.3E-03	--	--	--	--	--	3.4E-06	--	--	--	--	3.4E-06	--	--	--	--
Benzo(a)anthracene	1.2E-04	--	--	--	--	--	1.2E-05	--	--	--	--	--	1.2E-05	1.0E+00	1.2E-05	1.0E+01	1.2E-06
Benzo(a)pyrene	1.7E-04	--	--	--	--	--	1.7E-05	--	--	--	--	--	1.7E-05	1.0E+00	1.7E-05	1.0E+01	1.7E-06
Bis(2-Ethylhexyl)phthalate	--	3.7E+00	1.2E-03	4.1E+00	3.7E+00	3.7E+00	--	1.7E-03	1.3E-04	5.7E-02	2.6E-02	2.6E-02	1.1E-01	1.8E+01	6.0E-03	1.8E+02	6.0E-04
Carbazole	--	1.6E-01	8.8E-03	1.6E-01	8.9E-02	8.9E-02	--	7.4E-05	9.7E-04	2.3E-03	6.2E-04	6.2E-04	4.6E-03	5.0E+00	9.1E-04	5.0E+01	9.1E-05
Caprolactam	3.3E-04	--	--	--	--	--	3.2E-05	--	--	--	--	--	3.2E-05	8.0E+02	4.0E-08	8.0E+03	4.0E-09
Pyrene	3.9E-04	--	--	--	--	--	3.8E-05	--	--	--	--	--	3.8E-05	1.5E+01	2.5E-06	2.5E+01	1.5E-06
Aluminum	2.2E-01	--	--	--	--	--	2.1E-02	--	--	--	--	--	2.1E-02	1.9E+00	1.1E-02	1.9E+01	1.1E-03
Arsenic	--	1.3E+01	3.6E-01	1.7E+00	1.7E+00	1.7E+00	--	6.0E-03	4.0E-02	2.3E-02	1.1E-02	1.1E-02	9.2E-02	1.3E-01	7.3E-01	1.3E+00	7.3E-02
Barium	4.1E-02	6.2E+01	1.9E+00	1.1E+00	1.1E+00	1.1E+00	4.0E-03	2.9E-02	2.1E-01	1.6E-02	7.8E-03	7.8E-03	2.8E-01	5.2E+01	5.4E-03	1.2E+02	2.3E-03
Beryllium	--	5.3E-01	1.1E-03	4.8E-03	4.8E-03	4.8E-03	--	2.4E-04	1.2E-04	6.6E-05	3.3E-05	3.3E-05	4.9E-04	5.3E-01	9.3E-04	5.3E-01	9.3E-04
Cadmium	--	2.2E+00	1.2E-01	1.0E+00	1.0E+00	1.0E+00	--	1.0E-03	1.4E-02	1.4E-02	7.0E-03	7.0E-03	4.3E-02	1.9E+00	2.3E-02	7.1E+00	6.0E-03
Chromium	--	7.8E+02	6.4E+00	4.0E+00	4.0E+00	4.0E+00	--	3.6E-01	7.1E-01	5.5E-02	2.8E-02	2.8E-02	1.2E+00	2.4E+00	4.9E-01	4.1E+01	2.9E-02
Chromium, Hexavalent	--	9.0E-01	7.4E-03	9.0E-02	9.0E-02	9.0E-02	--	4.2E-04	8.2E-04	1.2E-03	6.2E-04	6.2E-04	3.7E-03	2.2E+01	1.7E-04	2.2E+01	1.7E-04
Copper	--	6.8E+01	2.8E+00	1.1E+02	1.1E+02	1.1E+02	--	3.1E-02	3.1E-01	1.5E+00	7.7E-01	7.7E-01	3.4E+00	1.5E+01	2.3E-01	1.5E+02	2.3E-02
Iron	2.9E+00	2.3E+04	2.0E+01	1.7E+02	1.7E+02	1.7E+02	2.8E-01	1.1E+01	2.2E+00	2.3E+00	1.1E+00	1.1E+00	1.8E+01	--	--	--	--
Lead	1.3E-03	1.1E+02	3.8E+00	7.3E+00	7.3E+00	7.3E+00	1.3E-04	5.1E-02	4.3E-01	1.0E-01	5.0E-02	5.0E-02	6.8E-01	4.7E+00	1.4E-01	1.5E+02	4.4E-03
Manganese	4.9E-01	1.3E+03	2.0E+01	5.5E+01	5.5E+01	5.5E+01	4.8E-02	5.8E-01	2.2E+00	7.6E-01	3.8E-01	3.8E-01	4.3E+00	8.8E+01	4.9E-02	2.8E+02	1.5E-02
Silver	2.2E-05	--	--	--	--	--	2.1E-06	--	--	--	--	--	2.1E-06	3.6E+01	5.9E-08	7.2E+01	3.0E-08
Thallium	--	8.2E-01	6.6E-04	--	8.2E-01	8.2E-01	--	3.8E-04	7.3E-05	--	5.7E-03	5.7E-03	1.2E-02	4.6E-02	2.6E-01	4.6E-01	2.6E-02
Tin	--	1.1E+01	6.6E-02	--	--	--	--	5.1E-03	7.3E-03	--	--	--	1.2E-02	2.3E+01	5.3E-04	3.5E+01	3.5E-04
Vanadium	--	2.6E+01	2.5E-02	2.2E-01	2.2E-01	2.2E-01	--	1.2E-02	2.8E-03	3.0E-03	1.5E-03	1.5E-03	2.1E-02	2.1E-01	9.9E-02	2.1E+00	9.9E-03
Zinc	--	3.6E+02	1.8E+01	9.4E+00	9.4E+00	9.4E+00	--	1.7E-01	2.0E+00	1.3E-01	6.5E-02	6.5E-02	2.4E+00	7.5E+01	3.2E-02	2.6E+02	9.5E-03
Bromide	6.5E-01	--	--	--	--	--	6.3E-02	--	--	--	--	--	6.3E-02	--	--	--	--
Chloride	3.2E+02	3.2E+02	--	--	--	--	3.1E+01	1.5E-01	--	--	--	--	3.1E+01	--	--	--	--
Nitrogen, as Ammonia	--	2.3E+01	--	--	--	--	--	1.1E-02	--	--	--	--	1.1E-02	--	--	--	--
Sulfate	--	2.7E+02	--	--	--	--	--	1.2E-01	--	--	--	--	1.2E-01	--	--	--	--

Table - North Pond - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	North Pond

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Off-PWD - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.0E-02	1.8E-02	1.1E-03	1.0E+00	6.2E-02	1.1E-01	6.5E-03	1.1E-01	6.5E-03
2,4,4-Trimethyl-2-pentene		8.0E-03	3.8E-02	3.0E-04	1.0E+00	8.2E-03	3.2E-01	2.6E-03	3.2E-01	2.6E-03
Formaldehyde		6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Carbon disulfide	2.5E-03		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
3 & 4 Methylphenol	7.6E-04		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Benzo(a)anthracene	2.0E-03		3.6E-03	--	1.1E+00	--	3.4E-01	--	3.4E-01	--
Benzo(a)pyrene	2.3E-03		2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Benzo(b)fluoranthene	4.0E-03		3.5E-03	--	1.1E+00	--	4.2E-01	--	4.2E-01	--
Benzo(ghi)perylene	2.6E-03		1.1E-03	--	1.1E+00	--	4.7E-02	--	4.7E-02	--
Benzo(k)fluoranthene	2.6E-03		2.3E-03	--	1.1E+00	--	2.9E-01	--	2.9E-01	--
Chrysene	2.7E-03		3.4E-03	--	1.1E+00	--	4.4E-01	--	4.4E-01	--
Dibenz(a,h)anthracene	1.2E-03		9.7E-04	--	1.1E+00	--	3.8E-01	--	3.8E-01	--
Indeno(1,2,3-cd)pyrene	4.0E-03		1.0E-03	--	1.1E+00	--	2.8E-01	--	2.8E-01	--
Phenanthrene	1.3E-03		2.0E-02	--	1.0E+00	--	3.0E-01	--	3.0E-01	--
Pyrene	6.3E-03		1.2E-02	--	1.0E+00	--	5.1E-01	--	5.1E-01	--
4-Chlorophenyl phenyl ether		6.1E-02	1.5E-02	9.1E-04	1.0E+00	6.3E-02	7.9E-02	4.8E-03	7.9E-02	4.8E-03
Carbazole		5.1E-02	5.5E-02	2.8E-03	1.0E+00	5.2E-02	5.6E-01	2.9E-02	5.6E-01	2.9E-02
Diphenyl ether		8.6E-01	2.9E-02	2.5E-02	1.0E+00	8.9E-01	2.1E-01	1.8E-01	2.1E-01	1.8E-01
Diphenylmethanone		2.0E-01	1.1E-01	2.2E-02	1.1E+00	2.1E-01	1.6E+00	3.2E-01	1.6E+00	3.2E-01
Aluminum	1.3E+00		5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Barium	4.1E-02	1.6E+01	3.1E-02	5.0E-01	1.8E-02	2.9E-01	1.8E-02	2.9E-01	1.8E-02	2.9E-01
Chromium	9.3E-02	2.4E+03	8.2E-03	2.0E+01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Iron	2.5E+01		8.5E-04	--	7.2E-03	--	7.2E-03	--	7.2E-03	--
Lead	4.3E-03		3.5E-02	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.3E+00		1.6E-02	--	4.4E-02	--	4.4E-02	--	4.4E-02	--
Zinc	9.5E-02		5.0E-02	--	2.6E-02	--	2.6E-02	--	2.6E-02	--
Arsenic		1.4E+01	2.8E-02	3.9E-01	1.3E-01	1.8E+00	1.3E-01	1.8E+00	1.3E-01	1.8E+00
Beryllium		1.4E+00	2.0E-03	2.8E-03	9.0E-03	1.3E-02	9.0E-03	1.3E-02	9.0E-03	1.3E-02
Copper		3.9E+01	4.1E-02	1.6E+00	1.6E+00	6.4E+01	1.6E+00	6.4E+01	1.6E+00	6.4E+01
Silver		4.1E+01	2.8E-03	1.1E-01	4.1E-01	1.7E+01	4.1E-01	1.7E+01	4.1E-01	1.7E+01
Vanadium		1.5E+01	9.7E-04	1.5E-02	8.4E-03	1.3E-01	8.4E-03	1.3E-01	8.4E-03	1.3E-01
Bromide	2.0E-01		0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Nitrite as N	2.0E-02		--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	6.0E+01	5.4E+02	--	--	--	--	--	--	--	--

Table - Off-PWD - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Chloride		2.4E+02	--	--	--	--	--	--	--	--
Sulfate		1.5E+03	--	--	--	--	--	--	--	--
Hydrazine		1.3E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Off-PWD - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Off-PWD

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	6.0E-02	1.1E-03	6.2E-02	6.5E-03	6.5E-03	--	1.4E-05	6.2E-05	4.4E-04	2.3E-05	2.3E-05	5.7E-04	4.1E-01	1.4E-03	4.1E+00	1.4E-04
2,4,4-Trimethyl-2-pentene	--	8.0E-03	3.0E-04	8.2E-03	2.6E-03	2.6E-03	--	1.9E-06	1.7E-05	5.9E-05	9.2E-06	9.2E-06	9.6E-05	4.1E-01	2.3E-04	4.1E+00	2.3E-05
Formaldehyde	--	6.1E-01	--	--	--	--	--	1.5E-04	--	--	--	--	1.5E-04	1.0E-01	1.5E-03	1.0E+00	1.5E-04
Carbon disulfide	2.5E-03	--	--	--	--	--	1.3E-04	--	--	--	--	--	1.3E-04	--	--	--	--
3 & 4 Methylphenol	7.6E-04	--	--	--	--	--	3.8E-05	--	--	--	--	--	3.8E-05	1.0E+02	3.8E-07	1.0E+03	3.8E-08
Benzo(a)anthracene	2.0E-03	--	--	--	--	--	1.0E-04	--	--	--	--	--	1.0E-04	1.0E+00	1.0E-04	1.0E+01	1.0E-05
Benzo(a)pyrene	2.3E-03	--	--	--	--	--	1.1E-04	--	--	--	--	--	1.1E-04	1.0E+00	1.1E-04	1.0E+01	1.1E-05
Benzo(b)fluoranthene	4.0E-03	--	--	--	--	--	2.0E-04	--	--	--	--	--	2.0E-04	1.0E+00	2.0E-04	1.0E+01	2.0E-05
Benzo(ghi)perylene	2.6E-03	--	--	--	--	--	1.3E-04	--	--	--	--	--	1.3E-04	1.0E+00	1.3E-04	1.0E+01	1.3E-05
Benzo(k)fluoranthene	2.6E-03	--	--	--	--	--	1.3E-04	--	--	--	--	--	1.3E-04	1.0E+00	1.3E-04	1.0E+01	1.3E-05
Chrysene	2.7E-03	--	--	--	--	--	1.4E-04	--	--	--	--	--	1.4E-04	1.0E+00	1.4E-04	1.0E+01	1.4E-05
Dibenz(a,h)anthracene	1.2E-03	--	--	--	--	--	6.0E-05	--	--	--	--	--	6.0E-05	1.0E+00	6.0E-05	1.0E+01	6.0E-06
Indeno(1,2,3-cd)pyrene	4.0E-03	--	--	--	--	--	2.0E-04	--	--	--	--	--	2.0E-04	1.0E+00	2.0E-04	1.0E+01	2.0E-05
Phenanthrene	1.3E-03	--	--	--	--	--	6.5E-05	--	--	--	--	--	6.5E-05	7.0E-01	9.3E-05	7.0E+00	9.3E-06
Pyrene	6.3E-03	--	--	--	--	--	3.2E-04	--	--	--	--	--	3.2E-04	1.5E+01	2.1E-05	2.5E+01	1.3E-05
4-Chlorophenyl phenyl ether	--	6.1E-02	9.1E-04	6.3E-02	4.8E-03	4.8E-03	--	1.5E-05	5.2E-05	4.5E-04	1.7E-05	1.7E-05	5.5E-04	1.0E+03	5.5E-07	1.0E+04	5.5E-08
Carbazole	--	5.1E-02	2.8E-03	5.2E-02	2.9E-02	2.9E-02	--	1.2E-05	1.6E-04	3.7E-04	1.0E-04	1.0E-04	7.5E-04	5.0E+00	1.5E-04	5.0E+01	1.5E-05
Diphenyl ether	--	8.6E-01	2.5E-02	8.9E-01	1.8E-01	1.8E-01	--	2.1E-04	1.4E-03	6.3E-03	6.5E-04	6.5E-04	9.2E-03	3.0E+00	3.1E-03	3.0E+01	3.1E-04
Diphenylmethanone	--	2.0E-01	2.2E-02	2.1E-01	3.2E-01	3.2E-01	--	4.8E-05	1.3E-03	1.5E-03	1.1E-03	1.1E-03	5.1E-03	3.8E+01	1.3E-04	3.8E+02	1.3E-05
Aluminum	1.3E+00	--	--	--	--	--	6.4E-02	--	--	--	--	--	6.4E-02	1.9E+00	3.3E-02	1.9E+01	3.3E-03
Barium	4.1E-02	1.6E+01	5.0E-01	2.9E-01	2.9E-01	2.9E-01	2.1E-03	3.8E-03	2.9E-02	2.1E-03	1.0E-03	1.0E-03	3.9E-02	5.2E+01	7.4E-04	1.2E+02	3.2E-04
Chromium	9.3E-02	2.4E+03	2.0E+01	4.0E+00	4.0E+00	4.0E+00	4.7E-03	5.7E-01	1.1E+00	2.9E-02	1.4E-02	1.4E-02	1.8E+00	2.4E+00	7.3E-01	4.1E+01	4.3E-02
Iron	2.5E+01	--	--	--	--	--	1.3E+00	--	--	--	--	--	1.3E+00	--	--	--	--
Lead	4.3E-03	--	--	--	--	--	2.2E-04	--	--	--	--	--	2.2E-04	4.7E+00	4.6E-05	1.5E+02	1.4E-06
Manganese	1.3E+00	--	--	--	--	--	6.4E-02	--	--	--	--	--	6.4E-02	8.8E+01	7.3E-04	2.8E+02	2.3E-04
Zinc	9.5E-02	--	--	--	--	--	4.8E-03	--	--	--	--	--	4.8E-03	7.5E+01	6.3E-05	2.6E+02	1.9E-05
Arsenic	--	1.4E+01	3.9E-01	1.8E+00	1.8E+00	1.8E+00	--	3.3E-03	2.2E-02	1.3E-02	6.3E-03	6.3E-03	5.1E-02	1.3E-01	4.0E-01	1.3E+00	4.0E-02
Beryllium	--	1.4E+00	2.8E-03	1.3E-02	1.3E-02	1.3E-02	--	3.3E-04	1.6E-04	9.0E-05	4.5E-05	4.5E-05	6.7E-04	5.3E-01	1.3E-03	5.3E-01	1.3E-03
Copper	--	3.9E+01	1.6E+00	6.4E+01	6.4E+01	6.4E+01	--	9.3E-03	9.2E-02	4.6E-01	2.3E-01	2.3E-01	1.0E+00	1.5E+01	6.7E-02	1.5E+02	6.7E-03
Silver	--	4.1E+01	1.1E-01	1.7E+01	1.7E+01	1.7E+01	--	9.8E-03	6.6E-03	1.2E-01	6.0E-02	6.0E-02	2.6E-01	3.6E+01	7.1E-03	7.2E+01	3.5E-03
Vanadium	--	1.5E+01	1.5E-02	1.3E-01	1.3E-01	1.3E-01	--	3.6E-03	8.3E-04	9.0E-04	4.5E-04	4.5E-04	6.2E-03	2.1E-01	3.0E-02	2.1E+00	3.0E-03
Bromide	2.0E-01	--	--	--	--	--	1.0E-02	--	--	--	--	--	1.0E-02	--	--	--	--
Nitrite as N	2.0E-02	--	--	--	--	--	1.0E-03	--	--	--	--	--	1.0E-03	--	--	--	--
Nitrogen, as Ammonia	6.0E+01	5.4E+02	--	--	--	--	3.0E+00	1.3E-01	--	--	--	--	3.1E+00	--	--	--	--
Chloride	--	2.4E+02	--	--	--	--	--	5.7E-02	--	--	--	--	5.7E-02	--	--	--	--
Sulfate	--	1.5E+03	--	--	--	--	--	3.6E-01	--	--	--	--	3.6E-01	--	--	--	--
Hydrazine	--	1.3E-03	--	--	--	--	--	3.1E-07	--	--	--	--	3.1E-07	2.5E+00	1.2E-07	5.0E+00	6.2E-08

Table - Off-PWD - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Off-PWD

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - On PWD/WDW - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Acetone	3.4E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	6.3E+00	3.1E-04	2.0E-03	1.1E+00	7.0E+00	1.0E+00	6.3E+00	1.0E+00	6.3E+00
Benzene	4.4E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Barium	3.8E+01	3.1E-02	1.2E+00	1.8E-02	6.8E-01	1.8E-02	6.8E-01	1.8E-02	6.8E-01
Beryllium	6.1E-01	2.0E-03	1.2E-03	9.0E-03	5.5E-03	9.0E-03	5.5E-03	9.0E-03	5.5E-03
Cadmium	9.4E-01	5.6E-02	5.3E-02	4.6E-01	4.3E-01	4.6E-01	4.3E-01	4.6E-01	4.3E-01
Chromium	3.0E+01	8.2E-03	2.4E-01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Lead	7.6E+01	3.5E-02	2.6E+00	6.6E-02	5.0E+00	6.6E-02	5.0E+00	6.6E-02	5.0E+00
Mercury	3.4E-01	2.6E-02	8.8E-03	2.8E+00	9.8E-01	2.8E+00	9.8E-01	2.8E+00	9.8E-01
Vanadium	2.7E+01	9.7E-04	2.6E-02	8.4E-03	2.3E-01	8.4E-03	2.3E-01	8.4E-03	2.3E-01

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - On PWD/WDW - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	On PWD/WDW

Chemical	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetone	3.4E-01	--	--	--	--	1.6E-04	--	--	--	--	1.6E-04	2.0E+01	7.9E-06	1.0E+02	1.6E-06
Bis(2-Ethylhexyl)phthalate	6.3E+00	2.0E-03	7.0E+00	6.3E+00	6.3E+00	2.9E-03	2.2E-04	9.7E-02	4.4E-02	4.4E-02	1.9E-01	1.8E+01	1.0E-02	1.8E+02	1.0E-03
Benzene	4.4E+00	--	--	--	--	2.0E-03	--	--	--	--	2.0E-03	2.6E+01	7.7E-05	2.6E+02	7.7E-06
Barium	3.8E+01	1.2E+00	6.8E-01	6.8E-01	6.8E-01	1.7E-02	1.3E-01	9.5E-03	4.7E-03	4.7E-03	1.7E-01	5.2E+01	3.2E-03	1.2E+02	1.4E-03
Beryllium	6.1E-01	1.2E-03	5.5E-03	5.5E-03	5.5E-03	2.8E-04	1.3E-04	7.6E-05	3.8E-05	3.8E-05	5.7E-04	5.3E-01	1.1E-03	5.3E-01	1.1E-03
Cadmium	9.4E-01	5.3E-02	4.3E-01	4.3E-01	4.3E-01	4.4E-04	5.8E-03	6.0E-03	3.0E-03	3.0E-03	1.8E-02	1.9E+00	9.8E-03	7.1E+00	2.6E-03
Chromium	3.0E+01	2.4E-01	4.0E+00	4.0E+00	4.0E+00	1.4E-02	2.7E-02	5.5E-02	2.8E-02	2.8E-02	1.5E-01	2.4E+00	6.3E-02	4.1E+01	3.7E-03
Lead	7.6E+01	2.6E+00	5.0E+00	5.0E+00	5.0E+00	3.5E-02	2.9E-01	6.9E-02	3.5E-02	3.5E-02	4.7E-01	4.7E+00	9.9E-02	1.5E+02	3.0E-03
Mercury	3.4E-01	8.8E-03	9.8E-01	9.8E-01	9.8E-01	1.6E-04	9.8E-04	1.3E-02	6.7E-03	6.7E-03	2.8E-02	1.0E+00	2.8E-02	1.0E+01	2.8E-03
Vanadium	2.7E+01	2.6E-02	2.3E-01	2.3E-01	2.3E-01	1.2E-02	2.9E-03	3.1E-03	1.6E-03	1.6E-03	2.2E-02	2.1E-01	1.0E-01	2.1E+00	1.0E-02

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Storm Water Detention Basin - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene		7.8E-03	1.8E-02	1.4E-04	1.0E+00	8.1E-03	1.1E-01	8.4E-04	1.1E-01	8.4E-04
2,4,4-Trimethyl-2-pentene		3.9E-03	3.8E-02	1.5E-04	1.0E+00	4.0E-03	3.2E-01	1.3E-03	3.2E-01	1.3E-03
Acetone		1.5E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol		4.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone		1.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde		1.3E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate		3.1E+00	3.1E-04	9.7E-04	1.1E+00	3.5E+00	1.0E+00	3.1E+00	1.0E+00	3.1E+00
Phenol		1.9E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
N-Nitrosodiphenylamine	7.4E-06		1.2E-01	--	1.1E+00	--	1.7E+00	--	1.7E+00	--
Benzo(a)pyrene		2.2E-01	2.2E-03	4.9E-04	1.1E+00	2.4E-01	2.2E-01	4.9E-02	2.2E-01	4.9E-02
Arsenic		1.2E+01	2.8E-02	3.4E-01	1.3E-01	1.5E+00	1.3E-01	1.5E+00	1.3E-01	1.5E+00
Barium	2.6E-02	5.1E+01	3.1E-02	1.6E+00	1.8E-02	9.3E-01	1.8E-02	9.3E-01	1.8E-02	9.3E-01
Beryllium		1.2E-01	2.0E-03	2.4E-04	9.0E-03	1.1E-03	9.0E-03	1.1E-03	9.0E-03	1.1E-03
Chromium		5.0E+01	8.2E-03	4.1E-01	--	4.0E+00	--	4.0E+00	--	4.0E+00
Vanadium		2.2E+01	9.7E-04	2.1E-02	8.4E-03	1.8E-01	8.4E-03	1.8E-01	8.4E-03	1.8E-01
Chloride		1.3E+01	--	--	--	--	--	--	--	--
Nitrite as N	2.6E-02		--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	2.2E+01	--	--	--	--	--	--	--	--
Sulfate		1.9E+03	--	--	--	--	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Storm Water Detention Basin - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Storm Water Detention Basin

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	7.8E-03	1.4E-04	8.1E-03	8.4E-04	8.4E-04	--	3.0E-06	1.3E-05	9.2E-05	4.8E-06	4.8E-06	1.2E-04	4.1E-01	2.9E-04	4.1E+00	2.9E-05
2,4,4-Trimethyl-2-pentene	--	3.9E-03	1.5E-04	4.0E-03	1.3E-03	1.3E-03	--	1.5E-06	1.3E-05	4.6E-05	7.2E-06	7.2E-06	7.5E-05	4.1E-01	1.8E-04	4.1E+00	1.8E-05
Acetone	--	1.5E-01	--	--	--	--	--	5.7E-05	--	--	--	--	5.7E-05	2.0E+01	2.9E-06	1.0E+02	5.7E-07
3 & 4 Methylphenol	--	4.0E+00	--	--	--	--	--	1.5E-03	--	--	--	--	1.5E-03	1.0E+02	1.5E-05	1.0E+03	1.5E-06
Acetophenone	--	1.6E-01	--	--	--	--	--	6.1E-05	--	--	--	--	6.1E-05	8.0E+02	7.6E-08	8.0E+03	7.6E-09
Benzaldehyde	--	1.3E+00	--	--	--	--	--	4.9E-04	--	--	--	--	4.9E-04	4.3E+01	1.2E-05	8.6E+01	5.8E-06
Bis(2-Ethylhexyl)phthalate	--	3.1E+00	9.7E-04	3.5E+00	3.1E+00	3.1E+00	--	1.2E-03	8.8E-05	3.9E-02	1.8E-02	1.8E-02	7.6E-02	1.8E+01	4.2E-03	1.8E+02	4.1E-04
Phenol	--	1.9E+00	--	--	--	--	--	7.2E-04	--	--	--	--	7.2E-04	4.0E+01	1.8E-05	5.4E+01	1.4E-05
N-Nitrosodiphenylamine	7.4E-06	--	--	--	--	--	5.9E-07	--	--	--	--	--	5.9E-07	2.0E+01	3.0E-08	2.0E+02	3.0E-09
Benzo(a)pyrene	--	2.2E-01	4.9E-04	2.4E-01	4.9E-02	4.9E-02	--	8.4E-05	4.4E-05	2.7E-03	2.8E-04	2.8E-04	3.4E-03	1.0E+00	3.4E-03	1.0E+01	3.4E-04
Arsenic	--	1.2E+01	3.4E-01	1.5E+00	1.5E+00	1.5E+00	--	4.6E-03	3.1E-02	1.7E-02	8.7E-03	8.7E-03	7.0E-02	1.3E-01	5.5E-01	1.3E+00	5.5E-02
Barium	2.6E-02	5.1E+01	1.6E+00	9.3E-01	9.3E-01	9.3E-01	2.1E-03	1.9E-02	1.4E-01	1.1E-02	5.3E-03	5.3E-03	1.9E-01	5.2E+01	3.6E-03	1.2E+02	1.6E-03
Beryllium	--	1.2E-01	2.4E-04	1.1E-03	1.1E-03	1.1E-03	--	4.6E-05	2.2E-05	1.2E-05	6.1E-06	6.1E-06	9.2E-05	5.3E-01	1.7E-04	5.3E-01	1.7E-04
Chromium	--	5.0E+01	4.1E-01	4.0E+00	4.0E+00	4.0E+00	--	1.9E-02	3.7E-02	4.6E-02	2.3E-02	2.3E-02	1.5E-01	2.4E+00	6.1E-02	4.1E+01	3.6E-03
Vanadium	--	2.2E+01	2.1E-02	1.8E-01	1.8E-01	1.8E-01	--	8.4E-03	1.9E-03	2.1E-03	1.1E-03	1.1E-03	1.5E-02	2.1E-01	6.9E-02	2.1E+00	6.9E-03
Chloride	--	1.3E+01	--	--	--	--	--	4.9E-03	--	--	--	--	4.9E-03	--	--	--	--
Nitrite as N	2.6E-02	--	--	--	--	--	2.1E-03	--	--	--	--	--	2.1E-03	--	--	--	--
Nitrogen, as Ammonia	7.5E+00	2.2E+01	--	--	--	--	6.0E-01	8.4E-03	--	--	--	--	6.1E-01	--	--	--	--
Sulfate	--	1.9E+03	--	--	--	--	--	7.2E-01	--	--	--	--	7.2E-01	--	--	--	--

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Upper South Ditch - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	3.7E-02	1.8E-02	6.7E-04	1.0E+00	3.8E-02	1.1E-01	4.0E-03	1.1E-01	4.0E-03
2,4,4-Trimethyl-2-pentene	--	3.0E-03	3.8E-02	1.1E-04	1.0E+00	3.1E-03	3.2E-01	9.7E-04	3.2E-01	9.7E-04
4-iso-Propyltoluene	--	2.6E-03	3.3E-02	8.6E-05	1.0E+00	2.7E-03	2.6E-01	6.9E-04	2.6E-01	6.9E-04
Acetaldehyde	--	8.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Formaldehyde	--	1.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3 & 4 Methylphenol	--	3.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Acetophenone	--	9.0E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Azobenzene	5.3E-04	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	2.2E-03	--	1.1E+00	--	2.2E-01	--	2.2E-01	--
Benzaldehyde	--	6.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Bis(2-Ethylhexyl)phthalate	3.4E-03	2.1E+02	3.1E-04	6.6E-02	1.1E+00	2.3E+02	1.0E+00	2.1E+02	1.0E+00	2.1E+02
Caprolactam	--	5.3E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Diphenyl ether	--	2.2E-01	2.9E-02	6.3E-03	1.0E+00	2.3E-01	2.1E-01	4.7E-02	2.1E-01	4.7E-02
Di-n-octylphthalate	--	1.5E-01	1.6E-04	2.4E-05	1.1E+00	1.7E-01	1.0E+00	1.5E-01	1.0E+00	1.5E-01
Diphenylmethanone	--	3.1E-02	1.1E-01	3.4E-03	1.1E+00	3.2E-02	1.6E+00	4.8E-02	1.6E+00	4.8E-02
N-Nitrosodi-n-propylamine	6.6E-06	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Phenol	--	9.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aluminum	1.9E+01	--	5.7E-04	--	8.6E-03	--	8.6E-03	--	8.6E-03	--
Arsenic	--	1.0E+01	2.8E-02	2.8E-01	1.3E-01	1.3E+00	1.3E-01	1.3E+00	1.3E-01	1.3E+00
Barium	2.7E-02	7.0E+01	3.1E-02	2.2E+00	1.8E-02	1.3E+00	1.8E-02	1.3E+00	1.8E-02	1.3E+00
Beryllium	8.4E-04	7.1E-01	2.0E-03	1.4E-03	9.0E-03	6.4E-03	9.0E-03	6.4E-03	9.0E-03	6.4E-03
Chromium	3.3E+00	9.3E+02	8.2E-03	7.6E+00	--	4.0E+00	--	4.0E+00	--	4.0E+00
Chromium, Hexavalent	--	2.5E+01	8.2E-03	2.1E-01	1.0E-01	2.5E+00	1.0E-01	2.5E+00	1.0E-01	2.5E+00
Cobalt	3.7E-02	--	1.5E-03	--	2.4E-02	--	2.4E-02	--	2.4E-02	--
Copper	1.7E-02	--	4.1E-02	--	1.6E+00	--	1.6E+00	--	1.6E+00	--
Iron	7.9E+00	1.4E+04	8.5E-04	1.2E+01	7.2E-03	1.0E+02	7.2E-03	1.0E+02	7.2E-03	1.0E+02
Lead	9.4E-04	--	3.5E-02	--	6.6E-02	--	6.6E-02	--	6.6E-02	--
Manganese	1.8E+00	--	1.6E-02	--	4.4E-02	--	4.4E-02	--	4.4E-02	--
Silver	1.7E-05	1.9E+01	2.8E-03	5.3E-02	4.1E-01	7.8E+00	4.1E-01	7.8E+00	4.1E-01	7.8E+00
Vanadium	--	1.5E+01	9.7E-04	1.4E-02	8.4E-03	1.2E-01	8.4E-03	1.2E-01	8.4E-03	1.2E-01
Bromide	4.0E-01	--	0.0E+00	--	0.0E+00	--	0.0E+00	--	0.0E+00	--
Chloride	1.7E+02	1.4E+02	--	--	--	--	--	--	--	--
Nitrite as N	2.1E-02	--	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.2E+02	--	--	--	--	--	--	--	--
Sulfate	--	7.0E+02	--	--	--	--	--	--	--	--

Table - Upper South Ditch - RME - Muskrat - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Amphibian	C_{amphib} (mg/kg)	BAF Fish	C_{fish} (mg/kg)
Hydrazine	8.0E-05	9.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:

BAF - Bioaccumulation Factor

C_{amphib} - Chemical concentration in amphibians

C_{fish} - Chemical concentration in fish

C_{inv} - Chemical concentration in invertebrates

C_{plant} - Chemical concentration in plant

C_{sed} - Chemical concentration in sediment

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - Upper South Ditch - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Chemical	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	C_{fish} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose sed (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphib (mg/Kg BW day) [a]	Dose Fish (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
2,4,4-Trimethyl-1-pentene	--	3.7E-02	6.7E-04	3.8E-02	4.0E-03	4.0E-03	--	3.2E-06	1.4E-05	9.9E-05	5.1E-06	5.1E-06	1.3E-04	4.1E-01	3.1E-04	4.1E+00	3.1E-05
2,4,4-Trimethyl-2-pentene	--	3.0E-03	1.1E-04	3.1E-03	9.7E-04	9.7E-04	--	2.6E-07	2.3E-06	8.0E-06	1.3E-06	1.3E-06	1.3E-05	4.1E-01	3.2E-05	4.1E+00	3.2E-06
4-iso-Propyltoluene	--	2.6E-03	8.6E-05	2.7E-03	6.9E-04	6.9E-04	--	2.2E-07	1.8E-06	6.9E-06	8.9E-07	8.9E-07	1.1E-05	--	--	--	--
Acetaldehyde	--	8.3E-02	--	--	--	--	--	7.2E-06	--	--	--	--	7.2E-06	2.4E+01	3.0E-07	2.4E+02	3.0E-08
Formaldehyde	--	1.1E+00	--	--	--	--	--	9.4E-05	--	--	--	--	9.4E-05	1.0E-01	9.4E-04	1.0E+00	9.4E-05
3 & 4 Methylphenol	--	3.0E+00	--	--	--	--	--	2.6E-04	--	--	--	--	2.6E-04	1.0E+02	2.6E-06	1.0E+03	2.6E-07
Acetophenone	--	9.0E-02	--	--	--	--	--	7.8E-06	--	--	--	--	7.8E-06	8.0E+02	9.7E-09	8.0E+03	9.7E-10
Azobenzene	5.3E-04	--	--	--	--	--	9.7E-06	--	--	--	--	--	9.7E-06	--	--	--	--
Benzo(a)pyrene	1.5E-04	--	--	--	--	--	2.7E-06	--	--	--	--	--	2.7E-06	1.0E+00	2.7E-06	1.0E+01	2.7E-07
Benzaldehyde	--	6.2E-01	--	--	--	--	--	5.4E-05	--	--	--	--	5.4E-05	4.3E+01	1.3E-06	8.6E+01	6.3E-07
Bis(2-Ethylhexyl)phthalate	3.4E-03	2.1E+02	6.6E-02	2.3E+02	2.1E+02	2.1E+02	6.3E-05	1.8E-02	1.4E-03	6.1E-01	2.7E-01	2.7E-01	1.2E+00	1.8E+01	6.4E-02	1.8E+02	6.4E-03
Caprolactam	--	5.3E-02	--	--	--	--	--	4.6E-06	--	--	--	--	4.6E-06	8.0E+02	5.7E-09	8.0E+03	5.7E-10
Diphenyl ether	--	2.2E-01	6.3E-03	2.3E-01	4.7E-02	4.7E-02	--	1.9E-05	1.3E-04	5.9E-04	6.0E-05	6.0E-05	8.6E-04	3.0E+00	2.9E-04	3.0E+01	2.9E-05
Di-n-octylphthalate	--	1.5E-01	2.4E-05	1.7E-01	1.5E-01	1.5E-01	--	1.3E-05	5.0E-07	4.4E-04	1.9E-04	1.9E-04	8.4E-04	1.0E+02	8.4E-06	4.0E+02	2.1E-06
Diphenylmethanone	--	3.1E-02	3.4E-03	3.2E-02	4.8E-02	4.8E-02	--	2.6E-06	7.1E-05	8.3E-05	6.2E-05	6.2E-05	2.8E-04	3.8E+01	7.4E-06	3.8E+02	7.4E-07
N-Nitrosodi-n-propylamine	6.6E-06	--	--	--	--	--	1.2E-07	--	--	--	--	--	1.2E-07	7.3E-02	1.6E-06	7.3E-01	1.6E-07
Phenol	--	9.6E-01	--	--	--	--	--	8.3E-05	--	--	--	--	8.3E-05	4.0E+01	2.1E-06	5.4E+01	1.6E-06
Aluminum	1.9E+01	--	--	--	--	--	3.4E-01	--	--	--	--	--	3.4E-01	1.9E+00	1.8E-01	1.9E+01	1.8E-02
Arsenic	--	1.0E+01	2.8E-01	1.3E+00	1.3E+00	1.3E+00	--	8.7E-04	5.8E-03	3.3E-03	1.6E-03	1.6E-03	1.3E-02	1.3E-01	1.0E-01	1.3E+00	1.0E-02
Barium	2.7E-02	7.0E+01	2.2E+00	1.3E+00	1.3E+00	1.3E+00	4.9E-04	6.1E-03	4.6E-02	3.3E-03	1.7E-03	1.7E-03	5.9E-02	5.2E+01	1.1E-03	1.2E+02	4.9E-04
Beryllium	8.4E-04	7.1E-01	1.4E-03	6.4E-03	6.4E-03	6.4E-03	1.5E-05	6.2E-05	2.9E-05	1.7E-05	8.3E-06	8.3E-06	1.4E-04	5.3E-01	2.6E-04	5.3E-01	2.6E-04
Chromium	3.3E+00	9.3E+02	7.6E+00	4.0E+00	4.0E+00	4.0E+00	6.1E-02	8.0E-02	1.6E-01	1.0E-02	5.2E-03	5.2E-03	3.2E-01	2.4E+00	1.3E-01	4.1E+01	7.8E-03
Chromium, Hexavalent	--	2.5E+01	2.1E-01	2.5E+00	2.5E+00	2.5E+00	--	2.2E-03	4.2E-03	6.5E-03	3.2E-03	3.2E-03	1.9E-02	2.2E+01	8.8E-04	2.2E+01	8.8E-04
Cobalt	3.7E-02	--	--	--	--	--	6.7E-04	--	--	--	--	--	6.7E-04	--	--	--	--
Copper	1.7E-02	--	--	--	--	--	3.0E-04	--	--	--	--	--	3.0E-04	1.5E+01	2.0E-05	1.5E+02	2.0E-06
Iron	7.9E+00	1.4E+04	1.2E+01	1.0E+02	1.0E+02	1.0E+02	1.4E-01	1.2E+00	2.4E-01	2.6E-01	1.3E-01	1.3E-01	2.1E+00	--	--	--	--
Lead	9.4E-04	--	--	--	--	--	1.7E-05	--	--	--	--	--	1.7E-05	4.7E+00	3.6E-06	1.5E+02	1.1E-07
Manganese	1.8E+00	--	--	--	--	--	3.3E-02	--	--	--	--	--	3.3E-02	8.8E+01	3.7E-04	2.8E+02	1.1E-04
Silver	1.7E-05	1.9E+01	5.3E-02	7.8E+00	7.8E+00	7.8E+00	3.1E-07	1.6E-03	1.1E-03	2.0E-02	1.0E-02	1.0E-02	4.3E-02	3.6E+01	1.2E-03	7.2E+01	5.9E-04
Vanadium	--	1.5E+01	1.4E-02	1.2E-01	1.2E-01	1.2E-01	--	1.3E-03	2.9E-04	3.2E-04	1.6E-04	1.6E-04	2.2E-03	2.1E-01	1.0E-02	2.1E+00	1.0E-03
Bromide	4.0E-01	--	--	--	--	--	7.3E-03	--	--	--	--	--	7.3E-03	--	--	--	--
Chloride	1.7E+02	1.4E+02	--	--	--	--	3.1E+00	1.2E-02	--	--	--	--	3.1E+00	--	--	--	--
Nitrite as N	2.1E-02	--	--	--	--	--	3.7E-04	--	--	--	--	--	3.7E-04	--	--	--	--
Nitrogen, as Ammonia	7.3E+01	2.2E+02	--	--	--	--	1.3E+00	1.9E-02	--	--	--	--	1.3E+00	--	--	--	--
Sulfate	--	7.0E+02	--	--	--	--	--	6.1E-02	--	--	--	--	6.1E-02	--	--	--	--
Hydrazine	8.0E-05	9.1E-04	--	--	--	--	1.5E-06	7.9E-08	--	--	--	--	1.5E-06	2.5E+00	6.1E-07	5.0E+00	3.1E-07

Table - Upper South Ditch - RME - Muskrat - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Muskrat
Scenario:	Current - RME
Exposure Point:	Upper South Ditch

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013

Notes:
[a] Doses for surface water (sw), sediment, invertebrates (inv), plants, fish and amphibian (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{plant} - Chemical concentration in plant tissue
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Central Pond - RME - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Central Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene		1.10E-02	1.82E-02	2.00E-04	1.04E+00	1.14E-02	1.08E-01	1.18E-03
2,4,4-Trimethyl-2-pentene		8.80E-03	3.78E-02	3.32E-04	1.03E+00	9.05E-03	3.23E-01	2.84E-03
Acetone		1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Methyl Tertbutyl Ether		1.70E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		6.10E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetophenone		2.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde		1.90E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Phenol		2.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(b)fluoranthene		1.40E-01	3.53E-03	4.95E-04	1.07E+00	1.49E-01	4.16E-01	5.82E-02
Fluoranthene		2.90E-01	8.06E-03	2.34E-03	1.05E+00	3.05E-01	7.97E-01	2.31E-01
Phenanthrene		2.10E-01	2.05E-02	4.30E-03	1.03E+00	2.17E-01	3.04E-01	6.38E-02
Pyrene		2.30E-01	1.17E-02	2.69E-03	1.04E+00	2.40E-01	5.14E-01	1.18E-01
Aluminum	2.10E-01		5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	4.90E-02	4.60E+01	3.12E-02	1.44E+00	1.82E-02	8.37E-01	1.82E-02	8.37E-01
Beryllium		9.40E-02	2.00E-03	1.88E-04	9.00E-03	8.46E-04	9.00E-03	8.46E-04
Chromium		1.40E+02	8.20E-03	1.15E+00	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent		2.70E-01	8.20E-03	2.21E-03	1.00E-01	2.70E-02	1.00E-01	2.70E-02
Lead		5.10E+01	3.50E-02	1.78E+00	6.60E-02	3.37E+00	6.60E-02	3.37E+00
Manganese	7.00E-01	5.90E+02	1.58E-02	9.35E+00	4.38E-02	2.58E+01	4.38E-02	2.58E+01
Tin		2.20E+00	6.00E-03	1.32E-02	--	--	--	--
Silver	1.50E-05		2.80E-03	--	4.09E-01	--	4.09E-01	--
Vanadium		1.70E+01	9.70E-04	1.65E-02	8.40E-03	1.43E-01	8.40E-03	1.43E-01
Bromide	1.30E-01		0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride		2.40E+01	--	--	--	--	--	--
Nitrite as N	7.50E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	2.80E+01	3.50E+01	--	--	--	--	--	--
Sulfate		1.20E+03	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Central Pond - RME - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Central Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	1.10E-02	2.00E-04	1.14E-02	1.18E-03	--	1.09E-08	1.10E-08	7.88E-08	8.17E-09	1.1E-07	4.10E-01	2.7E-07	4.10E+00	2.7E-08
2,4,4-Trimethyl-2-pentene	--	8.80E-03	3.32E-04	9.05E-03	2.84E-03	--	8.69E-09	1.84E-08	6.25E-08	1.96E-08	1.1E-07	4.10E-01	2.7E-07	4.10E+00	2.7E-08
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	1.18E-07	0.00E+00	0.00E+00	0.00E+00	1.2E-07	2.00E+01	5.9E-09	1.00E+02	1.2E-09
Methyl Tertbutyl Ether	--	1.70E-03	0.00E+00	0.00E+00	0.00E+00	--	1.68E-09	0.00E+00	0.00E+00	0.00E+00	1.7E-09	--	--	--	--
3 & 4 Methylphenol	--	6.10E+00	0.00E+00	0.00E+00	0.00E+00	--	6.02E-06	0.00E+00	0.00E+00	0.00E+00	6.0E-06	1.00E+02	6.0E-08	1.00E+03	6.0E-09
Acetophenone	--	2.60E-01	0.00E+00	0.00E+00	0.00E+00	--	2.57E-07	0.00E+00	0.00E+00	0.00E+00	2.6E-07	8.00E+02	3.2E-10	8.00E+03	3.2E-11
Benzaldehyde	--	1.90E+00	0.00E+00	0.00E+00	0.00E+00	--	1.88E-06	0.00E+00	0.00E+00	0.00E+00	1.9E-06	4.29E+01	4.4E-08	8.57E+01	2.2E-08
Phenol	--	2.20E+00	0.00E+00	0.00E+00	0.00E+00	--	2.17E-06	0.00E+00	0.00E+00	0.00E+00	2.2E-06	4.00E+01	5.4E-08	5.35E+01	4.1E-08
Benzo(b)fluoranthene	--	1.40E-01	4.95E-04	1.49E-01	5.82E-02	--	1.38E-07	2.73E-08	1.03E-06	4.02E-07	1.6E-06	1.00E+00	1.6E-06	1.00E+01	1.6E-07
Fluoranthene	--	2.90E-01	2.34E-03	3.05E-01	2.31E-01	--	2.86E-07	1.29E-07	2.11E-06	1.60E-06	4.1E-06	2.50E+01	1.6E-07	5.00E+01	8.2E-08
Phenanthrene	--	2.10E-01	4.30E-03	2.17E-01	6.38E-02	--	2.07E-07	2.38E-07	1.50E-06	4.41E-07	2.4E-06	7.00E-01	3.4E-06	7.00E+00	3.4E-07
Pyrene	--	2.30E-01	2.69E-03	2.40E-01	1.18E-01	--	2.27E-07	1.49E-07	1.66E-06	8.17E-07	2.9E-06	1.50E+01	1.9E-07	2.50E+01	1.1E-07
Aluminum	2.10E-01	--	--	--	--	1.45E-05	--	--	--	--	1.5E-05	1.93E+00	7.5E-06	1.93E+01	7.5E-07
Barium	4.90E-02	4.60E+01	1.44E+00	8.37E-01	8.37E-01	3.39E-06	4.54E-05	7.93E-05	5.79E-06	5.79E-06	1.4E-04	5.18E+01	2.7E-06	1.19E+02	1.2E-06
Beryllium	--	9.40E-02	1.88E-04	8.46E-04	8.46E-04	--	9.28E-08	1.04E-08	5.85E-09	5.85E-09	1.1E-07	5.32E-01	2.2E-07	5.32E-01	2.2E-07
Chromium	--	1.40E+02	1.15E+00	4.00E+00	4.00E+00	--	1.38E-04	6.35E-05	2.76E-05	2.76E-05	2.6E-04	2.40E+00	1.1E-04	4.06E+01	6.3E-06
Chromium, Hexavalent	--	2.70E-01	2.21E-03	2.70E-02	2.70E-02	--	2.67E-07	1.22E-07	1.87E-07	1.87E-07	7.6E-07	2.20E+01	3.5E-08	2.20E+01	3.5E-08
Lead	--	5.10E+01	1.78E+00	3.37E+00	3.37E+00	--	5.04E-05	9.87E-05	2.33E-05	2.33E-05	2.0E-04	4.70E+00	4.2E-05	1.54E+02	1.3E-06
Manganese	7.00E-01	5.90E+02	9.35E+00	2.58E+01	2.58E+01	4.85E-05	5.83E-04	5.17E-04	1.78E-04	1.78E-04	1.5E-03	8.80E+01	1.7E-05	2.84E+02	5.3E-06
Tin	--	2.20E+00	1.32E-02	--	--	--	2.17E-06	7.30E-07	--	--	2.9E-06	2.34E+01	1.2E-07	3.50E+01	8.3E-08
Silver	1.50E-05	--	--	--	--	1.04E-09	--	--	--	--	1.0E-09	3.62E+01	2.9E-11	7.25E+01	1.4E-11
Vanadium	--	1.70E+01	1.65E-02	1.43E-01	1.43E-01	--	1.68E-05	9.12E-07	9.87E-07	9.87E-07	2.0E-05	2.10E-01	9.4E-05	2.10E+00	9.4E-06
Bromide	1.30E-01	--	--	--	--	9.01E-06	--	--	--	--	9.0E-06	--	--	--	--
Chloride	--	2.40E+01	--	--	--	--	2.37E-05	--	--	--	2.4E-05	--	--	--	--
Nitrite as N	7.50E-02	--	--	--	--	5.20E-06	--	--	--	--	5.2E-06	--	--	--	--
Nitrogen, as Ammonia	2.80E+01	3.50E+01	--	--	--	1.94E-03	3.46E-05	--	--	--	2.0E-03	--	--	--	--
Sulfate	--	1.20E+03	--	--	--	--	1.18E-03	--	--	--	1.2E-03	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Lower South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-02	1.82E-02	3.63E-04	1.04E+00	2.07E-02	1.08E-01	2.15E-03
2,4,4-Trimethyl-2-pentene	--	3.50E-03	3.78E-02	1.32E-04	1.03E+00	3.60E-03	3.23E-01	1.13E-03
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	--	6.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Aniline	--	2.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)pyrene	1.50E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Bis(2-Ethylhexyl)phthalate	3.43E-03	6.02E+02	3.13E-04	1.89E-01	1.12E+00	6.72E+02	1.00E+00	6.02E+02
Di-n-octylphthalate	--	1.50E-01	1.61E-04	2.42E-05	1.13E+00	1.70E-01	1.00E+00	1.50E-01
Diphenyl ether	--	2.60E+00	2.86E-02	7.42E-02	1.03E+00	2.68E+00	2.13E-01	5.53E-01
Diphenylamine	--	9.50E-02	7.35E-02	6.98E-03	1.03E+00	9.82E-02	8.57E-01	8.14E-02
N-Nitrosodi-n-propylamine	6.56E-06	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
4,4`-DDT	--	6.20E-02	1.45E-03	8.98E-05	1.09E+00	6.73E-02	1.67E+00	1.04E-01
Hexachlorobenzene	--	3.70E-02	4.49E-03	1.66E-04	1.06E+00	3.93E-02	9.00E-02	3.33E-03
Aluminum	1.89E+01	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	2.67E-02	1.74E+01	3.12E-02	5.41E-01	1.82E-02	3.16E-01	1.82E-02	3.16E-01
Beryllium	8.41E-04	1.45E+00	2.00E-03	2.91E-03	9.00E-03	1.31E-02	9.00E-03	1.31E-02
Cadmium	--	1.03E+00	5.60E-02	5.75E-02	4.59E-01	4.71E-01	4.59E-01	4.71E-01
Chromium	3.32E+00	2.76E+03	8.20E-03	2.27E+01	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent	--	2.56E+01	8.20E-03	2.10E-01	1.00E-01	2.56E+00	1.00E-01	2.56E+00
Cobalt	3.65E-02	--	1.49E-03	--	2.44E-02	--	2.44E-02	--
Copper	1.65E-02	--	4.12E-02	--	1.65E+00	--	1.65E+00	--
Iron	7.93E+00	--	8.50E-04	--	7.20E-03	--	7.20E-03	--
Lead	9.41E-04	--	3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	1.79E+00	--	1.58E-02	--	4.38E-02	--	4.38E-02	--
Mercury	--	2.90E-01	2.57E-02	7.45E-03	2.84E+00	8.23E-01	2.84E+00	8.23E-01
Nickel	--	1.96E+01	4.70E-02	9.21E-01	8.18E-01	1.60E+01	8.18E-01	1.60E+01
Silver	1.70E-05	6.20E+01	2.80E-03	1.74E-01	4.09E-01	2.54E+01	4.09E-01	2.54E+01
Tin	--	1.60E+00	6.00E-03	9.60E-03	--	--	--	--
Vanadium	--	1.11E+01	9.70E-04	1.08E-02	8.40E-03	9.32E-02	8.40E-03	9.32E-02
Bromide	4.01E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	1.72E+02	1.40E+02	--	--	--	--	--	--
Nitrite as N	2.05E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.52E+02	--	--	--	--	--	--
Sulfate	--	8.30E+02	--	--	--	--	--	--
Hydrazine	8.00E-05	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	9.60E-04	--	9.33E-02	--	1.04E+00	--	1.21E+00	--
4-Nonylphenol (Tech.)	1.39E-02	--	2.93E-03	--	1.07E+00	--	6.48E-03	--

Table Lower South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Kempore (Azodicarbonamide)	1.21E+00	--	--	--	--	--	--	--
C11-C22 Aromatics	--	9.40E+03	--	--	--	--	--	--
C19-C36 Aliphatics	--	6.40E+03	--	--	--	--	--	--
C9-C18 Aliphatics	--	7.70E+02	--	--	--	--	--	--
EPH, Total	--	1.70E+04	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Lower South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-02	3.63E-04	2.07E-02	2.15E-03	--	4.39E-09	4.46E-09	3.18E-08	3.30E-09	4.4E-08	4.10E-01	1.1E-07	4.10E+00	1.1E-08
2,4,4-Trimethyl-2-pentene	--	3.50E-03	1.32E-04	3.60E-03	1.13E-03	--	7.68E-10	1.62E-09	5.53E-09	1.73E-09	9.7E-09	4.10E-01	2.4E-08	4.10E+00	2.4E-09
Acetaldehyde	--	6.30E-02	0.00E+00	0.00E+00	0.00E+00	--	1.38E-08	0.00E+00	0.00E+00	0.00E+00	1.4E-08	2.40E+01	5.8E-10	2.40E+02	5.8E-11
Acetone	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	2.63E-08	0.00E+00	0.00E+00	0.00E+00	2.6E-08	2.00E+01	1.3E-09	1.00E+02	2.6E-10
Formaldehyde	--	6.00E-01	0.00E+00	0.00E+00	0.00E+00	--	1.32E-07	0.00E+00	0.00E+00	0.00E+00	1.3E-07	1.00E-01	1.3E-06	1.00E+00	1.3E-07
Aniline	--	2.30E-01	0.00E+00	0.00E+00	0.00E+00	--	5.05E-08	0.00E+00	0.00E+00	0.00E+00	5.0E-08	2.00E+00	2.5E-08	2.00E+01	2.5E-09
Azobenzene	5.30E-04	--	--	--	--	8.16E-09	--	--	--	--	8.2E-09	--	--	--	--
Benzaldehyde	--	1.20E-01	0.00E+00	0.00E+00	0.00E+00	--	2.63E-08	0.00E+00	0.00E+00	0.00E+00	2.6E-08	4.29E+01	6.1E-10	8.57E+01	3.1E-10
Benzo(a)pyrene	1.50E-04	--	--	--	--	2.31E-09	--	--	--	--	2.3E-09	1.00E+00	2.3E-09	1.00E+01	2.3E-10
Bis(2-Ethylhexyl)phthalate	3.43E-03	6.02E+02	1.89E-01	6.72E+02	6.02E+02	5.28E-08	1.32E-04	2.32E-06	1.03E-03	9.24E-04	2.1E-03	1.83E+01	1.1E-04	1.83E+02	1.1E-05
Di-n-octylphthalate	--	1.50E-01	2.42E-05	1.70E-01	1.50E-01	--	3.29E-08	2.97E-10	2.61E-07	2.30E-07	5.2E-07	1.00E+02	5.2E-09	4.00E+02	1.3E-09
Diphenyl ether	--	2.60E+00	7.42E-02	2.68E+00	5.53E-01	--	5.70E-07	9.12E-07	4.11E-06	8.49E-07	6.4E-06	3.00E+00	2.1E-06	3.00E+01	2.1E-07
Diphenylamine	--	9.50E-02	6.98E-03	9.82E-02	8.14E-02	--	2.08E-08	8.57E-08	1.51E-07	1.25E-07	3.8E-07	3.30E+01	1.2E-08	3.33E+02	1.1E-09
N-Nitrosodi-n-propylamine	6.56E-06	--	--	--	--	1.01E-10	--	--	--	--	1.0E-10	7.29E-02	1.4E-09	7.29E-01	1.4E-10
4,4`-DDT	--	6.20E-02	8.98E-05	6.73E-02	1.04E-01	--	1.36E-08	1.10E-09	1.03E-07	1.59E-07	2.8E-07	8.00E-01	3.5E-07	4.00E+00	6.9E-08
Hexachlorobenzene	--	3.70E-02	1.66E-04	3.93E-02	3.33E-03	--	8.12E-09	2.04E-09	6.04E-08	5.11E-09	7.6E-08	3.20E-01	2.4E-07	1.60E+00	4.7E-08
Aluminum	1.89E+01	--	--	--	--	2.90E-04	--	--	--	--	2.9E-04	1.93E+00	1.5E-04	1.93E+01	1.5E-05
Barium	2.67E-02	1.74E+01	5.41E-01	3.16E-01	3.16E-01	4.11E-07	3.81E-06	6.65E-06	4.85E-07	4.85E-07	1.2E-05	5.18E+01	2.3E-07	1.19E+02	9.9E-08
Beryllium	8.41E-04	1.45E+00	2.91E-03	1.31E-02	1.31E-02	1.29E-08	3.19E-07	3.57E-08	2.01E-08	2.01E-08	4.1E-07	5.32E-01	7.7E-07	5.32E-01	7.7E-07
Cadmium	--	1.03E+00	5.75E-02	4.71E-01	4.71E-01	--	2.25E-07	7.06E-07	7.24E-07	7.24E-07	2.4E-06	1.86E+00	1.3E-06	7.10E+00	3.4E-07
Chromium	3.32E+00	2.76E+03	2.27E+01	4.00E+00	4.00E+00	5.12E-05	6.06E-04	2.78E-04	6.14E-06	6.14E-06	9.5E-04	2.40E+00	4.0E-04	4.06E+01	2.3E-05
Chromium, Hexavalent	--	2.56E+01	2.10E-01	2.56E+00	2.56E+00	--	5.62E-06	2.58E-06	3.93E-06	3.93E-06	1.6E-05	2.20E+01	7.3E-07	2.20E+01	7.3E-07
Cobalt	3.65E-02	--	--	--	--	5.62E-07	--	--	--	--	5.6E-07	--	--	--	--
Copper	1.65E-02	--	--	--	--	2.54E-07	--	--	--	--	2.5E-07	1.52E+01	1.7E-08	1.52E+02	1.7E-09
Iron	7.93E+00	--	--	--	--	1.22E-04	--	--	--	--	1.2E-04	--	--	--	--
Lead	9.41E-04	--	--	--	--	1.45E-08	--	--	--	--	1.4E-08	4.70E+00	3.1E-09	1.54E+02	9.4E-11
Manganese	1.79E+00	--	--	--	--	2.75E-05	--	--	--	--	2.7E-05	8.80E+01	3.1E-07	2.84E+02	9.7E-08
Mercury	--	2.90E-01	7.45E-03	8.23E-01	8.23E-01	--	6.36E-08	9.16E-08	1.26E-06	1.26E-06	2.7E-06	1.01E+00	2.7E-06	1.01E+01	2.7E-07
Nickel	--	1.96E+01	9.21E-01	1.60E+01	1.60E+01	--	4.30E-06	1.13E-05	2.46E-05	2.46E-05	6.5E-05	4.00E+01	1.6E-06	8.00E+01	8.1E-07
Silver	1.70E-05	6.20E+01	1.74E-01	2.54E+01	2.54E+01	2.62E-10	1.36E-05	2.13E-06	3.89E-05	3.89E-05	9.4E-05	3.62E+01	2.6E-06	7.25E+01	1.3E-06
Tin	--	1.60E+00	9.60E-03	--	--	--	3.51E-07	1.18E-07	--	--	4.7E-07	2.34E+01	2.0E-08	3.50E+01	1.3E-08
Vanadium	--	1.11E+01	1.08E-02	9.32E-02	9.32E-02	--	2.44E-06	1.32E-07	1.43E-07	1.43E-07	2.9E-06	2.10E-01	1.4E-05	2.10E+00	1.4E-06
Bromide	4.01E-01	--	--	--	--	6.17E-06	--	--	--	--	6.2E-06	--	--	--	--
Chloride	1.72E+02	1.40E+02	--	--	--	2.64E-03	3.07E-05	--	--	--	2.7E-03	--	--	--	--
Nitrite as N	2.05E-02	--	--	--	--	3.16E-07	--	--	--	--	3.2E-07	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.52E+02	--	--	--	1.12E-03	5.54E-05	--	--	--	1.2E-03	--	--	--	--
Sulfate	--	8.30E+02	--	--	--	--	1.82E-04	--	--	--	1.8E-04	--	--	--	--
Hydrazine	8.00E-05	2.40E-03	0.00E+00	0.00E+00	0.00E+00	1.23E-09	5.27E-10	0.00E+00	0.00E+00	0.00E+00	1.8E-09	2.50E+00	7.0E-10	5.00E+00	3.5E-10
4,4'-Isopropylidenediphenol	9.60E-04	--	--	--	--	1.48E-08	--	--	--	--	1.5E-08	--	--	--	--
4-Nonylphenol (Tech.)	1.39E-02	--	--	--	--	2.14E-07	--	--	--	--	2.1E-07	5.00E+00	4.3E-08	5.00E+01	4.3E-09
Kempore (Azodicarbonamide)	1.21E+00	--	--	--	--	1.85E-05	--	--	--	--	1.9E-05	--	--	--	--

Table Lower South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Lower South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
C11-C22 Aromatics	--	9.40E+03	--	--	--	--	2.06E-03	--	--	--	2.1E-03	--	--	--	--
C19-C36 Aliphatics	--	6.40E+03	--	--	--	--	1.40E-03	--	--	--	1.4E-03	--	--	--	--
C9-C18 Aliphatics	--	7.70E+02	--	--	--	--	1.69E-04	--	--	--	1.7E-04	--	--	--	--
EPH, Total	--	1.70E+04	--	--	--	--	3.73E-03	--	--	--	3.7E-03	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table North Pond - RME - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	North Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	2.00E-03	1.82E-02	3.63E-05	1.04E+00	2.07E-03	1.08E-01	2.15E-04
Acetone	--	3.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon disulfide	--	7.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzo(a)anthracene	1.20E-04	--	3.63E-03	--	1.07E+00	--	3.36E-01	--
Benzo(a)pyrene	1.70E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Bis(2-Ethylhexyl)phthalate	--	3.70E+00	3.13E-04	1.16E-03	1.12E+00	4.13E+00	1.00E+00	3.70E+00
Carbazole	--	1.60E-01	5.48E-02	8.77E-03	1.03E+00	1.65E-01	5.59E-01	8.95E-02
Caprolactam	3.30E-04	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Pyrene	3.90E-04	--	1.17E-02	--	1.04E+00	--	5.14E-01	--
Aluminum	2.20E-01	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Arsenic	--	1.30E+01	2.79E-02	3.63E-01	1.27E-01	1.65E+00	1.27E-01	1.65E+00
Barium	4.10E-02	6.20E+01	3.12E-02	1.93E+00	1.82E-02	1.13E+00	1.82E-02	1.13E+00
Beryllium	--	5.30E-01	2.00E-03	1.06E-03	9.00E-03	4.77E-03	9.00E-03	4.77E-03
Cadmium	--	2.20E+00	5.60E-02	1.23E-01	4.59E-01	1.01E+00	4.59E-01	1.01E+00
Chromium	--	7.80E+02	8.20E-03	6.40E+00	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent	--	9.00E-01	8.20E-03	7.38E-03	1.00E-01	9.00E-02	1.00E-01	9.00E-02
Copper	--	6.80E+01	4.12E-02	2.80E+00	1.65E+00	1.12E+02	1.65E+00	1.12E+02
Iron	2.90E+00	2.30E+04	8.50E-04	1.96E+01	7.20E-03	1.66E+02	7.20E-03	1.66E+02
Lead	1.30E-03	1.10E+02	3.50E-02	3.85E+00	6.60E-02	7.26E+00	6.60E-02	7.26E+00
Manganese	4.90E-01	1.25E+03	1.58E-02	1.98E+01	4.38E-02	5.47E+01	4.38E-02	5.47E+01
Silver	2.20E-05	--	2.80E-03	--	4.09E-01	--	4.09E-01	--
Thallium	--	8.20E-01	8.00E-04	6.56E-04	--	--	1.00E+00	8.20E-01
Tin	--	1.10E+01	6.00E-03	6.60E-02	--	--	--	--
Vanadium	--	2.60E+01	9.70E-04	2.52E-02	8.40E-03	2.18E-01	8.40E-03	2.18E-01
Zinc	--	3.60E+02	5.05E-02	1.82E+01	2.60E-02	9.36E+00	2.60E-02	9.36E+00
Bromide	6.50E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	3.20E+02	3.20E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	--	2.30E+01	--	--	--	--	--	--
Sulfate	--	2.70E+02	--	--	--	--	--	--

Table North Pond - RME - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	North Pond

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table North Pond - RME - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	North Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	2.00E-03	3.63E-05	2.07E-03	2.15E-04	--	1.76E-08	1.78E-08	1.27E-07	1.32E-08	1.8E-07	4.10E-01	4.3E-07	4.10E+00	4.3E-08
Acetone	--	3.30E-01	0.00E+00	0.00E+00	0.00E+00	--	2.90E-06	0.00E+00	0.00E+00	0.00E+00	2.9E-06	2.00E+01	1.4E-07	1.00E+02	2.9E-08
Carbon disulfide	--	7.30E-03	0.00E+00	0.00E+00	0.00E+00	--	6.41E-08	0.00E+00	0.00E+00	0.00E+00	6.4E-08	--	--	--	--
Benzo(a)anthracene	1.20E-04	--	--	--	--	7.39E-08	--	--	--	--	7.4E-08	1.00E+00	7.4E-08	1.00E+01	7.4E-09
Benzo(a)pyrene	1.70E-04	--	--	--	--	1.05E-07	--	--	--	--	1.0E-07	1.00E+00	1.0E-07	1.00E+01	1.0E-08
Bis(2-Ethylhexyl)phthalate	--	3.70E+00	1.16E-03	4.13E+00	3.70E+00	--	3.25E-05	5.70E-07	2.54E-04	2.27E-04	5.1E-04	1.83E+01	2.8E-05	1.83E+02	2.8E-06
Carbazole	--	1.60E-01	8.77E-03	1.65E-01	8.95E-02	--	1.40E-06	4.31E-06	1.01E-05	5.50E-06	2.1E-05	5.00E+00	4.3E-06	5.00E+01	4.3E-07
Caprolactam	3.30E-04	--	--	--	--	2.03E-07	--	--	--	--	2.0E-07	8.00E+02	2.5E-10	8.00E+03	2.5E-11
Pyrene	3.90E-04	--	--	--	--	2.40E-07	--	--	--	--	2.4E-07	1.50E+01	1.6E-08	2.50E+01	9.6E-09
Aluminum	2.20E-01	--	--	--	--	1.35E-04	--	--	--	--	1.4E-04	1.93E+00	7.0E-05	1.93E+01	7.0E-06
Arsenic	--	1.30E+01	3.63E-01	1.65E+00	1.65E+00	--	1.14E-04	1.78E-04	1.01E-04	1.01E-04	5.0E-04	1.26E-01	3.9E-03	1.26E+00	3.9E-04
Barium	4.10E-02	6.20E+01	1.93E+00	1.13E+00	1.13E+00	2.52E-05	5.44E-04	9.51E-04	6.93E-05	6.93E-05	1.7E-03	5.18E+01	3.2E-05	1.19E+02	1.4E-05
Beryllium	--	5.30E-01	1.06E-03	4.77E-03	4.77E-03	--	4.65E-06	5.21E-07	2.93E-07	2.93E-07	5.8E-06	5.32E-01	1.1E-05	5.32E-01	1.1E-05
Cadmium	--	2.20E+00	1.23E-01	1.01E+00	1.01E+00	--	1.93E-05	6.05E-05	6.20E-05	6.20E-05	2.0E-04	1.86E+00	1.1E-04	7.10E+00	2.9E-05
Chromium	--	7.80E+02	6.40E+00	4.00E+00	4.00E+00	--	6.85E-03	3.14E-03	2.46E-04	2.46E-04	1.0E-02	2.40E+00	4.4E-03	4.06E+01	2.6E-04
Chromium, Hexavalent	--	9.00E-01	7.38E-03	9.00E-02	9.00E-02	--	7.90E-06	3.63E-06	5.53E-06	5.53E-06	2.3E-05	2.20E+01	1.0E-06	2.20E+01	1.0E-06
Copper	--	6.80E+01	2.80E+00	1.12E+02	1.12E+02	--	5.97E-04	1.38E-03	6.88E-03	6.88E-03	1.6E-02	1.52E+01	1.0E-03	1.52E+02	1.0E-04
Iron	2.90E+00	2.30E+04	1.96E+01	1.66E+02	1.66E+02	1.79E-03	2.02E-01	9.61E-03	1.02E-02	1.02E-02	2.3E-01	--	--	--	--
Lead	1.30E-03	1.10E+02	3.85E+00	7.26E+00	7.26E+00	8.00E-07	9.65E-04	1.89E-03	4.46E-04	4.46E-04	3.7E-03	4.70E+00	8.0E-04	1.54E+02	2.4E-05
Manganese	4.90E-01	1.25E+03	1.98E+01	5.47E+01	5.47E+01	3.02E-04	1.10E-02	9.73E-03	3.36E-03	3.36E-03	2.8E-02	8.80E+01	3.2E-04	2.84E+02	9.8E-05
Silver	2.20E-05	--	--	--	--	1.35E-08	--	--	--	--	1.4E-08	3.62E+01	3.7E-10	7.25E+01	1.9E-10
Thallium	--	8.20E-01	6.56E-04	--	8.20E-01	--	7.20E-06	3.22E-07	--	5.04E-05	5.8E-05	4.60E-02	1.3E-03	4.60E-01	1.3E-04
Tin	--	1.10E+01	6.60E-02	--	--	--	9.65E-05	3.24E-05	--	--	1.3E-04	2.34E+01	5.5E-06	3.50E+01	3.7E-06
Vanadium	--	2.60E+01	2.52E-02	2.18E-01	2.18E-01	--	2.28E-04	1.24E-05	1.34E-05	1.34E-05	2.7E-04	2.10E-01	1.3E-03	2.10E+00	1.3E-04
Zinc	--	3.60E+02	1.82E+01	9.36E+00	9.36E+00	--	3.16E-03	8.93E-03	5.75E-04	5.75E-04	1.3E-02	7.54E+01	1.8E-04	2.55E+02	5.2E-05
Bromide	6.50E-01	--	--	--	--	4.00E-04	--	--	--	--	4.0E-04	--	--	--	--
Chloride	3.20E+02	3.20E+02	--	--	--	1.97E-01	2.81E-03	--	--	--	2.0E-01	--	--	--	--
Nitrogen, as Ammonia	--	2.30E+01	--	--	--	--	2.02E-04	--	--	--	2.0E-04	--	--	--	--
Sulfate	--	2.70E+02	--	--	--	--	2.37E-03	--	--	--	2.4E-03	--	--	--	--

Table North Pond - RME - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	North Pond

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Off-PWD - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Off-PWD

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene		6.00E-02	1.82E-02	1.09E-03	1.04E+00	6.22E-02	1.08E-01	6.45E-03
2,4,4-Trimethyl-2-pentene		8.00E-03	3.78E-02	3.02E-04	1.03E+00	8.23E-03	3.23E-01	2.58E-03
Formaldehyde		6.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Carbon disulfide	2.50E-03		0.00E+00	--	0.00E+00	--	0.00E+00	--
3 & 4 Methylphenol	7.60E-04		0.00E+00	--	0.00E+00	--	0.00E+00	--
Benzo(a)anthracene	2.00E-03		3.63E-03	--	1.07E+00	--	3.36E-01	--
Benzo(a)pyrene	2.27E-03		2.22E-03	--	1.08E+00	--	2.23E-01	--
Benzo(b)fluoranthene	4.00E-03		3.53E-03	--	1.07E+00	--	4.16E-01	--
Benzo(ghi)perylene	2.59E-03		1.14E-03	--	1.09E+00	--	4.70E-02	--
Benzo(k)fluoranthene	2.60E-03		2.28E-03	--	1.08E+00	--	2.91E-01	--
Chrysene	2.74E-03		3.40E-03	--	1.07E+00	--	4.38E-01	--
Dibenz(a,h)anthracene	1.20E-03		9.72E-04	--	1.09E+00	--	3.77E-01	--
Indeno(1,2,3-cd)pyrene	4.00E-03		1.04E-03	--	1.09E+00	--	2.81E-01	--
Phenanthrene	1.30E-03		2.05E-02	--	1.03E+00	--	3.04E-01	--
Pyrene	6.33E-03		1.17E-02	--	1.04E+00	--	5.14E-01	--
4-Chlorophenyl phenyl ether		6.10E-02	1.49E-02	9.07E-04	1.04E+00	6.34E-02	7.94E-02	4.84E-03
Carbazole		5.10E-02	5.48E-02	2.80E-03	1.03E+00	5.25E-02	5.59E-01	2.85E-02
Diphenyl ether		8.60E-01	2.86E-02	2.46E-02	1.03E+00	8.86E-01	2.13E-01	1.83E-01
Diphenylmethanone		2.00E-01	1.12E-01	2.25E-02	1.05E+00	2.11E-01	1.58E+00	3.16E-01
Aluminum	1.27E+00		5.74E-04	--	8.60E-03	--	8.60E-03	--
Barium	4.10E-02	1.60E+01	3.12E-02	4.99E-01	1.82E-02	2.91E-01	1.82E-02	2.91E-01
Chromium	9.26E-02	2.40E+03	8.20E-03	1.97E+01	--	4.00E+00	--	4.00E+00
Iron	2.53E+01		8.50E-04	--	7.20E-03	--	7.20E-03	--
Lead	4.28E-03		3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	1.28E+00		1.58E-02	--	4.38E-02	--	4.38E-02	--
Zinc	9.49E-02		5.05E-02	--	2.60E-02	--	2.60E-02	--
Arsenic		1.40E+01	2.79E-02	3.91E-01	1.27E-01	1.78E+00	1.27E-01	1.78E+00
Beryllium		1.40E+00	2.00E-03	2.80E-03	9.00E-03	1.26E-02	9.00E-03	1.26E-02
Copper		3.90E+01	4.12E-02	1.61E+00	1.65E+00	6.42E+01	1.65E+00	6.42E+01
Silver		4.10E+01	2.80E-03	1.15E-01	4.09E-01	1.68E+01	4.09E-01	1.68E+01
Vanadium		1.50E+01	9.70E-04	1.46E-02	8.40E-03	1.26E-01	8.40E-03	1.26E-01
Bromide	1.99E-01		0.00E+00	--	0.00E+00	--	0.00E+00	--
Nitrite as N	2.00E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	5.97E+01	5.40E+02	--	--	--	--	--	--
Chloride		2.40E+02	--	--	--	--	--	--
Sulfate		1.50E+03	--	--	--	--	--	--
Hydrazine		1.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table Off-PWD - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Off-PWD

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Off-PWD - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Off-PWD

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	6.00E-02	1.09E-03	6.22E-02	6.45E-03	--	4.54E-08	4.62E-08	3.29E-07	3.42E-08	4.6E-07	4.10E-01	1.1E-06	4.10E+00	1.1E-07
2,4,4-Trimethyl-2-pentene	--	8.00E-03	3.02E-04	8.23E-03	2.58E-03	--	6.06E-09	1.28E-08	4.36E-08	1.37E-08	7.6E-08	4.10E-01	1.9E-07	4.10E+00	1.9E-08
Formaldehyde	--	6.10E-01	0.00E+00	0.00E+00	0.00E+00	--	4.62E-07	0.00E+00	0.00E+00	0.00E+00	4.6E-07	1.00E-01	4.6E-06	1.00E+00	4.6E-07
Carbon disulfide	2.50E-03	--	--	--	--	1.33E-07	--	--	--	--	1.3E-07	--	--	--	--
3 & 4 Methylphenol	7.60E-04	--	--	--	--	4.04E-08	--	--	--	--	4.0E-08	1.00E+02	4.0E-10	1.00E+03	4.0E-11
Benzo(a)anthracene	2.00E-03	--	--	--	--	1.06E-07	--	--	--	--	1.1E-07	1.00E+00	1.1E-07	1.00E+01	1.1E-08
Benzo(a)pyrene	2.27E-03	--	--	--	--	1.21E-07	--	--	--	--	1.2E-07	1.00E+00	1.2E-07	1.00E+01	1.2E-08
Benzo(b)fluoranthene	4.00E-03	--	--	--	--	2.12E-07	--	--	--	--	2.1E-07	1.00E+00	2.1E-07	1.00E+01	2.1E-08
Benzo(ghi)perylene	2.59E-03	--	--	--	--	1.38E-07	--	--	--	--	1.4E-07	1.00E+00	1.4E-07	1.00E+01	1.4E-08
Benzo(k)fluoranthene	2.60E-03	--	--	--	--	1.38E-07	--	--	--	--	1.4E-07	1.00E+00	1.4E-07	1.00E+01	1.4E-08
Chrysene	2.74E-03	--	--	--	--	1.46E-07	--	--	--	--	1.5E-07	1.00E+00	1.5E-07	1.00E+01	1.5E-08
Dibenz(a,h)anthracene	1.20E-03	--	--	--	--	6.37E-08	--	--	--	--	6.4E-08	1.00E+00	6.4E-08	1.00E+01	6.4E-09
Indeno(1,2,3-cd)pyrene	4.00E-03	--	--	--	--	2.12E-07	--	--	--	--	2.1E-07	1.00E+00	2.1E-07	1.00E+01	2.1E-08
Phenanthrene	1.30E-03	--	--	--	--	6.90E-08	--	--	--	--	6.9E-08	7.00E-01	9.9E-08	7.00E+00	9.9E-09
Pyrene	6.33E-03	--	--	--	--	3.36E-07	--	--	--	--	3.4E-07	1.50E+01	2.2E-08	2.50E+01	1.3E-08
4-Chlorophenyl phenyl ether	--	6.10E-02	9.07E-04	6.34E-02	4.84E-03	--	4.62E-08	3.85E-08	3.36E-07	2.57E-08	4.5E-07	1.00E+03	4.5E-10	1.00E+04	4.5E-11
Carbazole	--	5.10E-02	2.80E-03	5.25E-02	2.85E-02	--	3.86E-08	1.18E-07	2.78E-07	1.51E-07	5.9E-07	5.00E+00	1.2E-07	5.00E+01	1.2E-08
Diphenyl ether	--	8.60E-01	2.46E-02	8.86E-01	1.83E-01	--	6.51E-07	1.04E-06	4.70E-06	9.69E-07	7.4E-06	3.00E+00	2.5E-06	3.00E+01	2.5E-07
Diphenylmethanone	--	2.00E-01	2.25E-02	2.11E-01	3.16E-01	--	1.51E-07	9.53E-07	1.12E-06	1.67E-06	3.9E-06	3.80E+01	1.0E-07	3.80E+02	1.0E-08
Aluminum	1.27E+00	--	--	--	--	6.72E-05	--	--	--	--	6.7E-05	1.93E+00	3.5E-05	1.93E+01	3.5E-06
Barium	4.10E-02	1.60E+01	4.99E-01	2.91E-01	2.91E-01	2.18E-06	1.21E-05	2.12E-05	1.54E-06	1.54E-06	3.9E-05	5.18E+01	7.4E-07	1.19E+02	3.2E-07
Chromium	9.26E-02	2.40E+03	1.97E+01	4.00E+00	4.00E+00	4.92E-06	1.82E-03	8.34E-04	2.12E-05	2.12E-05	2.7E-03	2.40E+00	1.1E-03	4.06E+01	6.6E-05
Iron	2.53E+01	--	--	--	--	1.35E-03	--	--	--	--	1.3E-03	--	--	--	--
Lead	4.28E-03	--	--	--	--	2.27E-07	--	--	--	--	2.3E-07	4.70E+00	4.8E-08	1.54E+02	1.5E-09
Manganese	1.28E+00	--	--	--	--	6.78E-05	--	--	--	--	6.8E-05	8.80E+01	7.7E-07	2.84E+02	2.4E-07
Zinc	9.49E-02	--	--	--	--	5.04E-06	--	--	--	--	5.0E-06	7.54E+01	6.7E-08	2.55E+02	2.0E-08
Arsenic	--	1.40E+01	3.91E-01	1.78E+00	1.78E+00	--	1.06E-05	1.66E-05	9.42E-06	9.42E-06	4.6E-05	1.26E-01	3.6E-04	1.26E+00	3.6E-05
Beryllium	--	1.40E+00	2.80E-03	1.26E-02	1.26E-02	--	1.06E-06	1.19E-07	6.68E-08	6.68E-08	1.3E-06	5.32E-01	2.5E-06	5.32E-01	2.5E-06
Copper	--	3.90E+01	1.61E+00	6.42E+01	6.42E+01	--	2.95E-05	6.81E-05	3.40E-04	3.40E-04	7.8E-04	1.52E+01	5.1E-05	1.52E+02	5.1E-06
Silver	--	4.10E+01	1.15E-01	1.68E+01	1.68E+01	--	3.10E-05	4.87E-06	8.88E-05	8.88E-05	2.1E-04	3.62E+01	5.9E-06	7.25E+01	2.9E-06
Vanadium	--	1.50E+01	1.46E-02	1.26E-01	1.26E-01	--	1.14E-05	6.17E-07	6.68E-07	6.68E-07	1.3E-05	2.10E-01	6.3E-05	2.10E+00	6.3E-06
Bromide	1.99E-01	--	--	--	--	1.06E-05	--	--	--	--	1.1E-05	--	--	--	--
Nitrite as N	2.00E-02	--	--	--	--	1.06E-06	--	--	--	--	1.1E-06	--	--	--	--
Nitrogen, as Ammonia	5.97E+01	5.40E+02	--	--	--	3.17E-03	4.09E-04	--	--	--	3.6E-03	--	--	--	--
Chloride	--	2.40E+02	--	--	--	--	1.82E-04	--	--	--	1.8E-04	--	--	--	--
Sulfate	--	1.50E+03	--	--	--	--	1.14E-03	--	--	--	1.1E-03	--	--	--	--
Hydrazine	--	1.30E-03	0.00E+00	0.00E+00	0.00E+00	--	9.84E-10	0.00E+00	0.00E+00	0.00E+00	9.8E-10	2.50E+00	3.9E-10	5.00E+00	2.0E-10

Table Off-PWD - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Off-PWD

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table On-PWD/WDW - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	On PWD/WDW

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
Acetone	--	3.40E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	--	6.30E+00	3.13E-04	1.98E-03	1.12E+00	7.04E+00	1.00E+00	6.30E+00
Benzene	--	4.40E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Barium	--	3.76E+01	3.12E-02	1.17E+00	1.82E-02	6.84E-01	1.82E-02	6.84E-01
Beryllium	--	6.10E-01	2.00E-03	1.22E-03	9.00E-03	5.49E-03	9.00E-03	5.49E-03
Cadmium	--	9.43E-01	5.60E-02	5.28E-02	4.59E-01	4.33E-01	4.59E-01	4.33E-01
Chromium	--	2.96E+01	8.20E-03	2.43E-01	--	4.00E+00	--	4.00E+00
Lead	--	7.57E+01	3.50E-02	2.65E+00	6.60E-02	5.00E+00	6.60E-02	5.00E+00
Mercury	--	3.44E-01	2.57E-02	8.84E-03	2.84E+00	9.76E-01	2.84E+00	9.76E-01
Vanadium	--	2.70E+01	9.70E-04	2.62E-02	8.40E-03	2.27E-01	8.40E-03	2.27E-01

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table On-PWD/WDW - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	On PWD/WDW

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Acetone	--	3.40E-01	0.00E+00	0.00E+00	0.00E+00	--	1.49E-06	0.00E+00	0.00E+00	0.00E+00	1.5E-06	2.00E+01	7.5E-08	1.00E+02	1.5E-08
Bis(2-Ethylhexyl)phthalate	--	6.30E+00	1.98E-03	7.04E+00	6.30E+00	--	2.76E-05	4.85E-07	2.16E-04	1.93E-04	4.4E-04	1.83E+01	2.4E-05	1.83E+02	2.4E-06
Benzene	--	4.40E+00	0.00E+00	0.00E+00	0.00E+00	--	1.93E-05	0.00E+00	0.00E+00	0.00E+00	1.9E-05	2.64E+01	7.3E-07	2.64E+02	7.3E-08
Barium	--	3.76E+01	1.17E+00	6.84E-01	6.84E-01	--	1.65E-04	2.88E-04	2.10E-05	2.10E-05	5.0E-04	5.18E+01	9.6E-06	1.19E+02	4.2E-06
Beryllium	--	6.10E-01	1.22E-03	5.49E-03	5.49E-03	--	2.68E-06	3.00E-07	1.69E-07	1.69E-07	3.3E-06	5.32E-01	6.2E-06	5.32E-01	6.2E-06
Cadmium	--	9.43E-01	5.28E-02	4.33E-01	4.33E-01	--	4.14E-06	1.30E-05	1.33E-05	1.33E-05	4.4E-05	1.86E+00	2.3E-05	7.10E+00	6.2E-06
Chromium	--	2.96E+01	2.43E-01	4.00E+00	4.00E+00	--	1.30E-04	5.97E-05	1.23E-04	1.23E-04	4.4E-04	2.40E+00	1.8E-04	4.06E+01	1.1E-05
Lead	--	7.57E+01	2.65E+00	5.00E+00	5.00E+00	--	3.32E-04	6.51E-04	1.53E-04	1.53E-04	1.3E-03	4.70E+00	2.7E-04	1.54E+02	8.4E-06
Mercury	--	3.44E-01	8.84E-03	9.76E-01	9.76E-01	--	1.51E-06	2.17E-06	3.00E-05	3.00E-05	6.4E-05	1.01E+00	6.3E-05	1.01E+01	6.3E-06
Vanadium	--	2.70E+01	2.62E-02	2.27E-01	2.27E-01	--	1.18E-04	6.43E-06	6.97E-06	6.97E-06	1.4E-04	2.10E-01	6.6E-04	2.10E+00	6.6E-05

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Storm Water Detention Basin - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Storm Water Detention Basin

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene		7.80E-03	1.82E-02	1.42E-04	1.04E+00	8.09E-03	1.08E-01	8.39E-04
2,4,4-Trimethyl-2-pentene		3.90E-03	3.78E-02	1.47E-04	1.03E+00	4.01E-03	3.23E-01	1.26E-03
Acetone		1.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol		4.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetophenone		1.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Benzaldehyde		1.30E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate		3.10E+00	3.13E-04	9.72E-04	1.12E+00	3.46E+00	1.00E+00	3.10E+00
Phenol		1.90E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
N-Nitrosodiphenylamine	7.40E-06		1.20E-01	--	1.06E+00	--	1.74E+00	--
Benzo(a)pyrene		2.20E-01	2.22E-03	4.88E-04	1.08E+00	2.37E-01	2.23E-01	4.91E-02
Arsenic		1.20E+01	2.79E-02	3.35E-01	1.27E-01	1.52E+00	1.27E-01	1.52E+00
Barium	2.60E-02	5.10E+01	3.12E-02	1.59E+00	1.82E-02	9.28E-01	1.82E-02	9.28E-01
Beryllium		1.20E-01	2.00E-03	2.40E-04	9.00E-03	1.08E-03	9.00E-03	1.08E-03
Chromium		5.00E+01	8.20E-03	4.10E-01	--	4.00E+00	--	4.00E+00
Vanadium		2.20E+01	9.70E-04	2.13E-02	8.40E-03	1.85E-01	8.40E-03	1.85E-01
Chloride		1.30E+01	--	--	--	--	--	--
Nitrite as N	2.60E-02		--	--	--	--	--	--
Nitrogen, as Ammonia	7.50E+00	2.20E+01	--	--	--	--	--	--
Sulfate		1.90E+03	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Storm Water Detention Basin - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Storm Water Detention Basin

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	7.80E-03	1.42E-04	8.09E-03	8.39E-04	--	9.41E-09	9.57E-09	6.83E-08	7.08E-09	9.4E-08	4.10E-01	2.3E-07	4.10E+00	2.3E-08
2,4,4-Trimethyl-2-pentene	--	3.90E-03	1.47E-04	4.01E-03	1.26E-03	--	4.71E-09	9.95E-09	3.39E-08	1.06E-08	5.9E-08	4.10E-01	1.4E-07	4.10E+00	1.4E-08
Acetone	--	1.50E-01	0.00E+00	0.00E+00	0.00E+00	--	1.81E-07	0.00E+00	0.00E+00	0.00E+00	1.8E-07	2.00E+01	9.1E-09	1.00E+02	1.8E-09
3 & 4 Methylphenol	--	4.00E+00	0.00E+00	0.00E+00	0.00E+00	--	4.83E-06	0.00E+00	0.00E+00	0.00E+00	4.8E-06	1.00E+02	4.8E-08	1.00E+03	4.8E-09
Acetophenone	--	1.60E-01	0.00E+00	0.00E+00	0.00E+00	--	1.93E-07	0.00E+00	0.00E+00	0.00E+00	1.9E-07	8.00E+02	2.4E-10	8.00E+03	2.4E-11
Benzaldehyde	--	1.30E+00	0.00E+00	0.00E+00	0.00E+00	--	1.57E-06	0.00E+00	0.00E+00	0.00E+00	1.6E-06	4.29E+01	3.7E-08	8.57E+01	1.8E-08
Bis(2-Ethylhexyl)phthalate	--	3.10E+00	9.72E-04	3.46E+00	3.10E+00	--	3.74E-06	6.57E-08	2.93E-05	2.62E-05	5.9E-05	1.83E+01	3.2E-06	1.83E+02	3.2E-07
Phenol	--	1.90E+00	0.00E+00	0.00E+00	0.00E+00	--	2.29E-06	0.00E+00	0.00E+00	0.00E+00	2.3E-06	4.00E+01	5.7E-08	5.35E+01	4.3E-08
N-Nitrosodiphenylamine	7.40E-06	--	--	--	--	6.27E-10	--	--	--	--	6.3E-10	2.00E+01	3.1E-11	2.00E+02	3.1E-12
Benzo(a)pyrene	--	2.20E-01	4.88E-04	2.37E-01	4.91E-02	--	2.65E-07	3.30E-08	2.00E-06	4.14E-07	2.7E-06	1.00E+00	2.7E-06	1.00E+01	2.7E-07
Arsenic	--	1.20E+01	3.35E-01	1.52E+00	1.52E+00	--	1.45E-05	2.26E-05	1.29E-05	1.29E-05	6.3E-05	1.26E-01	5.0E-04	1.26E+00	5.0E-05
Barium	2.60E-02	5.10E+01	1.59E+00	9.28E-01	9.28E-01	2.20E-06	6.15E-05	1.08E-04	7.84E-06	7.84E-06	1.9E-04	5.18E+01	3.6E-06	1.19E+02	1.6E-06
Beryllium	--	1.20E-01	2.40E-04	1.08E-03	1.08E-03	--	1.45E-07	1.62E-08	9.12E-09	9.12E-09	1.8E-07	5.32E-01	3.4E-07	5.32E-01	3.4E-07
Chromium	--	5.00E+01	4.10E-01	4.00E+00	4.00E+00	--	6.03E-05	2.77E-05	3.38E-05	3.38E-05	1.6E-04	2.40E+00	6.5E-05	4.06E+01	3.8E-06
Vanadium	--	2.20E+01	2.13E-02	1.85E-01	1.85E-01	--	2.65E-05	1.44E-06	1.56E-06	1.56E-06	3.1E-05	2.10E-01	1.5E-04	2.10E+00	1.5E-05
Chloride	--	1.30E+01	--	--	--	--	1.57E-05	--	--	--	1.6E-05	--	--	--	--
Nitrite as N	2.60E-02	--	--	--	--	2.20E-06	--	--	--	--	2.2E-06	--	--	--	--
Nitrogen, as Ammonia	7.50E+00	2.20E+01	--	--	--	6.35E-04	2.65E-05	--	--	--	6.6E-04	--	--	--	--
Sulfate	--	1.90E+03	--	--	--	--	2.29E-03	--	--	--	2.3E-03	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table Upper South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
2,4,4-Trimethyl-1-pentene	--	3.70E-02	1.82E-02	6.72E-04	1.04E+00	3.84E-02	1.08E-01	3.98E-03
2,4,4-Trimethyl-2-pentene	--	3.00E-03	3.78E-02	1.13E-04	1.03E+00	3.09E-03	3.23E-01	9.68E-04
4-iso-Propyltoluene	--	2.60E-03	3.31E-02	8.59E-05	1.03E+00	2.68E-03	2.65E-01	6.88E-04
Acetaldehyde	--	8.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Formaldehyde	--	1.09E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3 & 4 Methylphenol	--	3.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Acetophenone	--	9.00E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Azobenzene	5.30E-04	--	--	--	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	2.22E-03	--	1.08E+00	--	2.23E-01	--
Benzaldehyde	--	6.20E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bis(2-Ethylhexyl)phthalate	3.43E-03	2.10E+02	3.13E-04	6.58E-02	1.12E+00	2.35E+02	1.00E+00	2.10E+02
Caprolactam	--	5.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Diphenyl ether	--	2.20E-01	2.86E-02	6.28E-03	1.03E+00	2.27E-01	2.13E-01	4.68E-02
Di-n-octylphthalate	--	1.50E-01	1.61E-04	2.42E-05	1.13E+00	1.70E-01	1.00E+00	1.50E-01
Diphenylmethanone	--	3.05E-02	1.12E-01	3.43E-03	1.05E+00	3.22E-02	1.58E+00	4.82E-02
N-Nitrosodi-n-propylamine	6.56E-06	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Phenol	--	9.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Aluminum	1.89E+01	--	5.74E-04	--	8.60E-03	--	8.60E-03	--
Arsenic	--	1.00E+01	2.79E-02	2.80E-01	1.27E-01	1.27E+00	1.27E-01	1.27E+00
Barium	2.67E-02	7.05E+01	3.12E-02	2.20E+00	1.82E-02	1.28E+00	1.82E-02	1.28E+00
Beryllium	8.41E-04	7.12E-01	2.00E-03	1.42E-03	9.00E-03	6.41E-03	9.00E-03	6.41E-03
Chromium	3.32E+00	9.26E+02	8.20E-03	7.59E+00	--	4.00E+00	--	4.00E+00
Chromium, Hexavalent	--	2.50E+01	8.20E-03	2.05E-01	1.00E-01	2.50E+00	1.00E-01	2.50E+00
Cobalt	3.65E-02	--	1.49E-03	--	2.44E-02	--	2.44E-02	--
Copper	1.65E-02	--	4.12E-02	--	1.65E+00	--	1.65E+00	--
Iron	7.93E+00	1.39E+04	8.50E-04	1.18E+01	7.20E-03	1.00E+02	7.20E-03	1.00E+02
Lead	9.41E-04	--	3.50E-02	--	6.60E-02	--	6.60E-02	--
Manganese	1.79E+00	--	1.58E-02	--	4.38E-02	--	4.38E-02	--
Silver	1.70E-05	1.90E+01	2.80E-03	5.31E-02	4.09E-01	7.75E+00	4.09E-01	7.75E+00
Vanadium	--	1.45E+01	9.70E-04	1.41E-02	8.40E-03	1.22E-01	8.40E-03	1.22E-01
Bromide	4.01E-01	--	0.00E+00	--	0.00E+00	--	0.00E+00	--
Chloride	1.72E+02	1.40E+02	--	--	--	--	--	--
Nitrite as N	2.05E-02	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.15E+02	--	--	--	--	--	--
Sulfate	--	7.00E+02	--	--	--	--	--	--
Hydrazine	8.00E-05	9.10E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4,4'-Isopropylidenediphenol	9.60E-04	--	9.33E-02	--	1.04E+00	--	1.21E+00	--
4-Nonylphenol (Tech.)	1.39E-02	--	2.93E-03	--	1.07E+00	--	6.48E-03	--
Dimethylformamide	--	3.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kempore (Azodicarbonamide)	1.21E+00	--	--	--	--	--	--	--

Table Upper South Ditch - CTE - Raccoon - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Amphib	C_{amphib} (mg/kg)
C11-C22 Aromatics	--	2.40E+01	--	--	--	--	--	--
C19-C36 Aliphatics	--	4.30E+01	--	--	--	--	--	--
C9-C18 Aliphatics	--	9.60E+01	--	--	--	--	--	--

Prepared by: SFR 3/10/2014
Checked by: TR 3/10/2014

Notes:
COPEC - Chemicals of Potential Ecological Concern
CTE - Central Tendency Exposure
C_{sw} - Chemical concentration in surface water
C_{sed} - Chemical concentration in moss
C_{plant} - Chemical concentration in plant
C_{inv} - Chemical concentration in invertebrates
C_{fish} - Chemical concentration in fish
BAF - Bioaccumulation Factor
mg/L - milligrams per liter
mg/kg - milligrams per kilogram

Table Upper South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
2,4,4-Trimethyl-1-pentene	--	3.70E-02	6.72E-04	3.84E-02	3.98E-03	--	1.01E-08	1.03E-08	7.36E-08	7.64E-09	1.0E-07	4.10E-01	2.5E-07	4.10E+00	2.5E-08
2,4,4-Trimethyl-2-pentene	--	3.00E-03	1.13E-04	3.09E-03	9.68E-04	--	8.23E-10	1.74E-09	5.92E-09	1.86E-09	1.0E-08	4.10E-01	2.5E-08	4.10E+00	2.5E-09
4-iso-Propyltoluene	--	2.60E-03	8.59E-05	2.68E-03	6.88E-04	--	7.13E-10	1.32E-09	5.14E-09	1.32E-09	8.5E-09	--	--	--	--
Acetaldehyde	--	8.30E-02	0.00E+00	0.00E+00	0.00E+00	--	2.28E-08	0.00E+00	0.00E+00	0.00E+00	2.3E-08	2.40E+01	9.5E-10	2.40E+02	9.5E-11
Formaldehyde	--	1.09E+00	0.00E+00	0.00E+00	0.00E+00	--	2.99E-07	0.00E+00	0.00E+00	0.00E+00	3.0E-07	1.00E-01	3.0E-06	1.00E+00	3.0E-07
3 & 4 Methylphenol	--	3.00E+00	0.00E+00	0.00E+00	0.00E+00	--	8.23E-07	0.00E+00	0.00E+00	0.00E+00	8.2E-07	1.00E+02	8.2E-09	1.00E+03	8.2E-10
Acetophenone	--	9.00E-02	0.00E+00	0.00E+00	0.00E+00	--	2.47E-08	0.00E+00	0.00E+00	0.00E+00	2.5E-08	8.00E+02	3.1E-11	8.00E+03	3.1E-12
Azobenzene	5.30E-04	--	--	--	--	1.02E-08	--	--	--	--	1.0E-08	--	--	--	--
Benzo(a)pyrene	1.50E-04	--	--	--	--	2.89E-09	--	--	--	--	2.9E-09	1.00E+00	2.9E-09	1.00E+01	2.9E-10
Benzaldehyde	--	6.20E-01	0.00E+00	0.00E+00	0.00E+00	--	1.70E-07	0.00E+00	0.00E+00	0.00E+00	1.7E-07	4.29E+01	4.0E-09	8.57E+01	2.0E-09
Bis(2-Ethylhexyl)phthalate	3.43E-03	2.10E+02	6.58E-02	2.35E+02	2.10E+02	6.60E-08	5.76E-05	1.01E-06	4.50E-04	4.03E-04	9.1E-04	1.83E+01	5.0E-05	1.83E+02	5.0E-06
Caprolactam	--	5.30E-02	0.00E+00	0.00E+00	0.00E+00	--	1.45E-08	0.00E+00	0.00E+00	0.00E+00	1.5E-08	8.00E+02	1.8E-11	8.00E+03	1.8E-12
Diphenyl ether	--	2.20E-01	6.28E-03	2.27E-01	4.68E-02	--	6.03E-08	9.65E-08	4.35E-07	8.98E-08	6.8E-07	3.00E+00	2.3E-07	3.00E+01	2.3E-08
Di-n-octylphthalate	--	1.50E-01	2.42E-05	1.70E-01	1.50E-01	--	4.11E-08	3.71E-10	3.26E-07	2.88E-07	6.6E-07	1.00E+02	6.6E-09	4.00E+02	1.6E-09
Diphenylmethanone	--	3.05E-02	3.43E-03	3.22E-02	4.82E-02	--	8.36E-09	5.27E-08	6.17E-08	9.25E-08	2.2E-07	3.80E+01	5.7E-09	3.80E+02	5.7E-10
N-Nitrosodi-n-propylamine	6.56E-06	--	--	--	--	1.26E-10	--	--	--	--	1.3E-10	7.29E-02	1.7E-09	7.29E-01	1.7E-10
Phenol	--	9.60E-01	0.00E+00	0.00E+00	0.00E+00	--	2.63E-07	0.00E+00	0.00E+00	0.00E+00	2.6E-07	4.00E+01	6.6E-09	5.35E+01	4.9E-09
Aluminum	1.89E+01	--	--	--	--	3.63E-04	--	--	--	--	3.6E-04	1.93E+00	1.9E-04	1.93E+01	1.9E-05
Arsenic	--	1.00E+01	2.80E-01	1.27E+00	1.27E+00	--	2.75E-06	4.29E-06	2.44E-06	2.44E-06	1.2E-05	1.26E-01	9.5E-05	1.26E+00	9.5E-06
Barium	2.67E-02	7.05E+01	2.20E+00	1.28E+00	1.28E+00	5.14E-07	1.93E-05	3.38E-05	2.46E-06	2.46E-06	5.9E-05	5.18E+01	1.1E-06	1.19E+02	4.9E-07
Beryllium	8.41E-04	7.12E-01	1.42E-03	6.41E-03	6.41E-03	1.62E-08	1.95E-07	2.19E-08	1.23E-08	1.23E-08	2.6E-07	5.32E-01	4.8E-07	5.32E-01	4.8E-07
Chromium	3.32E+00	9.26E+02	7.59E+00	4.00E+00	4.00E+00	6.40E-05	2.54E-04	1.17E-04	7.68E-06	7.68E-06	4.5E-04	2.40E+00	1.9E-04	4.06E+01	1.1E-05
Chromium, Hexavalent	--	2.50E+01	2.05E-01	2.50E+00	2.50E+00	--	6.86E-06	3.15E-06	4.80E-06	4.80E-06	2.0E-05	2.20E+01	8.9E-07	2.20E+01	8.9E-07
Cobalt	3.65E-02	--	--	--	--	7.02E-07	--	--	--	--	7.0E-07	--	--	--	--
Copper	1.65E-02	--	--	--	--	3.18E-07	--	--	--	--	3.2E-07	1.52E+01	2.1E-08	1.52E+02	2.1E-09
Iron	7.93E+00	1.39E+04	1.18E+01	1.00E+02	1.00E+02	1.53E-04	3.81E-03	1.81E-04	1.92E-04	1.92E-04	4.5E-03	--	--	--	--
Lead	9.41E-04	--	--	--	--	1.81E-08	--	--	--	--	1.8E-08	4.70E+00	3.9E-09	1.54E+02	1.2E-10
Manganese	1.79E+00	--	--	--	--	3.43E-05	--	--	--	--	3.4E-05	8.80E+01	3.9E-07	2.84E+02	1.2E-07
Silver	1.70E-05	1.90E+01	5.31E-02	7.75E+00	7.75E+00	3.27E-10	5.20E-06	8.15E-07	1.49E-05	1.49E-05	3.6E-05	3.62E+01	9.9E-07	7.25E+01	4.9E-07
Vanadium	--	1.45E+01	1.41E-02	1.22E-01	1.22E-01	--	3.99E-06	2.17E-07	2.34E-07	2.34E-07	4.7E-06	2.10E-01	2.2E-05	2.10E+00	2.2E-06

Table Upper South Ditch - CTE - Raccoon - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Raccoon
Scenario:	Current - RME
Expousre Point:	Upper South Ditch

COPEC	C_{sw} (mg/L)	C_{sed} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{amphib} (mg/kg)	Dose sw (mg/Kg BW day) [a]	Dose Sediment (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose Amphibian (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c] (mg/kg BW day)	NOAEL Based Total HQ	TRV LOAEL [c] (mg/kg BW day)	LOAEL Based Total HQ
Bromide	4.01E-01	--	--	--	--	7.72E-06	--	--	--	--	7.7E-06	--	--	--	--
Chloride	1.72E+02	1.40E+02	--	--	--	3.30E-03	3.84E-05	--	--	--	3.3E-03	--	--	--	--
Nitrite as N	2.05E-02	--	--	--	--	3.94E-07	--	--	--	--	3.9E-07	--	--	--	--
Nitrogen, as Ammonia	7.28E+01	2.15E+02	--	--	--	1.40E-03	5.91E-05	--	--	--	1.5E-03	--	--	--	--
Sulfate	--	7.00E+02	--	--	--	--	1.92E-04	--	--	--	1.9E-04	--	--	--	--
Hydrazine	8.00E-05	9.10E-04	0.00E+00	0.00E+00	0.00E+00	1.54E-09	2.50E-10	0.00E+00	0.00E+00	0.00E+00	1.8E-09	2.50E+00	7.2E-10	5.00E+00	3.6E-10
4,4'-Isopropylidenediphenol	9.60E-04	--	--	--	--	1.85E-08	--	--	--	--	1.8E-08	--	--	--	--
4-Nonylphenol (Tech.)	1.39E-02	--	--	--	--	2.67E-07	--	--	--	--	2.7E-07	5.00E+00	5.3E-08	5.00E+01	5.3E-09
Dimethylformamide	--	3.00E-01	0.00E+00	0.00E+00	0.00E+00	--	8.23E-08	0.00E+00	0.00E+00	0.00E+00	8.2E-08	2.00E+01	4.1E-09	2.00E+02	4.1E-10
Kempore (Azodicarbonamide)	1.21E+00	--	--	--	--	2.32E-05	--	--	--	--	2.3E-05	--	--	--	--
C11-C22 Aromatics	--	2.40E+01	--	--	--	--	6.58E-06	--	--	--	6.6E-06	--	--	--	--
C19-C36 Aliphatics	--	4.30E+01	--	--	--	--	1.18E-05	--	--	--	1.2E-05	--	--	--	--
C9-C18 Aliphatics	--	9.60E+01	--	--	--	--	2.63E-05	--	--	--	2.6E-05	--	--	--	--

Prepared by: SFR 2/5/2014
Checked by: TR 3/10/2014

Notes:
[a] Doses for surface water (sw), sediment, plants, invertebrates, and amphibians (amphib) were calculated using the equations in Attachment 5-2.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-12.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

CTE - Central Tendency Exposure
BW - body weight
C_{amphib} - Chemical concentration in amphibian tissue
C_{fish} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in fish tissue
C_{inv} - Chemical concentration in invertebrates
C_{sed} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.2E-02	2.2E-03	4.9E-05	5.4E+00	1.2E-01	2.0E+00	4.5E-02	2.0E+00	4.5E-02
Bis(2-Ethylhexyl)phthalate	3.1E-02	3.1E-04	9.7E-06	5.6E+00	1.7E-01	6.0E+01	1.9E+00	6.0E+01	1.9E+00
Fluoranthene	4.3E-02	8.1E-03	3.5E-04	5.3E+00	2.3E-01	2.2E-01	9.4E-03	2.2E-01	9.4E-03
Phenanthrene	3.5E-02	2.0E-02	7.2E-04	5.2E+00	1.8E-01	4.3E-02	1.5E-03	4.3E-02	1.5E-03
Pyrene	4.9E-02	1.2E-02	5.7E-04	5.2E+00	2.6E-01	1.1E-01	5.6E-03	1.1E-01	5.6E-03
Aluminum	1.3E+04	5.7E-04	7.5E+00	8.6E-03	1.1E+02	5.3E-03	6.8E+01	5.3E-03	6.8E+01
Arsenic	1.0E+01	2.8E-02	2.8E-01	3.6E-02	3.6E-01	1.0E-01	1.0E+00	1.0E-01	1.0E+00
Cadmium	2.6E-01	4.2E-01	1.1E-01	3.1E-01	8.1E-02	3.8E-01	9.8E-02	3.8E-01	9.8E-02
Chromium	1.0E+01	8.2E-03	8.2E-02	--	4.0E+00	5.3E-02	5.3E-01	5.3E-02	5.3E-01
Cobalt	2.9E+00	1.5E-03	4.3E-03	2.4E-02	7.1E-02	4.1E-03	1.2E-02	4.1E-03	1.2E-02
Copper	5.8E+00	6.0E-02	3.5E-01	4.7E-02	2.7E-01	1.5E-01	8.6E-01	1.5E-01	8.6E-01
Iron	1.2E+04	8.5E-04	1.0E+01	7.2E-03	8.6E+01	1.9E-02	2.3E+02	1.9E-02	2.3E+02
Lead	2.6E+01	1.7E-02	4.4E-01	5.1E-02	1.3E+00	7.1E-02	1.8E+00	7.1E-02	1.8E+00
Manganese	6.9E+01	1.6E-02	1.1E+00	1.2E-02	8.4E-01	4.1E-03	2.8E-01	4.1E-03	2.8E-01
Mercury	1.1E-01	2.6E-02	2.8E-03	6.5E-02	7.1E-03	1.1E-02	1.2E-03	1.1E-02	1.2E-03
Nickel	7.3E+00	5.7E-02	4.2E-01	9.5E-01	6.9E+00	8.2E-02	6.0E-01	8.2E-02	6.0E-01
Selenium	6.0E-01	2.4E-01	1.4E-01	2.7E-01	1.6E-01	2.8E-01	1.7E-01	2.8E-01	1.7E-01
Tin	3.5E+00	6.0E-03	2.1E-02	--	--	4.0E+00	1.4E+01	4.0E+00	1.4E+01
Vanadium	2.1E+01	9.7E-04	2.0E-02	8.4E-03	1.8E-01	2.5E-03	5.2E-02	2.5E-03	5.2E-02
Zinc	1.8E+01	3.6E-02	6.4E-01	4.1E-02	7.3E-01	1.6E-02	2.9E-01	1.6E-02	2.9E-01
Nitrogen, as Ammonia	2.0E+02	--	--	--	--	--	--	--	--
Sulfate	6.3E+01	--	--	--	--	--	--	--	--

Table - Background - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	Background

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/5/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.0E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.0E-08	4.3E+01	1.2E-09	8.6E+01	5.8E-10
Benzo(a)pyrene	2.2E-02	4.9E-05	1.2E-01	4.5E-02	4.5E-02	1.1E-08	4.6E-10	3.8E-07	4.3E-07	1.8E-06	2.7E-06	1.0E+00	2.7E-06	1.0E+01	2.7E-07
Bis(2-Ethylhexyl)phthalate	3.1E-02	9.7E-06	1.7E-01	1.9E+00	1.9E+00	1.6E-08	9.2E-11	5.5E-07	1.8E-05	7.7E-05	9.5E-05	1.8E+01	5.2E-06	1.8E+02	5.2E-07
Fluoranthene	4.3E-02	3.5E-04	2.3E-01	9.4E-03	9.4E-03	2.2E-08	3.3E-09	7.2E-07	8.9E-08	3.9E-07	1.2E-06	2.5E+01	4.9E-08	5.0E+01	2.4E-08
Phenanthrene	3.5E-02	7.2E-04	1.8E-01	1.5E-03	1.5E-03	1.8E-08	6.8E-09	5.7E-07	1.4E-08	6.3E-08	6.8E-07	7.0E-01	9.7E-07	7.0E+00	9.7E-08
Pyrene	4.9E-02	5.7E-04	2.6E-01	5.6E-03	5.6E-03	2.5E-08	5.5E-09	8.1E-07	5.3E-08	2.3E-07	1.1E-06	1.5E+01	7.5E-08	2.5E+01	4.5E-08
Aluminum	1.3E+04	7.5E+00	1.1E+02	6.8E+01	6.8E+01	6.6E-03	7.1E-05	3.5E-04	6.5E-04	2.8E-03	1.1E-02	1.9E+00	5.4E-03	1.9E+01	5.4E-04
Arsenic	1.0E+01	2.8E-01	3.6E-01	1.0E+00	1.0E+00	5.1E-06	2.7E-06	1.2E-06	1.0E-05	4.3E-05	6.2E-05	1.3E-01	4.9E-04	1.3E+00	4.9E-05
Cadmium	2.6E-01	1.1E-01	8.1E-02	9.8E-02	9.8E-02	1.3E-07	1.0E-06	2.6E-07	9.3E-07	4.0E-06	6.4E-06	1.9E+00	3.4E-06	7.1E+00	9.0E-07
Chromium	1.0E+01	8.2E-02	4.0E+00	5.3E-01	5.3E-01	5.1E-06	7.8E-07	1.3E-05	5.0E-06	2.2E-05	4.5E-05	2.4E+00	1.9E-05	4.1E+01	1.1E-06
Cobalt	2.9E+00	4.3E-03	7.1E-02	1.2E-02	1.2E-02	1.5E-06	4.1E-08	2.2E-07	1.1E-07	4.9E-07	2.3E-06	--	--	--	--
Copper	5.8E+00	3.5E-01	2.7E-01	8.6E-01	8.6E-01	3.0E-06	3.3E-06	8.7E-07	8.2E-06	3.5E-05	5.1E-05	1.5E+01	3.3E-06	1.5E+02	3.3E-07
Iron	1.2E+04	1.0E+01	8.6E+01	2.3E+02	2.3E+02	6.1E-03	9.7E-05	2.7E-04	2.2E-03	9.5E-03	1.8E-02	--	--	--	--
Lead	2.6E+01	4.4E-01	1.3E+00	1.8E+00	1.8E+00	1.3E-05	4.2E-06	4.2E-06	1.7E-05	7.6E-05	1.1E-04	4.7E+00	2.4E-05	1.5E+02	7.4E-07
Manganese	6.9E+01	1.1E+00	8.4E-01	2.8E-01	2.8E-01	3.5E-05	1.0E-05	2.7E-06	2.7E-06	1.2E-05	6.3E-05	8.8E+01	7.1E-07	2.8E+02	2.2E-07
Mercury	1.1E-01	2.8E-03	7.1E-03	1.2E-03	1.2E-03	5.6E-08	2.7E-08	2.3E-08	1.1E-08	4.9E-08	1.7E-07	1.0E+00	1.6E-07	1.0E+01	1.6E-08
Nickel	7.3E+00	4.2E-01	6.9E+00	6.0E-01	6.0E-01	3.7E-06	4.0E-06	2.2E-05	5.7E-06	2.5E-05	6.0E-05	4.0E+01	1.5E-06	8.0E+01	7.5E-07
Selenium	6.0E-01	1.4E-01	1.6E-01	1.7E-01	1.7E-01	3.1E-07	1.4E-06	5.1E-07	1.6E-06	7.0E-06	1.1E-05	4.4E-01	2.5E-05	7.9E-01	1.4E-05
Tin	3.5E+00	2.1E-02	--	1.4E+01	1.4E+01	1.8E-06	2.0E-07	--	1.3E-04	5.8E-04	7.1E-04	2.3E+01	3.0E-05	3.5E+01	2.0E-05
Vanadium	2.1E+01	2.0E-02	1.8E-01	5.2E-02	5.2E-02	1.1E-05	1.9E-07	5.6E-07	4.9E-07	2.1E-06	1.4E-05	2.1E-01	6.7E-05	2.1E+00	6.7E-06
Zinc	1.8E+01	6.4E-01	7.3E-01	2.9E-01	2.9E-01	9.2E-06	6.1E-06	2.3E-06	2.8E-06	1.2E-05	3.2E-05	7.5E+01	4.3E-07	2.6E+02	1.3E-07
Nitrogen, as Ammonia	2.0E+02	--	--	--	--	1.0E-04	--	--	--	--	1.0E-04	--	--	--	--
Sulfate	6.3E+01	--	--	--	--	3.2E-05	--	--	--	--	3.2E-05	--	--	--	--

Table - Background - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	Background

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/5/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-2 - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.2E-03	3.3E-04	5.4E+00	8.1E-01	2.0E+00	3.0E-01	2.0E+00	3.0E-01
Bis(2-Ethylhexyl)phthalate	1.1E+02	3.1E-04	3.5E-02	5.6E+00	6.2E+02	6.0E+01	6.6E+03	6.0E+01	6.6E+03
Diphenyl ether	1.2E-01	2.9E-02	3.4E-03	5.2E+00	6.2E-01	2.4E-02	2.9E-03	2.4E-02	2.9E-03
Fluoranthene	4.0E-01	8.1E-03	3.2E-03	5.3E+00	2.1E+00	2.2E-01	8.6E-02	2.2E-01	8.6E-02
Phenanthrene	2.7E-01	2.0E-02	5.6E-03	5.2E+00	1.4E+00	4.3E-02	1.2E-02	4.3E-02	1.2E-02
Pyrene	3.1E-01	1.2E-02	3.6E-03	5.2E+00	1.6E+00	1.1E-01	3.5E-02	1.1E-01	3.5E-02
4,4'-DDD	3.9E-02	2.4E-03	9.5E-05	5.4E+00	2.1E-01	1.7E+00	6.7E-02	1.7E+00	6.7E-02
4,4'-DDE	4.9E-02	9.6E-04	4.7E-05	5.5E+00	2.7E-01	8.7E+00	4.2E-01	8.7E+00	4.2E-01
4,4'-DDT	6.8E-01	1.4E-03	9.9E-04	5.4E+00	3.7E+00	4.2E+00	2.9E+00	4.2E+00	2.9E+00
Aluminum	1.3E+04	5.7E-04	7.5E+00	8.6E-03	1.1E+02	5.3E-03	6.9E+01	5.3E-03	6.9E+01
Arsenic	8.8E+00	3.2E-02	2.8E-01	4.1E-02	3.6E-01	1.1E-01	9.7E-01	1.1E-01	9.7E-01
Cadmium	6.9E-01	2.5E-01	1.7E-01	2.3E-01	1.6E-01	2.4E-01	1.6E-01	2.4E-01	1.6E-01
Chromium	1.2E+02	8.2E-03	9.5E-01	--	4.0E+00	2.0E-03	2.3E-01	2.0E-03	2.3E-01
Copper	2.2E+01	2.4E-02	5.4E-01	1.6E-02	3.5E-01	1.2E-01	2.6E+00	1.2E-01	2.6E+00
Iron	2.2E+04	8.5E-04	1.9E+01	7.2E-03	1.6E+02	1.7E-02	3.7E+02	1.7E-02	3.7E+02
Lead	5.3E+01	1.0E-02	5.4E-01	3.9E-02	2.0E+00	5.7E-02	3.0E+00	5.7E-02	3.0E+00
Mercury	1.6E-01	--	--	1.7E-01	2.7E-02	1.1E-02	1.8E-03	1.1E-02	1.8E-03
Selenium	2.4E+00	1.5E-01	3.5E-01	1.3E-01	3.0E-01	1.1E-01	2.7E-01	1.1E-01	2.7E-01
Vanadium	2.9E+01	9.7E-04	2.8E-02	8.4E-03	2.5E-01	2.5E-03	7.2E-02	2.5E-03	7.2E-02
Zinc	7.0E+01	1.6E-02	1.1E+00	2.0E-02	1.4E+00	5.1E-03	3.6E-01	5.1E-03	3.6E-01
Chloride	2.4E+02	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	--	--	--	--	--	--

Table - EA-2 - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-2

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-2 - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.8E-07	2.4E+01	1.2E-08	2.4E+02	1.2E-09
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-06	4.3E+01	2.6E-08	8.6E+01	1.3E-08
Benzo(a)pyrene	1.5E-01	3.3E-04	8.1E-01	3.0E-01	3.0E-01	2.1E-07	8.8E-09	7.1E-06	8.0E-06	3.5E-05	5.0E-05	1.0E+00	5.0E-05	1.0E+01	5.0E-06
Bis(2-Ethylhexyl)phthalate	1.1E+02	3.5E-02	6.2E+02	6.6E+03	6.6E+03	1.6E-04	9.1E-07	5.4E-03	1.7E-01	7.5E-01	9.3E-01	1.8E+01	5.1E-02	1.8E+02	5.1E-03
Diphenyl ether	1.2E-01	3.4E-03	6.2E-01	2.9E-03	2.9E-03	1.7E-07	9.0E-08	5.4E-06	7.7E-08	3.3E-07	6.1E-06	3.0E+00	2.0E-06	3.0E+01	2.0E-07
Fluoranthene	4.0E-01	3.2E-03	2.1E+00	8.6E-02	8.6E-02	5.6E-07	8.4E-08	1.8E-05	2.3E-06	9.8E-06	3.1E-05	2.5E+01	1.2E-06	5.0E+01	6.2E-07
Phenanthrene	2.7E-01	5.6E-03	1.4E+00	1.2E-02	1.2E-02	3.9E-07	1.5E-07	1.2E-05	3.1E-07	1.4E-06	1.5E-05	7.0E-01	2.1E-05	7.0E+00	2.1E-06
Pyrene	3.1E-01	3.6E-03	1.6E+00	3.5E-02	3.5E-02	4.3E-07	9.5E-08	1.4E-05	9.2E-07	4.0E-06	2.0E-05	1.5E+01	1.3E-06	2.5E+01	7.8E-07
4,4'-DDD	3.9E-02	9.5E-05	2.1E-01	6.7E-02	6.7E-02	5.5E-08	2.5E-09	1.8E-06	1.8E-06	7.7E-06	1.1E-05	8.0E-01	1.4E-05	4.0E+00	2.8E-06
4,4'-DDE	4.9E-02	4.7E-05	2.7E-01	4.2E-01	4.2E-01	6.9E-08	1.2E-09	2.3E-06	1.1E-05	4.8E-05	6.2E-05	8.0E-01	7.8E-05	4.0E+00	1.6E-05
4,4'-DDT	6.8E-01	9.9E-04	3.7E+00	2.9E+00	2.9E+00	9.6E-07	2.6E-08	3.2E-05	7.6E-05	3.3E-04	4.4E-04	8.0E-01	5.5E-04	4.0E+00	1.1E-04
Aluminum	1.3E+04	7.5E+00	1.1E+02	6.9E+01	6.9E+01	1.8E-02	2.0E-04	9.9E-04	1.8E-03	7.8E-03	2.9E-02	1.9E+00	1.5E-02	1.9E+01	1.5E-03
Arsenic	8.8E+00	2.8E-01	3.6E-01	9.7E-01	9.7E-01	1.2E-05	7.4E-06	3.2E-06	2.5E-05	1.1E-04	1.6E-04	1.3E-01	1.3E-03	1.3E+00	1.3E-04
Cadmium	6.9E-01	1.7E-01	1.6E-01	1.6E-01	1.6E-01	9.7E-07	4.5E-06	1.4E-06	4.3E-06	1.9E-05	3.0E-05	1.9E+00	1.6E-05	7.1E+00	4.2E-06
Chromium	1.2E+02	9.5E-01	4.0E+00	2.3E-01	2.3E-01	1.6E-04	2.5E-05	3.5E-05	6.0E-06	2.6E-05	2.6E-04	2.4E+00	1.1E-04	4.1E+01	6.3E-06
Copper	2.2E+01	5.4E-01	3.5E-01	2.6E+00	2.6E+00	3.1E-05	1.4E-05	3.1E-06	6.9E-05	3.0E-04	4.2E-04	1.5E+01	2.8E-05	1.5E+02	2.8E-06
Iron	2.2E+04	1.9E+01	1.6E+02	3.7E+02	3.7E+02	3.2E-02	5.0E-04	1.4E-03	9.8E-03	4.2E-02	8.6E-02	--	--	--	--
Lead	5.3E+01	5.4E-01	2.0E+00	3.0E+00	3.0E+00	7.4E-05	1.4E-05	1.8E-05	7.9E-05	3.4E-04	5.3E-04	4.7E+00	1.1E-04	1.5E+02	3.4E-06
Mercury	1.6E-01	--	2.7E-02	1.8E-03	1.8E-03	2.3E-07	--	2.4E-07	4.7E-08	2.0E-07	7.2E-07	1.0E+00	7.1E-07	1.0E+01	7.1E-08
Selenium	2.4E+00	3.5E-01	3.0E-01	2.7E-01	2.7E-01	3.4E-06	9.3E-06	2.6E-06	7.2E-06	3.1E-05	5.4E-05	4.4E-01	1.2E-04	7.9E-01	6.8E-05
Vanadium	2.9E+01	2.8E-02	2.5E-01	7.2E-02	7.2E-02	4.1E-05	7.5E-07	2.2E-06	1.9E-06	8.2E-06	5.4E-05	2.1E-01	2.6E-04	2.1E+00	2.6E-05
Zinc	7.0E+01	1.1E+00	1.4E+00	3.6E-01	3.6E-01	9.8E-05	3.0E-05	1.2E-05	9.4E-06	4.1E-05	1.9E-04	7.5E+01	2.5E-06	2.6E+02	7.4E-07
Chloride	2.4E+02	--	--	--	--	3.4E-04	--	--	--	--	3.4E-04	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	--	--	8.8E-04	--	--	--	--	8.8E-04	--	--	--	--

Table - EA-2 - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-2

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-4 - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.5E-01	2.2E-03	7.8E-04	5.4E+00	1.9E+00	2.0E+00	7.2E-01	2.0E+00	7.2E-01
Bis(2-Ethylhexyl)phthalate	3.0E+01	3.1E-04	9.4E-03	5.6E+00	1.7E+02	6.0E+01	1.8E+03	6.0E+01	1.8E+03
Fluoranthene	4.1E-01	8.1E-03	3.3E-03	5.3E+00	2.1E+00	2.2E-01	8.9E-02	2.2E-01	8.9E-02
Naphthalene	6.5E-02	9.6E-02	6.2E-03	5.2E+00	3.4E-01	3.0E-03	1.9E-04	3.0E-03	1.9E-04
Phenanthrene	1.4E-01	2.0E-02	2.9E-03	5.2E+00	7.3E-01	4.3E-02	6.1E-03	4.3E-02	6.1E-03
Pyrene	2.2E-01	1.2E-02	2.6E-03	5.2E+00	1.2E+00	1.1E-01	2.6E-02	1.1E-01	2.6E-02
4,4'-DDD	1.6E-02	2.4E-03	3.9E-05	5.4E+00	8.6E-02	1.7E+00	2.8E-02	1.7E+00	2.8E-02
4,4'-DDE	3.8E-03	9.6E-04	3.6E-06	5.5E+00	2.1E-02	8.7E+00	3.3E-02	8.7E+00	3.3E-02
4,4'-DDT	6.8E-02	1.4E-03	9.9E-05	5.4E+00	3.7E-01	4.2E+00	2.9E-01	4.2E+00	2.9E-01
Alpha-BHC	2.0E-03	5.1E-02	1.0E-04	5.1E+00	1.0E-02	9.1E-03	1.9E-05	9.1E-03	1.9E-05
Gamma-BHC/Lindane	1.2E-02	5.9E-02	7.2E-04	5.1E+00	6.3E-02	7.0E-03	8.7E-05	7.0E-03	8.7E-05
Aluminum	8.8E+03	5.7E-04	5.1E+00	8.6E-03	7.6E+01	5.3E-03	4.6E+01	5.3E-03	4.6E+01
Arsenic	9.1E+00	3.0E-02	2.8E-01	3.9E-02	3.6E-01	1.1E-01	9.8E-01	1.1E-01	9.8E-01
Cadmium	4.8E-01	2.9E-01	1.4E-01	2.5E-01	1.2E-01	2.8E-01	1.3E-01	2.8E-01	1.3E-01
Chromium	5.8E+02	8.2E-03	4.8E+00	--	4.0E+00	4.9E-03	2.9E+00	4.9E-03	2.9E+00
Chromium, Hexavalent	3.8E+01	8.2E-03	3.1E-01	--	4.0E+00	4.9E-03	1.9E-01	4.9E-03	1.9E-01
Cobalt	1.6E+01	1.5E-03	2.4E-02	2.4E-02	4.0E-01	4.1E-03	6.6E-02	4.1E-03	6.6E-02
Copper	2.7E+01	2.5E-02	6.8E-01	1.7E-02	4.5E-01	1.2E-01	3.2E+00	1.2E-01	3.2E+00
Iron	1.9E+04	8.5E-04	1.6E+01	7.2E-03	1.4E+02	1.7E-02	3.3E+02	1.7E-02	3.3E+02
Lead	4.3E+01	1.1E-02	4.9E-01	4.1E-02	1.8E+00	6.0E-02	2.6E+00	6.0E-02	2.6E+00
Manganese	1.7E+02	1.6E-02	2.7E+00	6.1E-03	1.0E+00	4.1E-03	7.0E-01	4.1E-03	7.0E-01
Mercury	1.4E-01	--	--	5.1E-01	7.3E-02	1.1E-02	1.6E-03	1.1E-02	1.6E-03
Nickel	2.5E+01	3.6E-03	9.1E-02	9.5E-01	2.4E+01	5.0E-02	1.3E+00	5.0E-02	1.3E+00
Vanadium	2.0E+01	9.7E-04	2.0E-02	8.4E-03	1.7E-01	2.5E-03	5.0E-02	2.5E-03	5.0E-02
Zinc	4.8E+01	1.9E-02	9.3E-01	2.3E-02	1.1E+00	6.6E-03	3.2E-01	6.6E-03	3.2E-01
Chloride	1.2E+02	--	--	--	--	--	--	--	--
Cyanide, Total	7.9E+00	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	--	--	--	--	--	--
Sulfate	1.0E+04	--	--	--	--	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	--	--	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	--	--	--	--	--	--

Table - EA-4 - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-4 - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.5E-07	2.4E+01	1.9E-08	2.4E+02	1.9E-09
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.0E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.0E-06	4.3E+01	1.4E-07	8.6E+01	7.1E-08
Benzo(a)pyrene	3.5E-01	7.8E-04	1.9E+00	7.2E-01	7.2E-01	3.5E-06	1.4E-07	1.2E-04	1.3E-04	5.7E-04	8.3E-04	1.0E+00	8.3E-04	1.0E+01	8.3E-05
Bis(2-Ethylhexyl)phthalate	3.0E+01	9.4E-03	1.7E+02	1.8E+03	1.8E+03	2.9E-04	1.7E-06	1.0E-02	3.3E-01	1.4E+00	1.8E+00	1.8E+01	9.7E-02	1.8E+02	9.7E-03
Fluoranthene	4.1E-01	3.3E-03	2.1E+00	8.9E-02	8.9E-02	4.0E-06	6.1E-07	1.3E-04	1.6E-05	7.1E-05	2.2E-04	2.5E+01	9.0E-06	5.0E+01	4.5E-06
Naphthalene	6.5E-02	6.2E-03	3.4E-01	1.9E-04	1.9E-04	6.4E-07	1.1E-06	2.1E-05	3.6E-08	1.6E-07	2.3E-05	3.0E+01	7.6E-07	3.0E+02	7.6E-08
Phenanthrene	1.4E-01	2.9E-03	7.3E-01	6.1E-03	6.1E-03	1.4E-06	5.3E-07	4.5E-05	1.1E-06	4.9E-06	5.3E-05	7.0E-01	7.6E-05	7.0E+00	7.6E-06
Pyrene	2.2E-01	2.6E-03	1.2E+00	2.6E-02	2.6E-02	2.2E-06	4.8E-07	7.2E-05	4.7E-06	2.0E-05	1.0E-04	1.5E+01	6.7E-06	2.5E+01	4.0E-06
4,4'-DDD	1.6E-02	3.9E-05	8.6E-02	2.8E-02	2.8E-02	1.6E-07	7.2E-09	5.3E-06	5.1E-06	2.2E-05	3.3E-05	8.0E-01	4.1E-05	4.0E+00	8.2E-06
4,4'-DDE	3.8E-03	3.6E-06	2.1E-02	3.3E-02	3.3E-02	3.7E-08	6.6E-10	1.3E-06	6.0E-06	2.6E-05	3.3E-05	8.0E-01	4.2E-05	4.0E+00	8.3E-06
4,4'-DDT	6.8E-02	9.9E-05	3.7E-01	2.9E-01	2.9E-01	6.7E-07	1.8E-08	2.3E-05	5.4E-05	2.3E-04	3.1E-04	8.0E-01	3.9E-04	4.0E+00	7.7E-05
Alpha-BHC	2.0E-03	1.0E-04	1.0E-02	1.9E-05	1.9E-05	2.0E-08	1.9E-08	6.5E-07	3.4E-09	1.5E-08	7.0E-07	5.0E+00	1.4E-07	2.0E+01	3.5E-08
Gamma-BHC/Lindane	1.2E-02	7.2E-04	6.3E-02	8.7E-05	8.7E-05	1.2E-07	1.3E-07	3.9E-06	1.6E-08	6.9E-08	4.2E-06	5.0E+00	8.5E-07	1.0E+01	4.2E-07
Aluminum	8.8E+03	5.1E+00	7.6E+01	4.6E+01	4.6E+01	8.7E-02	9.3E-04	4.7E-03	8.6E-03	3.7E-02	1.4E-01	1.9E+00	7.2E-02	1.9E+01	7.2E-03
Arsenic	9.1E+00	2.8E-01	3.6E-01	9.8E-01	9.8E-01	9.0E-05	5.1E-05	2.2E-05	1.8E-04	7.8E-04	1.1E-03	1.3E-01	8.9E-03	1.3E+00	8.9E-04
Cadmium	4.8E-01	1.4E-01	1.2E-01	1.3E-01	1.3E-01	4.7E-06	2.6E-05	7.4E-06	2.4E-05	1.1E-04	1.7E-04	1.9E+00	9.0E-05	7.1E+00	2.4E-05
Chromium	5.8E+02	4.8E+00	4.0E+00	2.9E+00	2.9E+00	5.8E-03	8.8E-04	2.5E-04	5.3E-04	2.3E-03	9.7E-03	2.4E+00	4.1E-03	4.1E+01	2.4E-04
Chromium, Hexavalent	3.8E+01	3.1E-01	4.0E+00	1.9E-01	1.9E-01	3.7E-04	5.7E-05	2.5E-04	3.4E-05	1.5E-04	8.6E-04	2.2E+01	3.9E-05	2.2E+01	3.9E-05
Cobalt	1.6E+01	2.4E-02	4.0E-01	6.6E-02	6.6E-02	1.6E-04	4.5E-06	2.4E-05	1.2E-05	5.3E-05	2.5E-04	--	--	--	--
Copper	2.7E+01	6.8E-01	4.5E-01	3.2E+00	3.2E+00	2.7E-04	1.3E-04	2.8E-05	6.0E-04	2.6E-03	3.6E-03	1.5E+01	2.4E-04	1.5E+02	2.4E-05
Iron	1.9E+04	1.6E+01	1.4E+02	3.3E+02	3.3E+02	1.9E-01	3.0E-03	8.5E-03	6.1E-02	2.6E-01	5.2E-01	--	--	--	--
Lead	4.3E+01	4.9E-01	1.8E+00	2.6E+00	2.6E+00	4.2E-04	9.1E-05	1.1E-04	4.7E-04	2.0E-03	3.1E-03	4.7E+00	6.7E-04	1.5E+02	2.0E-05
Manganese	1.7E+02	2.7E+00	1.0E+00	7.0E-01	7.0E-01	1.7E-03	5.0E-04	6.4E-05	1.3E-04	5.6E-04	2.9E-03	8.8E+01	3.3E-05	2.8E+02	1.0E-05
Mercury	1.4E-01	--	7.3E-02	1.6E-03	1.6E-03	1.4E-06	--	4.5E-06	2.9E-07	1.2E-06	7.4E-06	1.0E+00	7.4E-06	1.0E+01	7.4E-07
Nickel	2.5E+01	9.1E-02	2.4E+01	1.3E+00	1.3E+00	2.5E-04	1.7E-05	1.5E-03	2.3E-04	1.0E-03	3.0E-03	4.0E+01	7.4E-05	8.0E+01	3.7E-05
Vanadium	2.0E+01	2.0E-02	1.7E-01	5.0E-02	5.0E-02	2.0E-04	3.7E-06	1.1E-05	9.3E-06	4.0E-05	2.7E-04	2.1E-01	1.3E-03	2.1E+00	1.3E-04
Zinc	4.8E+01	9.3E-01	1.1E+00	3.2E-01	3.2E-01	4.8E-04	1.7E-04	6.9E-05	5.9E-05	2.6E-04	1.0E-03	7.5E+01	1.4E-05	2.6E+02	4.1E-06
Chloride	1.2E+02	--	--	--	--	1.2E-03	--	--	--	--	1.2E-03	--	--	--	--
Cyanide, Total	7.9E+00	--	--	--	--	7.8E-05	--	--	--	--	7.8E-05	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	--	--	3.5E-03	--	--	--	--	3.5E-03	--	--	--	--
Sulfate	1.0E+04	--	--	--	--	9.9E-02	--	--	--	--	9.9E-02	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	--	--	5.6E-04	--	--	--	--	5.6E-04	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	--	--	8.0E-04	--	--	--	--	8.0E-04	--	--	--	--

Table - EA-4 - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-5 - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrate	C_{inv} (mg/kg)	BAF Bird	C_{bird} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.2E-03	3.4E-04	5.4E+00	8.2E-01	2.0E+00	3.1E-01	2.0E+00	3.1E-01
Bis(2-Ethylhexyl)phthalate	1.0E+02	3.1E-04	3.2E-02	5.6E+00	5.8E+02	6.0E+01	6.2E+03	6.0E+01	6.2E+03
Diphenyl ether	1.9E+00	2.9E-02	5.4E-02	5.2E+00	9.8E+00	2.4E-02	4.6E-02	2.4E-02	4.6E-02
Fluoranthene	2.5E+00	8.1E-03	2.0E-02	5.3E+00	1.3E+01	2.2E-01	5.5E-01	2.2E-01	5.5E-01
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	1.5E-01	2.0E-02	3.0E-03	5.2E+00	7.5E-01	4.3E-02	6.3E-03	4.3E-02	6.3E-03
Pyrene	5.6E-01	1.2E-02	6.6E-03	5.2E+00	2.9E+00	1.1E-01	6.4E-02	1.1E-01	6.4E-02
4,4'-DDT	4.5E-02	1.4E-03	6.5E-05	5.4E+00	2.4E-01	4.2E+00	1.9E-01	4.2E+00	1.9E-01
Hexachlorobenzene	2.9E-02	4.5E-03	1.3E-04	5.3E+00	1.5E-01	6.0E-01	1.7E-02	6.0E-01	1.7E-02
Aluminum	2.0E+04	5.7E-04	1.1E+01	8.6E-03	1.7E+02	5.3E-03	1.1E+02	5.3E-03	1.1E+02
Antimony	3.4E-01	2.0E-03	6.9E-04	2.0E-01	6.8E-02	5.0E-02	1.7E-02	5.0E-02	1.7E-02
Arsenic	2.7E+01	1.2E-02	3.2E-01	1.8E-02	4.7E-01	8.0E-02	2.1E+00	8.0E-02	2.1E+00
Cadmium	4.2E-01	3.2E-01	1.4E-01	2.7E-01	1.1E-01	3.0E-01	1.3E-01	3.0E-01	1.3E-01
Chromium	2.6E+04	8.2E-03	2.2E+02	--	4.0E+00	5.5E-04	1.4E+01	5.5E-04	1.4E+01
Chromium, Hexavalent	5.6E+02	8.2E-03	4.6E+00	--	4.0E+00	5.5E-04	3.1E-01	5.5E-04	3.1E-01
Copper	9.7E+01	8.6E-03	8.4E-01	4.7E-03	4.6E-01	9.2E-02	8.9E+00	9.2E-02	8.9E+00
Iron	2.0E+04	8.5E-04	1.7E+01	7.2E-03	1.5E+02	1.7E-02	3.4E+02	1.7E-02	3.4E+02
Lead	9.3E+01	6.5E-03	6.0E-01	3.0E-02	2.8E+00	4.7E-02	4.4E+00	4.7E-02	4.4E+00
Mercury	1.9E+00	--	--	1.4E-01	2.8E-01	1.1E-02	2.1E-02	1.1E-02	2.1E-02
Silver	1.1E+03	2.8E-03	3.1E+00	4.1E-01	4.5E+02	8.0E-04	8.8E-01	8.0E-04	8.8E-01
Thallium	7.4E+00	8.0E-04	5.9E-03	2.2E-02	1.7E-01	2.2E-02	1.7E-01	2.2E-02	1.7E-01
Tin	2.6E+04	6.0E-03	1.6E+02	--	--	4.0E+00	1.0E+05	4.0E+00	1.0E+05
Vanadium	6.9E+01	9.7E-04	6.7E-02	8.4E-03	5.8E-01	2.5E-03	1.7E-01	2.5E-03	1.7E-01
Zinc	3.1E+01	2.6E-02	8.0E-01	3.0E-02	9.4E-01	1.0E-02	3.1E-01	1.0E-02	3.1E-01
Cyanide, Total	6.5E+00	--	--	--	--	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	--	--	--	--	--	--
Sulfate	2.3E+02	--	--	--	--	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	--	--	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	--	--	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	--	--	--	--	--	--

Table - EA-5 - RME - Red Fox - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-5 - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{bird} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose bird (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.6E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.6E-08	2.4E+01	2.8E-09	2.4E+02	2.8E-10
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-08	2.0E+00	3.1E-08	2.0E+01	3.1E-09
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-07	4.3E+01	2.5E-09	8.6E+01	1.3E-09
Benzo(a)pyrene	1.5E-01	3.4E-04	8.2E-01	3.1E-01	3.1E-01	7.7E-08	3.2E-09	2.6E-06	2.9E-06	1.3E-05	1.8E-05	1.0E+00	1.8E-05	1.0E+01	1.8E-06
Bis(2-Ethylhexyl)phthalate	1.0E+02	3.2E-02	5.8E+02	6.2E+03	6.2E+03	5.3E-05	3.1E-07	1.8E-03	5.9E-02	2.6E-01	3.2E-01	1.8E+01	1.7E-02	1.8E+02	1.7E-03
Diphenyl ether	1.9E+00	5.4E-02	9.8E+00	4.6E-02	4.6E-02	9.7E-07	5.2E-07	3.1E-05	4.4E-07	1.9E-06	3.5E-05	3.0E+00	1.2E-05	3.0E+01	1.2E-06
Fluoranthene	2.5E+00	2.0E-02	1.3E+01	5.5E-01	5.5E-01	1.3E-06	1.9E-07	4.2E-05	5.2E-06	2.3E-05	7.1E-05	2.5E+01	2.9E-06	5.0E+01	1.4E-06
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-07	7.3E-02	1.8E-06	7.3E-01	1.8E-07
Phenanthrene	1.5E-01	3.0E-03	7.5E-01	6.3E-03	6.3E-03	7.4E-08	2.8E-08	2.4E-06	6.0E-08	2.6E-07	2.8E-06	7.0E-01	4.0E-06	7.0E+00	4.0E-07
Pyrene	5.6E-01	6.6E-03	2.9E+00	6.4E-02	6.4E-02	2.9E-07	6.3E-08	9.3E-06	6.1E-07	2.6E-06	1.3E-05	1.5E+01	8.6E-07	2.5E+01	5.2E-07
4,4'-DDT	4.5E-02	6.5E-05	2.4E-01	1.9E-01	1.9E-01	2.3E-08	6.2E-10	7.7E-07	1.8E-06	7.9E-06	1.0E-05	8.0E-01	1.3E-05	4.0E+00	2.6E-06
Hexachlorobenzene	2.9E-02	1.3E-04	1.5E-01	1.7E-02	1.7E-02	1.5E-08	1.2E-09	4.9E-07	1.7E-07	7.2E-07	1.4E-06	3.2E-01	4.3E-06	1.6E+00	8.7E-07
Aluminum	2.0E+04	1.1E+01	1.7E+02	1.1E+02	1.1E+02	1.0E-02	1.1E-04	5.5E-04	1.0E-03	4.3E-03	1.6E-02	1.9E+00	8.4E-03	1.9E+01	8.4E-04
Antimony	3.4E-01	6.9E-04	6.8E-02	1.7E-02	1.7E-02	1.7E-07	6.6E-09	2.2E-07	1.6E-07	7.0E-07	1.3E-06	1.3E+01	9.5E-08	1.4E+01	8.8E-08
Arsenic	2.7E+01	3.2E-01	4.7E-01	2.1E+00	2.1E+00	1.4E-05	3.1E-06	1.5E-06	2.0E-05	8.8E-05	1.3E-04	1.3E-01	1.0E-03	1.3E+00	1.0E-04
Cadmium	4.2E-01	1.4E-01	1.1E-01	1.3E-01	1.3E-01	2.1E-07	1.3E-06	3.6E-07	1.2E-06	5.2E-06	8.3E-06	1.9E+00	4.5E-06	7.1E+00	1.2E-06
Chromium	2.6E+04	2.2E+02	4.0E+00	1.4E+01	1.4E+01	1.3E-02	2.1E-03	1.3E-05	1.4E-04	5.9E-04	1.6E-02	2.4E+00	6.8E-03	4.1E+01	4.0E-04
Chromium, Hexavalent	5.6E+02	4.6E+00	4.0E+00	3.1E-01	3.1E-01	2.8E-04	4.4E-05	1.3E-05	2.9E-06	1.3E-05	3.6E-04	2.2E+01	1.6E-05	2.2E+01	1.6E-05
Copper	9.7E+01	8.4E-01	4.6E-01	8.9E+00	8.9E+00	5.0E-05	8.0E-06	1.4E-06	8.5E-05	3.7E-04	5.1E-04	1.5E+01	3.4E-05	1.5E+02	3.4E-06
Iron	2.0E+04	1.7E+01	1.5E+02	3.4E+02	3.4E+02	1.0E-02	1.6E-04	4.6E-04	3.2E-03	1.4E-02	2.8E-02	--	--	--	--
Lead	9.3E+01	6.0E-01	2.8E+00	4.4E+00	4.4E+00	4.7E-05	5.7E-06	8.8E-06	4.2E-05	1.8E-04	2.8E-04	4.7E+00	6.0E-05	1.5E+02	1.8E-06
Mercury	1.9E+00	--	2.8E-01	2.1E-02	2.1E-02	9.8E-07	--	8.9E-07	2.0E-07	8.6E-07	2.9E-06	1.0E+00	2.9E-06	1.0E+01	2.9E-07
Silver	1.1E+03	3.1E+00	4.5E+02	8.8E-01	8.8E-01	5.6E-04	2.9E-05	1.4E-03	8.4E-06	3.6E-05	2.1E-03	3.6E+01	5.7E-05	7.2E+01	2.8E-05
Thallium	7.4E+00	5.9E-03	1.7E-01	1.7E-01	1.7E-01	3.8E-06	5.6E-08	5.3E-07	1.6E-06	6.9E-06	1.3E-05	4.6E-02	2.8E-04	4.6E-01	2.8E-05
Tin	2.6E+04	1.6E+02	--	1.0E+05	1.0E+05	1.3E-02	1.5E-03	--	9.9E-01	4.3E+00	5.3E+00	2.3E+01	2.3E-01	3.5E+01	1.5E-01
Vanadium	6.9E+01	6.7E-02	5.8E-01	1.7E-01	1.7E-01	3.5E-05	6.4E-07	1.8E-06	1.6E-06	7.0E-06	4.6E-05	2.1E-01	2.2E-04	2.1E+00	2.2E-05
Zinc	3.1E+01	8.0E-01	9.4E-01	3.1E-01	3.1E-01	1.6E-05	7.6E-06	3.0E-06	3.0E-06	1.3E-05	4.2E-05	7.5E+01	5.6E-07	2.6E+02	1.7E-07
Cyanide, Total	6.5E+00	--	--	--	--	3.3E-06	--	--	--	--	3.3E-06	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	--	--	3.8E-04	--	--	--	--	3.8E-04	--	--	--	--
Sulfate	2.3E+02	--	--	--	--	1.2E-04	--	--	--	--	1.2E-04	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	--	--	3.8E-03	--	--	--	--	3.8E-03	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	--	--	2.5E-03	--	--	--	--	2.5E-03	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	--	--	4.0E-04	--	--	--	--	4.0E-04	--	--	--	--

Table - EA-5 - RME - Red Fox - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Red Fox
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared By: EYM 7/15/2013
Checked By: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), birds, and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{bird} - Chemical concentration in bird tissue
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
CTE - Central Tendency Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - Background - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	2.2E-02	2.2E-03	4.9E-05	5.4E+00	1.2E-01	2.0E+00	4.5E-02
Bis(2-Ethylhexyl)phthalate	3.1E-02	3.1E-04	9.7E-06	5.6E+00	1.7E-01	6.0E+01	1.9E+00
Fluoranthene	4.3E-02	8.1E-03	3.5E-04	5.3E+00	2.3E-01	2.2E-01	9.4E-03
Phenanthrene	3.5E-02	2.0E-02	7.2E-04	5.2E+00	1.8E-01	4.3E-02	1.5E-03
Pyrene	4.9E-02	1.2E-02	5.7E-04	5.2E+00	2.6E-01	1.1E-01	5.6E-03
Aluminum	1.3E+04	5.7E-04	7.5E+00	8.6E-03	1.1E+02	5.3E-03	6.8E+01
Arsenic	1.0E+01	2.8E-02	2.8E-01	3.6E-02	3.6E-01	1.0E-01	1.0E+00
Cadmium	2.6E-01	4.2E-01	1.1E-01	3.1E-01	8.1E-02	3.8E-01	9.8E-02
Chromium	1.0E+01	8.2E-03	8.2E-02	--	4.0E+00	5.3E-02	5.3E-01
Cobalt	2.9E+00	1.5E-03	4.3E-03	2.4E-02	7.1E-02	4.1E-03	1.2E-02
Copper	5.8E+00	6.0E-02	3.5E-01	4.7E-02	2.7E-01	1.5E-01	8.6E-01
Iron	1.2E+04	8.5E-04	1.0E+01	7.2E-03	8.6E+01	1.9E-02	2.3E+02
Lead	2.6E+01	1.7E-02	4.4E-01	5.1E-02	1.3E+00	7.1E-02	1.8E+00
Manganese	6.9E+01	1.6E-02	1.1E+00	1.2E-02	8.4E-01	4.1E-03	2.8E-01
Mercury	1.1E-01	2.6E-02	2.8E-03	6.5E-02	7.1E-03	1.1E-02	1.2E-03
Nickel	7.3E+00	5.7E-02	4.2E-01	9.5E-01	6.9E+00	8.2E-02	6.0E-01
Selenium	6.0E-01	2.4E-01	1.4E-01	2.7E-01	1.6E-01	2.8E-01	1.7E-01
Tin	3.5E+00	6.0E-03	2.1E-02	--	--	4.0E+00	1.4E+01
Vanadium	2.1E+01	9.7E-04	2.0E-02	8.4E-03	1.8E-01	2.5E-03	5.2E-02
Zinc	1.8E+01	3.6E-02	6.4E-01	4.1E-02	7.3E-01	1.6E-02	2.9E-01
Nitrogen, as Ammonia	2.0E+02	--	--	--	--	--	--
Sulfate	6.3E+01	--	--	--	--	--	--

Table - Background - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	Background

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - Background - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	Background

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Benzaldehyde	9.8E-02	0.0E+00	0.0E+00	0.0E+00	1.4E-04	0.0E+00	0.0E+00	0.0E+00	1.4E-04	4.3E+01	3.4E-06	8.6E+01	1.7E-06
Benzo(a)pyrene	2.2E-02	4.9E-05	1.2E-01	4.5E-02	3.2E-05	2.7E-06	3.5E-02	1.5E-03	3.7E-02	1.0E+00	3.7E-02	1.0E+01	3.7E-03
Bis(2-Ethylhexyl)phthalate	3.1E-02	9.7E-06	1.7E-01	1.9E+00	4.6E-05	5.4E-07	5.1E-02	6.3E-02	1.1E-01	1.8E+01	6.3E-03	1.8E+02	6.3E-04
Fluoranthene	4.3E-02	3.5E-04	2.3E-01	9.4E-03	6.3E-05	1.9E-05	6.7E-02	3.2E-04	6.7E-02	2.5E+01	2.7E-03	5.0E+01	1.3E-03
Phenanthrene	3.5E-02	7.2E-04	1.8E-01	1.5E-03	5.2E-05	4.0E-05	5.4E-02	5.2E-05	5.4E-02	7.0E-01	7.7E-02	7.0E+00	7.7E-03
Pyrene	4.9E-02	5.7E-04	2.6E-01	5.6E-03	7.2E-05	3.2E-05	7.6E-02	1.9E-04	7.6E-02	1.5E+01	5.1E-03	2.5E+01	3.0E-03
Aluminum	1.3E+04	7.5E+00	1.1E+02	6.8E+01	1.9E+01	4.1E-01	3.3E+01	2.3E+00	5.5E+01	1.9E+00	2.9E+01	1.9E+01	2.9E+00
Arsenic	1.0E+01	2.8E-01	3.6E-01	1.0E+00	1.5E-02	1.5E-02	1.1E-01	3.6E-02	1.7E-01	1.3E-01	1.4E+00	1.3E+00	1.4E-01
Cadmium	2.6E-01	1.1E-01	8.1E-02	9.8E-02	3.8E-04	6.0E-03	2.4E-02	3.3E-03	3.4E-02	1.9E+00	1.8E-02	7.1E+00	4.8E-03
Chromium	1.0E+01	8.2E-02	4.0E+00	5.3E-01	1.5E-02	4.5E-03	1.2E+00	1.8E-02	1.2E+00	2.4E+00	5.1E-01	4.1E+01	3.0E-02
Cobalt	2.9E+00	4.3E-03	7.1E-02	1.2E-02	4.3E-03	2.4E-04	2.1E-02	4.1E-04	2.6E-02	--	--	--	--
Copper	5.8E+00	3.5E-01	2.7E-01	8.6E-01	8.5E-03	1.9E-02	8.1E-02	2.9E-02	1.4E-01	1.5E+01	9.1E-03	1.5E+02	9.1E-04
Iron	1.2E+04	1.0E+01	8.6E+01	2.3E+02	1.8E+01	5.6E-01	2.6E+01	7.8E+00	5.2E+01	--	--	--	--
Lead	2.6E+01	4.4E-01	1.3E+00	1.8E+00	3.8E-02	2.4E-02	3.9E-01	6.2E-02	5.2E-01	4.7E+00	1.1E-01	1.5E+02	3.4E-03
Manganese	6.9E+01	1.1E+00	8.4E-01	2.8E-01	1.0E-01	6.0E-02	2.5E-01	9.6E-03	4.2E-01	8.8E+01	4.8E-03	2.8E+02	1.5E-03
Mercury	1.1E-01	2.8E-03	7.1E-03	1.2E-03	1.6E-04	1.6E-04	2.1E-03	4.1E-05	2.5E-03	1.0E+00	2.4E-03	1.0E+01	2.4E-04
Nickel	7.3E+00	4.2E-01	6.9E+00	6.0E-01	1.1E-02	2.3E-02	2.0E+00	2.0E-02	2.1E+00	4.0E+01	5.3E-02	8.0E+01	2.6E-02
Selenium	6.0E-01	1.4E-01	1.6E-01	1.7E-01	8.8E-04	8.0E-03	4.8E-02	5.8E-03	6.2E-02	4.4E-01	1.4E-01	7.9E-01	7.9E-02
Tin	3.5E+00	2.1E-02	--	1.4E+01	5.2E-03	1.2E-03	--	4.8E-01	4.8E-01	2.3E+01	2.1E-02	3.5E+01	1.4E-02
Vanadium	2.1E+01	2.0E-02	1.8E-01	5.2E-02	3.1E-02	1.1E-03	5.2E-02	1.8E-03	8.6E-02	2.1E-01	4.1E-01	2.1E+00	4.1E-02
Zinc	1.8E+01	6.4E-01	7.3E-01	2.9E-01	2.7E-02	3.5E-02	2.2E-01	9.9E-03	2.9E-01	7.5E+01	3.8E-03	2.6E+02	1.1E-03
Nitrogen, as Ammonia	2.0E+02	--	--	--	2.9E-01	--	--	--	2.9E-01	--	--	--	--
Sulfate	6.3E+01	--	--	--	9.3E-02	--	--	--	9.3E-02	--	--	--	--

Table - Background - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	Background

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-2 - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.2E-03	3.3E-04	5.4E+00	8.1E-01	2.0E+00	3.0E-01
Bis(2-Ethylhexyl)phthalate	1.1E+02	3.1E-04	3.5E-02	5.6E+00	6.2E+02	6.0E+01	6.6E+03
Diphenyl ether	1.2E-01	2.9E-02	3.4E-03	5.2E+00	6.2E-01	2.4E-02	2.9E-03
Fluoranthene	4.0E-01	8.1E-03	3.2E-03	5.3E+00	2.1E+00	2.2E-01	8.6E-02
Phenanthrene	2.7E-01	2.0E-02	5.6E-03	5.2E+00	1.4E+00	4.3E-02	1.2E-02
Pyrene	3.1E-01	1.2E-02	3.6E-03	5.2E+00	1.6E+00	1.1E-01	3.5E-02
4,4'-DDD	3.9E-02	2.4E-03	9.5E-05	5.4E+00	2.1E-01	1.7E+00	6.7E-02
4,4'-DDE	4.9E-02	9.6E-04	4.7E-05	5.5E+00	2.7E-01	8.7E+00	4.2E-01
4,4'-DDT	6.8E-01	1.4E-03	9.9E-04	5.4E+00	3.7E+00	4.2E+00	2.9E+00
Aluminum	1.3E+04	5.7E-04	7.5E+00	8.6E-03	1.1E+02	5.3E-03	6.9E+01
Arsenic	8.8E+00	3.2E-02	2.8E-01	4.1E-02	3.6E-01	1.1E-01	9.7E-01
Cadmium	6.9E-01	2.5E-01	1.7E-01	2.3E-01	1.6E-01	2.4E-01	1.6E-01
Chromium	1.2E+02	8.2E-03	9.5E-01	--	4.0E+00	2.0E-03	2.3E-01
Copper	2.2E+01	2.4E-02	5.4E-01	1.6E-02	3.5E-01	1.2E-01	2.6E+00
Iron	2.2E+04	8.5E-04	1.9E+01	7.2E-03	1.6E+02	1.7E-02	3.7E+02
Lead	5.3E+01	1.0E-02	5.4E-01	3.9E-02	2.0E+00	5.7E-02	3.0E+00
Mercury	1.6E-01	--	--	1.7E-01	2.7E-02	1.1E-02	1.8E-03
Selenium	2.4E+00	1.5E-01	3.5E-01	1.3E-01	3.0E-01	1.1E-01	2.7E-01
Vanadium	2.9E+01	9.7E-04	2.8E-02	8.4E-03	2.5E-01	2.5E-03	7.2E-02
Zinc	7.0E+01	1.6E-02	1.1E+00	2.0E-02	1.4E+00	5.1E-03	3.6E-01
Chloride	2.4E+02	--	--	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	--	--	--	--

Table - EA-2 - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{inv} - Chemical concentration in invertebrates

C_{mam} - Chemical concentration in mammal tissue

C_{plant} - Chemical concentration in plant

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-2 - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-2

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	2.0E-01	0.0E+00	0.0E+00	0.0E+00	2.9E-04	0.0E+00	0.0E+00	0.0E+00	2.9E-04	2.4E+01	1.2E-05	2.4E+02	1.2E-06
Benzaldehyde	7.9E-01	0.0E+00	0.0E+00	0.0E+00	1.2E-03	0.0E+00	0.0E+00	0.0E+00	1.2E-03	4.3E+01	2.7E-05	8.6E+01	1.4E-05
Benzo(a)pyrene	1.5E-01	3.3E-04	8.1E-01	3.0E-01	2.2E-04	1.8E-05	2.4E-01	1.0E-02	2.5E-01	1.0E+00	2.5E-01	1.0E+01	2.5E-02
Bis(2-Ethylhexyl)phthalate	1.1E+02	3.5E-02	6.2E+02	6.6E+03	1.6E-01	1.9E-03	1.8E+02	2.3E+02	4.1E+02	1.8E+01	2.2E+01	1.8E+02	2.2E+00
Diphenyl ether	1.2E-01	3.4E-03	6.2E-01	2.9E-03	1.8E-04	1.9E-04	1.8E-01	1.0E-04	1.8E-01	3.0E+00	6.1E-02	3.0E+01	6.1E-03
Fluoranthene	4.0E-01	3.2E-03	2.1E+00	8.6E-02	5.8E-04	1.8E-04	6.2E-01	2.9E-03	6.2E-01	2.5E+01	2.5E-02	5.0E+01	1.2E-02
Phenanthrene	2.7E-01	5.6E-03	1.4E+00	1.2E-02	4.0E-04	3.1E-04	4.2E-01	4.1E-04	4.2E-01	7.0E-01	6.0E-01	7.0E+00	6.0E-02
Pyrene	3.1E-01	3.6E-03	1.6E+00	3.5E-02	4.5E-04	2.0E-04	4.8E-01	1.2E-03	4.8E-01	1.5E+01	3.2E-02	2.5E+01	1.9E-02
4,4'-DDD	3.9E-02	9.5E-05	2.1E-01	6.7E-02	5.7E-05	5.2E-06	6.2E-02	2.3E-03	6.5E-02	8.0E-01	8.1E-02	4.0E+00	1.6E-02
4,4'-DDE	4.9E-02	4.7E-05	2.7E-01	4.2E-01	7.2E-05	2.6E-06	8.0E-02	1.4E-02	9.4E-02	8.0E-01	1.2E-01	4.0E+00	2.4E-02
4,4'-DDT	6.8E-01	9.9E-04	3.7E+00	2.9E+00	1.0E-03	5.4E-05	1.1E+00	9.8E-02	1.2E+00	8.0E-01	1.5E+00	4.0E+00	3.0E-01
Aluminum	1.3E+04	7.5E+00	1.1E+02	6.9E+01	1.9E+01	4.1E-01	3.3E+01	2.3E+00	5.5E+01	1.9E+00	2.9E+01	1.9E+01	2.9E+00
Arsenic	8.8E+00	2.8E-01	3.6E-01	9.7E-01	1.3E-02	1.6E-02	1.1E-01	3.3E-02	1.7E-01	1.3E-01	1.3E+00	1.3E+00	1.3E-01
Cadmium	6.9E-01	1.7E-01	1.6E-01	1.6E-01	1.0E-03	9.3E-03	4.6E-02	5.6E-03	6.2E-02	1.9E+00	3.3E-02	7.1E+00	8.8E-03
Chromium	1.2E+02	9.5E-01	4.0E+00	2.3E-01	1.7E-01	5.3E-02	1.2E+00	7.7E-03	1.4E+00	2.4E+00	5.9E-01	4.1E+01	3.5E-02
Copper	2.2E+01	5.4E-01	3.5E-01	2.6E+00	3.3E-02	3.0E-02	1.1E-01	9.0E-02	2.6E-01	1.5E+01	1.7E-02	1.5E+02	1.7E-03
Iron	2.2E+04	1.9E+01	1.6E+02	3.7E+02	3.3E+01	1.1E+00	4.8E+01	1.3E+01	9.5E+01	--	--	--	--
Lead	5.3E+01	5.4E-01	2.0E+00	3.0E+00	7.7E-02	3.0E-02	6.0E-01	1.0E-01	8.1E-01	4.7E+00	1.7E-01	1.5E+02	5.3E-03
Mercury	1.6E-01	--	2.7E-02	1.8E-03	2.4E-04	--	8.1E-03	6.1E-05	8.4E-03	1.0E+00	8.3E-03	1.0E+01	8.3E-04
Selenium	2.4E+00	3.5E-01	3.0E-01	2.7E-01	3.5E-03	2.0E-02	8.9E-02	9.3E-03	1.2E-01	4.4E-01	2.8E-01	7.9E-01	1.5E-01
Vanadium	2.9E+01	2.8E-02	2.5E-01	7.2E-02	4.3E-02	1.6E-03	7.3E-02	2.5E-03	1.2E-01	2.1E-01	5.7E-01	2.1E+00	5.7E-02
Zinc	7.0E+01	1.1E+00	1.4E+00	3.6E-01	1.0E-01	6.2E-02	4.1E-01	1.2E-02	5.9E-01	7.5E+01	7.8E-03	2.6E+02	2.3E-03
Chloride	2.4E+02	--	--	--	3.6E-01	--	--	--	3.6E-01	--	--	--	--
Nitrogen, as Ammonia	6.2E+02	--	--	--	9.2E-01	--	--	--	9.2E-01	--	--	--	--

Table - EA-2 - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-2

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-4 - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	3.5E-01	2.2E-03	7.8E-04	5.4E+00	1.9E+00	2.0E+00	7.2E-01
Bis(2-Ethylhexyl)phthalate	3.0E+01	3.1E-04	9.4E-03	5.6E+00	1.7E+02	6.0E+01	1.8E+03
Fluoranthene	4.1E-01	8.1E-03	3.3E-03	5.3E+00	2.1E+00	2.2E-01	8.9E-02
Naphthalene	6.5E-02	9.6E-02	6.2E-03	5.2E+00	3.4E-01	3.0E-03	1.9E-04
Phenanthrene	1.4E-01	2.0E-02	2.9E-03	5.2E+00	7.3E-01	4.3E-02	6.1E-03
Pyrene	2.2E-01	1.2E-02	2.6E-03	5.2E+00	1.2E+00	1.1E-01	2.6E-02
4,4'-DDD	1.6E-02	2.4E-03	3.9E-05	5.4E+00	8.6E-02	1.7E+00	2.8E-02
4,4'-DDE	3.8E-03	9.6E-04	3.6E-06	5.5E+00	2.1E-02	8.7E+00	3.3E-02
4,4'-DDT	6.8E-02	1.4E-03	9.9E-05	5.4E+00	3.7E-01	4.2E+00	2.9E-01
Alpha-BHC	2.0E-03	5.1E-02	1.0E-04	5.1E+00	1.0E-02	9.1E-03	1.9E-05
Gamma-BHC/Lindane	1.2E-02	5.9E-02	7.2E-04	5.1E+00	6.3E-02	7.0E-03	8.7E-05
Aluminum	8.8E+03	5.7E-04	5.1E+00	8.6E-03	7.6E+01	5.3E-03	4.6E+01
Arsenic	9.1E+00	3.0E-02	2.8E-01	3.9E-02	3.6E-01	1.1E-01	9.8E-01
Cadmium	4.8E-01	2.9E-01	1.4E-01	2.5E-01	1.2E-01	2.8E-01	1.3E-01
Chromium	5.8E+02	8.2E-03	4.8E+00	--	4.0E+00	4.9E-03	2.9E+00
Chromium, Hexavalent	3.8E+01	8.2E-03	3.1E-01	--	4.0E+00	4.9E-03	1.9E-01
Cobalt	1.6E+01	1.5E-03	2.4E-02	2.4E-02	4.0E-01	4.1E-03	6.6E-02
Copper	2.7E+01	2.5E-02	6.8E-01	1.7E-02	4.5E-01	1.2E-01	3.2E+00
Iron	1.9E+04	8.5E-04	1.6E+01	7.2E-03	1.4E+02	1.7E-02	3.3E+02
Lead	4.3E+01	1.1E-02	4.9E-01	4.1E-02	1.8E+00	6.0E-02	2.6E+00
Manganese	1.7E+02	1.6E-02	2.7E+00	6.1E-03	1.0E+00	4.1E-03	7.0E-01
Mercury	1.4E-01	--	--	5.1E-01	7.3E-02	1.1E-02	1.6E-03
Nickel	2.5E+01	3.6E-03	9.1E-02	9.5E-01	2.4E+01	5.0E-02	1.3E+00
Vanadium	2.0E+01	9.7E-04	2.0E-02	8.4E-03	1.7E-01	2.5E-03	5.0E-02
Zinc	4.8E+01	1.9E-02	9.3E-01	2.3E-02	1.1E+00	6.6E-03	3.2E-01
Chloride	1.2E+02	--	--	--	--	--	--
Cyanide, Total	7.9E+00	--	--	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	--	--	--	--
Sulfate	1.0E+04	--	--	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	--	--	--	--

Table - EA-4 - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:

BAF - Bioaccumulation Factor

C_{inv} - Chemical concentration in invertebrates

C_{mam} - Chemical concentration in mammal tissue

C_{plant} - Chemical concentration in plant

C_{soil} - Chemical concentration in soil

C_{sw} - Chemical concentration in surface water

RME - Reasonable Maximum Exposure

mg/kg - milligrams per kilogram

mg/L - milligrams per liter

Table - EA-4 - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-4

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	4.6E-02	0.0E+00	0.0E+00	0.0E+00	6.8E-05	0.0E+00	0.0E+00	0.0E+00	6.8E-05	2.4E+01	2.8E-06	2.4E+02	2.8E-07
Benzaldehyde	6.1E-01	0.0E+00	0.0E+00	0.0E+00	9.0E-04	0.0E+00	0.0E+00	0.0E+00	9.0E-04	4.3E+01	2.1E-05	8.6E+01	1.1E-05
Benzo(a)pyrene	3.5E-01	7.8E-04	1.9E+00	7.2E-01	5.2E-04	4.3E-05	5.6E-01	2.4E-02	5.9E-01	1.0E+00	5.9E-01	1.0E+01	5.9E-02
Bis(2-Ethylhexyl)phthalate	3.0E+01	9.4E-03	1.7E+02	1.8E+03	4.4E-02	5.2E-04	4.9E+01	6.1E+01	1.1E+02	1.8E+01	6.0E+00	1.8E+02	6.0E-01
Fluoranthene	4.1E-01	3.3E-03	2.1E+00	8.9E-02	6.0E-04	1.8E-04	6.4E-01	3.0E-03	6.4E-01	2.5E+01	2.6E-02	5.0E+01	1.3E-02
Naphthalene	6.5E-02	6.2E-03	3.4E-01	1.9E-04	9.6E-05	3.4E-04	1.0E-01	6.6E-06	1.0E-01	3.0E+01	3.4E-03	3.0E+02	3.4E-04
Phenanthrene	1.4E-01	2.9E-03	7.3E-01	6.1E-03	2.1E-04	1.6E-04	2.2E-01	2.1E-04	2.2E-01	7.0E-01	3.1E-01	7.0E+00	3.1E-02
Pyrene	2.2E-01	2.6E-03	1.2E+00	2.6E-02	3.3E-04	1.4E-04	3.5E-01	8.7E-04	3.5E-01	1.5E+01	2.3E-02	2.5E+01	1.4E-02
4,4'-DDD	1.6E-02	3.9E-05	8.6E-02	2.8E-02	2.4E-05	2.2E-06	2.6E-02	9.5E-04	2.7E-02	8.0E-01	3.3E-02	4.0E+00	6.7E-03
4,4'-DDE	3.8E-03	3.6E-06	2.1E-02	3.3E-02	5.5E-06	2.0E-07	6.1E-03	1.1E-03	7.2E-03	8.0E-01	9.0E-03	4.0E+00	1.8E-03
4,4'-DDT	6.8E-02	9.9E-05	3.7E-01	2.9E-01	1.0E-04	5.5E-06	1.1E-01	9.9E-03	1.2E-01	8.0E-01	1.5E-01	4.0E+00	3.0E-02
Alpha-BHC	2.0E-03	1.0E-04	1.0E-02	1.9E-05	3.0E-06	5.7E-06	3.1E-03	6.3E-07	3.1E-03	5.0E+00	6.2E-04	2.0E+01	1.6E-04
Gamma-BHC/Lindane	1.2E-02	7.2E-04	6.3E-02	8.7E-05	1.8E-05	4.0E-05	1.9E-02	3.0E-06	1.9E-02	5.0E+00	3.8E-03	1.0E+01	1.9E-03
Aluminum	8.8E+03	5.1E+00	7.6E+01	4.6E+01	1.3E+01	2.8E-01	2.2E+01	1.6E+00	3.7E+01	1.9E+00	1.9E+01	1.9E+01	1.9E+00
Arsenic	9.1E+00	2.8E-01	3.6E-01	9.8E-01	1.3E-02	1.5E-02	1.1E-01	3.3E-02	1.7E-01	1.3E-01	1.3E+00	1.3E+00	1.3E-01
Cadmium	4.8E-01	1.4E-01	1.2E-01	1.3E-01	7.0E-04	7.7E-03	3.6E-02	4.5E-03	4.9E-02	1.9E+00	2.6E-02	7.1E+00	6.8E-03
Chromium	5.8E+02	4.8E+00	4.0E+00	2.9E+00	8.6E-01	2.6E-01	1.2E+00	9.8E-02	2.4E+00	2.4E+00	1.0E+00	4.1E+01	5.9E-02
Chromium, Hexavalent	3.8E+01	3.1E-01	4.0E+00	1.9E-01	5.5E-02	1.7E-02	1.2E+00	6.3E-03	1.3E+00	2.2E+01	5.8E-02	2.2E+01	5.8E-02
Cobalt	1.6E+01	2.4E-02	4.0E-01	6.6E-02	2.4E-02	1.3E-03	1.2E-01	2.3E-03	1.4E-01	--	--	--	--
Copper	2.7E+01	6.8E-01	4.5E-01	3.2E+00	4.0E-02	3.7E-02	1.3E-01	1.1E-01	3.2E-01	1.5E+01	2.1E-02	1.5E+02	2.1E-03
Iron	1.9E+04	1.6E+01	1.4E+02	3.3E+02	2.8E+01	9.0E-01	4.1E+01	1.1E+01	8.2E+01	--	--	--	--
Lead	4.3E+01	4.9E-01	1.8E+00	2.6E+00	6.3E-02	2.7E-02	5.2E-01	8.7E-02	7.0E-01	4.7E+00	1.5E-01	1.5E+02	4.5E-03
Manganese	1.7E+02	2.7E+00	1.0E+00	7.0E-01	2.5E-01	1.5E-01	3.1E-01	2.4E-02	7.3E-01	8.8E+01	8.3E-03	2.8E+02	2.6E-03
Mercury	1.4E-01	--	7.3E-02	1.6E-03	2.1E-04	--	2.2E-02	5.3E-05	2.2E-02	1.0E+00	2.2E-02	1.0E+01	2.2E-03
Nickel	2.5E+01	9.1E-02	2.4E+01	1.3E+00	3.7E-02	5.0E-03	7.1E+00	4.3E-02	7.2E+00	4.0E+01	1.8E-01	8.0E+01	9.0E-02
Vanadium	2.0E+01	2.0E-02	1.7E-01	5.0E-02	3.0E-02	1.1E-03	5.1E-02	1.7E-03	8.4E-02	2.1E-01	4.0E-01	2.1E+00	4.0E-02
Zinc	4.8E+01	9.3E-01	1.1E+00	3.2E-01	7.1E-02	5.1E-02	3.3E-01	1.1E-02	4.7E-01	7.5E+01	6.2E-03	2.6E+02	1.8E-03
Chloride	1.2E+02	--	--	--	1.8E-01	--	--	--	1.8E-01	--	--	--	--
Cyanide, Total	7.9E+00	--	--	--	1.2E-02	--	--	--	1.2E-02	--	--	--	--
Nitrogen, as Ammonia	3.6E+02	--	--	--	5.3E-01	--	--	--	5.3E-01	--	--	--	--
Sulfate	1.0E+04	--	--	--	1.5E+01	--	--	--	1.5E+01	--	--	--	--
C11-C22 Aromatics	5.6E+01	--	--	--	8.3E-02	--	--	--	8.3E-02	--	--	--	--
C19-C36 Aliphatics	8.1E+01	--	--	--	1.2E-01	--	--	--	1.2E-01	--	--	--	--

Table - EA-4 - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-4

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

Table - EA-5 - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	BAF Plant	C_{plant} (mg/kg)	BAF Invertebrates	C_{inv} (mg/kg)	BAF Mammal	C_{mam} (mg/kg)
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Benzo(a)pyrene	1.5E-01	2.2E-03	3.4E-04	5.4E+00	8.2E-01	2.0E+00	3.1E-01
Bis(2-Ethylhexyl)phthalate	1.0E+02	3.1E-04	3.2E-02	5.6E+00	5.8E+02	6.0E+01	6.2E+03
Diphenyl ether	1.9E+00	2.9E-02	5.4E-02	5.2E+00	9.8E+00	2.4E-02	4.6E-02
Fluoranthene	2.5E+00	8.1E-03	2.0E-02	5.3E+00	1.3E+01	2.2E-01	5.5E-01
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Phenanthrene	1.5E-01	2.0E-02	3.0E-03	5.2E+00	7.5E-01	4.3E-02	6.3E-03
Pyrene	5.6E-01	1.2E-02	6.6E-03	5.2E+00	2.9E+00	1.1E-01	6.4E-02
4,4'-DDT	4.5E-02	1.4E-03	6.5E-05	5.4E+00	2.4E-01	4.2E+00	1.9E-01
Hexachlorobenzene	2.9E-02	4.5E-03	1.3E-04	5.3E+00	1.5E-01	6.0E-01	1.7E-02
Aluminum	2.0E+04	5.7E-04	1.1E+01	8.6E-03	1.7E+02	5.3E-03	1.1E+02
Antimony	3.4E-01	2.0E-03	6.9E-04	2.0E-01	6.8E-02	5.0E-02	1.7E-02
Arsenic	2.7E+01	1.2E-02	3.2E-01	1.8E-02	4.7E-01	8.0E-02	2.1E+00
Cadmium	4.2E-01	3.2E-01	1.4E-01	2.7E-01	1.1E-01	3.0E-01	1.3E-01
Chromium	2.6E+04	8.2E-03	2.2E+02	--	4.0E+00	5.5E-04	1.4E+01
Chromium, Hexavalent	5.6E+02	8.2E-03	4.6E+00	--	4.0E+00	5.5E-04	3.1E-01
Copper	9.7E+01	8.6E-03	8.4E-01	4.7E-03	4.6E-01	9.2E-02	8.9E+00
Iron	2.0E+04	8.5E-04	1.7E+01	7.2E-03	1.5E+02	1.7E-02	3.4E+02
Lead	9.3E+01	6.5E-03	6.0E-01	3.0E-02	2.8E+00	4.7E-02	4.4E+00
Mercury	1.9E+00	--	--	1.4E-01	2.8E-01	1.1E-02	2.1E-02
Silver	1.1E+03	2.8E-03	3.1E+00	4.1E-01	4.5E+02	8.0E-04	8.8E-01
Thallium	7.4E+00	8.0E-04	5.9E-03	2.2E-02	1.7E-01	2.2E-02	1.7E-01
Tin	2.6E+04	6.0E-03	1.6E+02	--	--	4.0E+00	1.0E+05
Vanadium	6.9E+01	9.7E-04	6.7E-02	8.4E-03	5.8E-01	2.5E-03	1.7E-01
Zinc	3.1E+01	2.6E-02	8.0E-01	3.0E-02	9.4E-01	1.0E-02	3.1E-01
Cyanide, Total	6.5E+00	--	--	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	--	--	--	--
Sulfate	2.3E+02	--	--	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	--	--	--	--

Table - EA-5 - RME - Short-Tailed Shrew - 1
Calculated Exposure Point Concentrations
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised by: SFR 3/10/2014

Notes:
BAF - Bioaccumulation Factor
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant
C_{soil} - Chemical concentration in soil
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
mg/kg - milligrams per kilogram
mg/L - milligrams per liter

Table - EA-5 - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-5

Chemical	C_{soil} (mg/kg)	C_{plant} (mg/kg)	C_{inv} (mg/kg)	C_{mam} (mg/kg)	Dose soil (mg/Kg BW day) [a]	Dose plant (mg/Kg BW day) [a]	Dose Inv (mg/Kg BW day) [a]	Dose mam (mg/Kg BW day) [a]	Total Dose (mg/Kg BW day) [b]	TRV NOAEL [c]	NOAEL Based Total HQ [d]	TRV LOAEL [c]	LOAEL Based Total HQ [d]
Acetaldehyde	1.3E-01	0.0E+00	0.0E+00	0.0E+00	1.9E-04	0.0E+00	0.0E+00	0.0E+00	1.9E-04	2.4E+01	8.0E-06	2.4E+02	8.0E-07
Aniline	1.2E-01	0.0E+00	0.0E+00	0.0E+00	1.8E-04	0.0E+00	0.0E+00	0.0E+00	1.8E-04	2.0E+00	8.8E-05	2.0E+01	8.8E-06
Benzaldehyde	2.1E-01	0.0E+00	0.0E+00	0.0E+00	3.1E-04	0.0E+00	0.0E+00	0.0E+00	3.1E-04	4.3E+01	7.3E-06	8.6E+01	3.6E-06
Benzo(a)pyrene	1.5E-01	3.4E-04	8.2E-01	3.1E-01	2.2E-04	1.9E-05	2.4E-01	1.1E-02	2.5E-01	1.0E+00	2.5E-01	1.0E+01	2.5E-02
Bis(2-Ethylhexyl)phthalate	1.0E+02	3.2E-02	5.8E+02	6.2E+03	1.5E-01	1.8E-03	1.7E+02	2.1E+02	3.8E+02	1.8E+01	2.1E+01	1.8E+02	2.1E+00
Diphenyl ether	1.9E+00	5.4E-02	9.8E+00	4.6E-02	2.8E-03	3.0E-03	2.9E+00	1.6E-03	2.9E+00	3.0E+00	9.7E-01	3.0E+01	9.7E-02
Fluoranthene	2.5E+00	2.0E-02	1.3E+01	5.5E-01	3.7E-03	1.1E-03	3.9E+00	1.9E-02	4.0E+00	2.5E+01	1.6E-01	5.0E+01	7.9E-02
N-Nitrosodi-n-propylamine	2.6E-01	0.0E+00	0.0E+00	0.0E+00	3.8E-04	0.0E+00	0.0E+00	0.0E+00	3.8E-04	7.3E-02	5.3E-03	7.3E-01	5.3E-04
Phenanthrene	1.5E-01	3.0E-03	7.5E-01	6.3E-03	2.1E-04	1.6E-04	2.2E-01	2.1E-04	2.2E-01	7.0E-01	3.2E-01	7.0E+00	3.2E-02
Pyrene	5.6E-01	6.6E-03	2.9E+00	6.4E-02	8.3E-04	3.6E-04	8.7E-01	2.2E-03	8.7E-01	1.5E+01	5.8E-02	2.5E+01	3.5E-02
4,4'-DDT	4.5E-02	6.5E-05	2.4E-01	1.9E-01	6.6E-05	3.6E-06	7.2E-02	6.5E-03	7.9E-02	8.0E-01	9.9E-02	4.0E+00	2.0E-02
Hexachlorobenzene	2.9E-02	1.3E-04	1.5E-01	1.7E-02	4.3E-05	7.2E-06	4.6E-02	5.9E-04	4.6E-02	3.2E-01	1.4E-01	1.6E+00	2.9E-02
Aluminum	2.0E+04	1.1E+01	1.7E+02	1.1E+02	2.9E+01	6.3E-01	5.1E+01	3.6E+00	8.5E+01	1.9E+00	4.4E+01	1.9E+01	4.4E+00
Antimony	3.4E-01	6.9E-04	6.8E-02	1.7E-02	5.0E-04	3.8E-05	2.0E-02	5.8E-04	2.1E-02	1.3E+01	1.6E-03	1.4E+01	1.5E-03
Arsenic	2.7E+01	3.2E-01	4.7E-01	2.1E+00	3.9E-02	1.8E-02	1.4E-01	7.3E-02	2.7E-01	1.3E-01	2.1E+00	1.3E+00	2.1E-01
Cadmium	4.2E-01	1.4E-01	1.1E-01	1.3E-01	6.2E-04	7.5E-03	3.3E-02	4.3E-03	4.6E-02	1.9E+00	2.5E-02	7.1E+00	6.4E-03
Chromium	2.6E+04	2.2E+02	4.0E+00	1.4E+01	3.9E+01	1.2E+01	1.2E+00	4.9E-01	5.2E+01	2.4E+00	2.2E+01	4.1E+01	1.3E+00
Chromium, Hexavalent	5.6E+02	4.6E+00	4.0E+00	3.1E-01	8.2E-01	2.5E-01	1.2E+00	1.0E-02	2.3E+00	2.2E+01	1.0E-01	2.2E+01	1.0E-01
Copper	9.7E+01	8.4E-01	4.6E-01	8.9E+00	1.4E-01	4.6E-02	1.4E-01	3.1E-01	6.3E-01	1.5E+01	4.1E-02	1.5E+02	4.1E-03
Iron	2.0E+04	1.7E+01	1.5E+02	3.4E+02	3.0E+01	9.4E-01	4.3E+01	1.2E+01	8.5E+01	--	--	--	--
Lead	9.3E+01	6.0E-01	2.8E+00	4.4E+00	1.4E-01	3.3E-02	8.2E-01	1.5E-01	1.1E+00	4.7E+00	2.4E-01	1.5E+02	7.4E-03
Mercury	1.9E+00	--	2.8E-01	2.1E-02	2.8E-03	--	8.3E-02	7.1E-04	8.7E-02	1.0E+00	8.6E-02	1.0E+01	8.6E-03
Silver	1.1E+03	3.1E+00	4.5E+02	8.8E-01	1.6E+00	1.7E-01	1.3E+02	3.0E-02	1.4E+02	3.6E+01	3.7E+00	7.2E+01	1.9E+00
Thallium	7.4E+00	5.9E-03	1.7E-01	1.7E-01	1.1E-02	3.3E-04	4.9E-02	5.7E-03	6.6E-02	4.6E-02	1.4E+00	4.6E-01	1.4E-01
Tin	2.6E+04	1.6E+02	--	1.0E+05	3.8E+01	8.6E+00	--	3.5E+03	3.6E+03	2.3E+01	1.5E+02	3.5E+01	1.0E+02
Vanadium	6.9E+01	6.7E-02	5.8E-01	1.7E-01	1.0E-01	3.7E-03	1.7E-01	5.8E-03	2.8E-01	2.1E-01	1.3E+00	2.1E+00	1.3E-01
Zinc	3.1E+01	8.0E-01	9.4E-01	3.1E-01	4.6E-02	4.4E-02	2.8E-01	1.1E-02	3.8E-01	7.5E+01	5.0E-03	2.6E+02	1.5E-03
Cyanide, Total	6.5E+00	--	--	--	9.6E-03	--	--	--	9.6E-03	--	--	--	--
Nitrogen, as Ammonia	7.5E+02	--	--	--	1.1E+00	--	--	--	1.1E+00	--	--	--	--
Sulfate	2.3E+02	--	--	--	3.4E-01	--	--	--	3.4E-01	--	--	--	--
C11-C22 Aromatics	7.5E+03	--	--	--	1.1E+01	--	--	--	1.1E+01	--	--	--	--
C19-C36 Aliphatics	4.9E+03	--	--	--	7.2E+00	--	--	--	7.2E+00	--	--	--	--
C9-C18 Aliphatics	7.8E+02	--	--	--	1.1E+00	--	--	--	1.1E+00	--	--	--	--

Table - EA-5 - RME - Short-Tailed Shrew - 2
Summary of Doses
Baseline Ecological Risk Assessment OU1 & OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Receptor:	Short-Tailed Shrew
Scenario:	Current - RME
Exposure Point:	EA-5

Prepared by: EYM 7/15/2013
Checked by: SFR 7/15/2013
Revised by: SFR 3/10/2014

Notes:
[a] Doses for surface water (sw), soil, plants, invertebrates (inv), and mammals (mam) were calculated using the equations in Attachment 5-1.
[b] Total Dose is the sum of all doses.
[c] NOAEL and LOAEL TRVs are presented in Attachment 5-13.
[d] NOAEL and LOAEL HQs are calculated by dividing the Total Dose by the TRV.

BW - body weight
C_{inv} - Chemical concentration in invertebrates
C_{mam} - Chemical concentration in mammal tissue
C_{plant} - Chemical concentration in plant tissue
C_{soil} - Chemical concentration in sediment
C_{sw} - Chemical concentration in surface water
RME - Reasonable Maximum Exposure
HQ - Hazard Quotient
LOAEL - Lowest Observed Adverse Effects Level
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NOAEL - No Observed Adverse Effects Level
TRV - Toxicity Reference Value

ATTACHMENT 6

LOWER SOUTH DITCH SEDIMENT TOXICITY TEST REPORT

(Provided on CD ROM)

TOXICOLOGICAL EVALUATION
OF FRESHWATER SEDIMENT SAMPLES

South Ditch Sediment Evaluation
Olin Chemical Superfund Site, Wilmington, Massachusetts
MACTEC Purchase Order 201102101

42 Day *Hyalella azteca*
Survival, Growth and Reproduction Sediment Toxicity Test

Prepared For:

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Prepared By:

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June 2011
Reference Number 20686-11-06-R2

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TOXICOLOGICAL EVALUATION
OF FRESHWATER SEDIMENT SAMPLES

South Ditch Sediment Evaluation
Olin Chemical Superfund Site, Wilmington, Massachusetts
MACTEC Purchase Order 201102101
42 Day *Hyalella azteca*
Survival, Growth and Reproduction Sediment Toxicity Test

1.0 INTRODUCTION

This report presents the results of chronic exposure toxicity tests conducted on sediment samples collected from the South Ditch at the Olin Chemical Superfund Site located in Wilmington, Massachusetts. Samples were provided by MACTEC Engineering & Consulting, Inc., Wakefield, Massachusetts. Testing was based on programs and protocols developed by the ASTM (2010) and US EPA (2000). The toxicity of the samples was assessed by conducting survival, growth and reproduction tests using the freshwater amphipod, *Hyalella azteca*. Toxicity tests and associated supporting analyses were performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire.

Toxicity tests expose groups of organisms to environmental samples, a laboratory control and field reference sites for a specified period to assess potential impacts on a variety of endpoints, such as survival, growth or reproduction. Analysis of variance techniques are used to determine the relative toxicity of the samples as compared to the laboratory control and/or field reference sites. Endpoints for this study included survival (measured on days 28, 35 and 42), growth (measured on days 28 and 42, as mean dry weight and mean dry biomass), reproduction (measured on days 35 and 42).

2.0 MATERIALS AND METHODS

2.1 General Methods, Biological Evaluations

Toxicological and analytical protocols used in this program follow procedures outlined in *Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates* (ASTM Method E 1706-05, 2010), *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (US EPA 2000) and *Standard Methods for the Examination of Water and Wastewater*, 20th Edition (APHA 1998). These protocols provide standard approaches for physical and chemical analysis and for the evaluation of toxicological effects of sediments on aquatic invertebrates.

2.2 Test Species

H. azteca were obtained from Aquatic Research Organisms, Hampton, New Hampshire. Organisms used in the 42 day exposure assay were approximately 7 days old at the start of the assay.

2.3 Test Samples and Laboratory Control Sediment

Sediment samples collected from the project site were received at ESI under chain of custody. Once received, samples were inspected to determine integrity, given unique sample numbers and logged into the laboratory sample management database. Once logged in, the samples were placed in a secure refrigerated, 2 - 4 °C, storage area. A listing of sample sites, sample collection, and receipt information is summarized in Table 1.

The control substrate was an artificial sediment prepared according to guidance presented in the EPA/ASTM method. Organic detritus from amphipod cultures and disintegrated paper pulp was used to provide organic content. Overlying water for the sediment toxicity tests was a mixture of natural surface water, collected from the upper portion of the Taylor River watershed in Hampton Falls, New Hampshire, and moderately hard reconstituted water. Use of natural surface water mixed with artificial reconstituted water is recommended by the protocol (US EPA 2000, ASTM 2010).

2.4 *Hyalella azteca* Survival, Growth and Reproduction Toxicity Tests

Prior to test initiation test sediments were sieved using a ≥2 mm sieve to remove large stones, sticks, roots, man-made material and any indigenous organisms. Once sieved, the sediment was homogenized and placed in test chambers. Overlying water was added immediately and then the chambers were allowed to stabilize. The chambers received one volume addition daily until organisms were added.

Test vessels were 400 mL glass beakers containing 100 mL of sediment and approximately 225 mL of overlying water. Test vessels were drilled at a consistent height above their bases and the hole covered with Nytex® screen. The screened hole facilitates water exchange while retaining test organisms. Vessels were maintained in a water bath during the test. Depth of the water in the bath was set below the drain hole in the test vessel to eliminate flow of water from the bath into the test vessel. Test chambers were randomly placed in the water bath after addition of test sediments. Placement locations were generated by the CETIS® software program. The randomization work sheets are included in the data appendix. The water bath was maintained in a limited access, temperature controlled room. Temperatures in the room and water bath were independently set at a temperature of 23°C. Temperature was recorded on an hourly frequency using a temperature logger placed in a surrogate vessel. The photoperiod in the test chamber was set at 16:8 hour light:dark. Lighting was supplied by cool white fluorescent bulbs.

A total of 10 amphipods were randomly selected from the pool of organisms and added to each treatment. Each treatment group included 12 replicates and during the sediment portion of the assay, a surrogate test chamber was used to obtain water qualities without disturbing the sediment or test animals. The surrogate chamber was treated the same as actual test chambers with the addition of animals and food, but was not used to determine endpoint data.

Prior to the daily overlying water renewal, dissolved oxygen, pH, specific conductance and temperature were measured for each treatment. Overlying water in each replicate was then renewed. The volume of water added to each test chamber was approximately two volumes. Water exchanges were facilitated by use of a distribution system designed to provide equal, regulated flow to each chamber. The system was activated manually by the addition of water during the assay. After overlying water renewal each replicate was fed 1.0 mL of a yeast/trout chow/alfalfa suspension. Alkalinity, ammonia and hardness of the overlying water were measured on days 0, 7, 14, 21, 28, 35 and 42. The total organic carbon of the overlying water was measured on days 0 and 28. Water quality records are available in Appendix A.

After 28 days exposure, all replicates of each test treatment were terminated to collect data for initial survival. Each test chamber was gently swirled to loosen the sediments and the test material was dumped into a stainless steel sieve. The sediments were washed through the sieve using freshwater and material left on the screen was sorted to recover the organisms. This process was continued until the entire sample was evaluated.

Surviving amphipods from 4 replicates identified for day 28 survival and growth analysis were counted and placed on tared weighing pans. Pans were dried overnight at 104°C to obtain dry weight to the nearest 0.01 mg. The mean dry weight of surviving organisms was determined to assess growth.

Surviving amphipods from the remaining 8 replicates were enumerated and then returned to test chambers, which were filled with a 50:50 mix of natural surface water and moderately hard reconstituted water. The test vessels were returned to the water bath for the additional 14 day exposure. During this period, water quality monitoring, water exchanges and feeding were conducted in the same manner as during the initial 28 day exposure. Survival and juvenile counts were recorded on Days 35 and 42 in the remaining eight replicates of each test treatment. Growth, measured as dry weight and dry biomass, was determined on Day 42.

2.5 Statistical Analysis

Survival, growth and reproduction were analyzed using CETIS® software to determine significant differences between the test sediment and both the laboratory control and reference site sediments. Data sets were evaluated to determine normality of distribution and homogeneity of sample variance. Data sets were

subsequently evaluated using the appropriate parametric or non-parametric Analysis of Variance (ANOVA) statistic. Statistical comparisons were made for the following endpoints; survival on days 28, 35 and 42; dry weight and dry biomass on days 28 and 42; surviving amphipod juvenile production on day 35 and the total for days 35 and 42; surviving female amphipod juvenile production on day 42 and the total for days 35 and 42. Pair-wise comparisons were made using the appropriate statistical evaluation. Statistical difference was evaluated at α=0.05.

2.6 Quality Control

As part of the laboratory quality control program, reference toxicant evaluations are conducted by ESI on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. Results are summarized in Table 2.

2.7 Protocol Deviations

Review of data generated during the 42 day exposure period documented the following protocol deviations.

There was one instance where an extra animal was added to a test vessel at the assay start. On day 28, a total of 11 animals were recovered in sample 001, replicate 11. In this case the start number of animals exposed was adjusted to 11 for the statistical analysis and calculation of growth.

On day 35 water qualities were measured on replicate 1 beakers and then sub-sampled for chemical analysis. During this process the beakers were accidently tipped and organisms were lost. The beakers were retained for water quality purposes, but were excluded from analysis for day 35 and 42 endpoints.

It is the opinion of ESI's study director that these deviations did not adversely affect the outcome of the assay.

Table 1. Summary of Sample Collection and Receipt Information. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

			Sample Collected		Sample Received	
Field ID	ESI Code	Designation	Date	Time	Date	Time
OC-SD-SDBK-002-XXX	20686-001	reference	02/17/11	1130	02/17/11	1600
OC-SD-MMB-SW/SD-1-XXX	20686-002	reference	02/17/11	1330	02/17/11	1600
OC-SD-ISCO.2-XXX	20686-003	site	02/17/11	0940	02/17/11	1600

Table 2. Reference Toxicant Evaluation. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Date	Endpoint		Value	Historic Mean/ Central Tendency	Acceptable Range	Reference Toxicant
Hyalella azteca						
03/31/11	Survival	LC-50	0.0149	0.0093	0.000 - 0.026	Cadmium (mg/L)
03/31/11	Survival	LC-50	0.0168	0.0093	0.000 - 0.026	Cadmium (mg/L)

3.0 RESULTS AND DISCUSSION

3.1 Laboratory Control and Project Reference Site Performance

At the end of the 28 day exposure period, mean survival in laboratory control sediment was 93.33% with a coefficient of variation (CV) of 10.55%. Amphipods recovered from laboratory control sediment had a mean dry weight of 0.840 mg/amphipod, with a CV of 7.10%. The dry weight of a representative group of

amphipods at the start of the assay was 0.026 mg/individual. The minimum test acceptability criteria for survival in the laboratory control is ≥80%. The minimum acceptable criteria for growth is a demonstration of increased dry weight after 28 days exposure. The minimum acceptable criteria for reproduction is a demonstration of juvenile production. These criteria were met indicating that the organisms were healthy and not stressed by handling and that the overlying water did not adversely impact the results of the assay. Table 3 provides a summary of assay acceptability criteria and laboratory control achievement. Table 4 summarizes the reference site performance.

During daily water quality observations the temperature recorded for the assay had a mean value of 22.82°C with a range of 22.38 to 23.42°C. Confirmation temperature data collected hourly in a surrogate replicate documented a mean temperature of 23.0°C with a range of 22.2 to 24.2°C. Test acceptability criteria requires a mean temperature of 23±1°C, with maximum temporary fluctuations of 23±3°C.

Table 3. Summary of Acceptable Endpoints and Measurements. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Endpoint / Measurement	Protocol Criteria		Study
Survival	lab mean ≥ 80%	Mean Survival %	93.33
		Protocol Met	Yes
Growth	measured growth	start dry wt. (mg)	0.026
		end dry wt. (mg)	0.840
		Protocol Met	Yes
Reproduction	juveniles produced in lab	day 35 j / amphipod	0.85
		day 42 j / amphipod	3.81
		Protocol Met	Yes
Temperature	mean: 23°±1°C	daily / hourly	22.82 / 23.0
	minimum: 20°C	daily / hourly	22.38 / 22.2
	maximum: 26°C	daily / hourly	23.42 / 24.2
		Protocol Met	Yes

Table 4. Summary of Project Reference Site Performance. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Field ID	ESI Code	Mean Percent Survival			Mean Dry Weight (mg)		Mean Dry Biomass (mg)		Reproduction ♂♀		Reproduction ♀	
		D 28	D 35	D 42	D 28	D 42	D 28	D 42	D 35	D 35+42	D 42	D 35+42
OC-SD-SDBK-002-XXX	20686-001	95.83	94.29	91.43	0.364	0.597	0.355	0.549	0.54	3.28	3.86	4.68
OC-SD-MMB-SW/SD-1-XXX	20686-002	95.00	92.86	90.00	0.457	0.659	0.435	0.591	1.05	4.05	4.51	6.20

3.2 Summary

This program utilized protocols developed by the US EPA and ASTM to assess the potential toxicological impacts that exposure to sediments from the South Ditch at the Olin Chemical Superfund Site would have on freshwater invertebrates. Table 5 provides a summary of toxicity test findings and conclusions. Table 6 provides a summary of sample sites that demonstrated a negative effect, based on the finding of statistically significant reduction in an endpoint as compared to the laboratory control or reference site. Tables 7 through 17 provide summaries of assay endpoints and detailed statistical results for each sample location. Table 18 summarizes overlying water qualities measured during the test. Laboratory bench sheets, detailed summaries of survival, dry weights, and associated statistical support data are included in Appendix A.

Table 5. Toxicity Test Summary. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Endpoint	Field ID	Sample Designation	Data	Mean Reference Site Value	Ratio of Site Sample to Mean of Reference Samples
Day 28 Survival (percent)	OC-SD-SDBK-002-XXX	Ref 1	95.83	95.42	0.44
	OC-SD-MMB-SW/SD-1-XXX	Ref 2	95.00		
	OC-SD-ISCO.2-XXX	Site	41.67		
Day 28 Growth[A] (mg)	OC-SD-SDBK-002-XXX	Ref 1	0.364	0.4105	0.47
	OC-SD-MMB-SW/SD-1-XXX	Ref 2	0.457		
	OC-SD-ISCO.2-XXX	Site	0.193		
Day 28 Growth[B] (mg)	OC-SD-SDBK-002-XXX	Ref 1	0.355	0.395	0.17
	OC-SD-MMB-SW/SD-1-XXX	Ref 2	0.435		
	OC-SD-ISCO.2-XXX	Site	0.068		
Day 42 Reproduction[C] (number of juveniles)	OC-SD-SDBK-002-XXX	Ref 1	3.28	3.665	0.21
	OC-SD-MMB-SW/SD-1-XXX	Ref 2	4.05		
	OC-SD-ISCO.2-XXX	Site	0.76		

Notes: [A] Day 28 Growth calculated as: mg of dry weight on day 28 / # of surviving amphipods on day 28.
[B] Day 28 Growth calculated as: mg of dry weight on day 28 / # of amphipods exposed.
[C] Day 42 Reproduction calculated as: day 35 + day 42 juveniles / day 42 survivors.

Conclusions:

Survival, growth and reproduction for organisms maintained in the project site sediment were all statistically lower as compared to the same endpoints for the reference sites. The results can be summarized as follows.

- Survival in the project site sediment sample was 44% of the mean reference site survival.
- Growth in the project site sample, measured as dry weight of the surviving amphipods, was 47% of the mean of the reference sites. Growth, when measured as dry biomass, was 17% of the mean of the reference sites.
- Amphipod reproduction in the project site sample, measured as the mean total juvenile produced by day 42, was 21% of the mean reference site reproduction.

Table 6. Summary of Significant Endpoints. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

		Finding of Significant Difference(s) between Project Sites and Lab Control (20686-000)											OC-SD-SDBK-002-XXX (20686-001)										
		survival			dry wt		dry bio.		reproduction				survival			dry wt		dry bio.		reproduction			
									♂♀		♀									♂♀		♀	
Field ID	ESI Code	day 28	day 35	day 42	day 28	day 42	day 28	day 42	D 35	D 35+42	D 42	D 35+42	day 28	day 35	day 42	day 28	day 42	day 28	day 42	D 35	D 35+42	D 42	D 35+42
OC-SD-SDBK-002-XXX	20686-001				X	X	X	X				X	-	-	-	-	-	-	-	-	-	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002				X	X	X	X					-	-	-	-	-	-	-	-	-	-	-
OC-SD-ISCO.2-XXX	20686-003	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

		Finding of Significant Difference(s) between Project Sites and OC-SD-MMB-SW/SD-1-XXX (20686-002)										
		survival			dry wt		dry bio.		reproduction			
									♂♀		♀	
Field ID	ESI Code	day 28	day 35	day 42	day 28	day 42	day 28	day 42	D 35	D 35+42	D 42	D 35+42
OC-SD-SDBK-002-XXX	20686-001	-	-	-	-	-	-	-	-	-	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	-	-	-	-	-	-	-	-	-	-	-
OC-SD-ISCO.2-XXX	20686-003	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

4.0 REFERENCES

APHA. 1998. *Standard Methods for the Examination of Water and Wastewater*, 20th Edition. Washington D.C.

ASTM. 2010. Annual Book of ASTM Standards. Volume 11.06. *Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates*. E 1706-05. ASTM, West Conshohocken, PA.

US EPA. 2000. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates.* Second Edition. EPA/600-R-99/064.

Table 7. Day 28 *Hyalella azteca* Survival Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 28 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	12	93.33%	70.00%	100.00%	10.55%
OC-SD-SDBK-002-XXX	20686-001	12	95.83%	80.00%	100.00%	6.98%
OC-SD-MMB-SW/SD-1-XXX	20686-002	12	95.00%	80.00%	100.00%	8.40%
OC-SD-ISCO.2-XXX	20686-003	12	41.67%	20.00%	80.00%	45.58%

Day 28 Survival Statistical Analysis

			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	93.33%	-	-	-
OC-SD-SDBK-002-XXX	20686-001	95.83%	No	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	95.00%	No	-	-
OC-SD-ISCO.2-XXX	20686-003	41.67%	Yes	Yes	Yes

Table 8. Day 35 *Hyalella azteca* Survival Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 35 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	87.14%	60.00%	100.00%	17.17%
OC-SD-SDBK-002-XXX	20686-001	7	94.29%	80.00%	100.00%	10.35%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	92.86%	80.00%	100.00%	10.24%
OC-SD-ISCO.2-XXX	20686-003	7	38.57%	10.00%	60.00%	50.60%

Day 35 Survival Statistical Analysis

			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	87.14%	-	-	-
OC-SD-SDBK-002-XXX	20686-001	94.29%	No	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	92.86%	No	-	-
OC-SD-ISCO.2-XXX	20686-003	38.57%	Yes	Yes	Yes

Table 9. Day 42 *Hyalella azteca* Survival Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 42 Survival Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	85.71%	60.00%	100.00%	16.30%
OC-SD-SDBK-002-XXX	20686-001	7	91.43%	80.00%	100.00%	11.69%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	90.00%	70.00%	100.00%	12.83%
OC-SD-ISCO.2-XXX	20686-003	7	37.14%	10.00%	60.00%	50.88%

Day 42 Survival Statistical Analysis

			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	85.71%	-	-	-
OC-SD-SDBK-002-XXX	20686-001	91.43%	No	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	90.00%	No	-	-
OC-SD-ISCO.2-XXX	20686-003	37.14%	Yes	Yes	Yes

Table 10. Day 28 *Hyalella azteca* Dry Weight Summary and Statistical Analysis.*Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 28 Dry Weight Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	4	0.840	0.797	0.926	7.10%
OC-SD-SDBK-002-XXX	20686-001	4	0.364	0.352	0.381	3.47%
OC-SD-MMB-SW/SD-1-XXX	20686-002	4	0.457	0.380	0.499	12.00%
OC-SD-ISCO.2-XXX	20686-003	4	0.193	0.153	0.280	30.52%

Day 28 Dry Weight Statistical Analysis

			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	0.840	-	-	-
OC-SD-SDBK-002-XXX	20686-001	0.364	Yes	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	0.457	Yes	-	-
OC-SD-ISCO.2-XXX	20686-003	0.193	Yes	Yes	Yes

Table 11. Day 28 *Hyalella azteca* Dry Biomass Summary and Statistical Analysis. 42 *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 28 Biomass Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	4	0.840	0.797	0.926	7.10%
OC-SD-SDBK-002-XXX	20686-001	4	0.355	0.330	0.381	5.91%
OC-SD-MMB-SW/SD-1-XXX	20686-002	4	0.435	0.342	0.499	15.26%
OC-SD-ISCO.2-XXX	20686-003	4	0.068	0.046	0.088	29.48%

Day 28 Biomass Statistical Analysis			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	0.840	-	-	-
OC-SD-SDBK-002-XXX	20686-001	0.355	Yes	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	0.435	Yes	-	-
OC-SD-ISCO.2-XXX	20686-003	0.068	Yes	Yes	Yes

Table 12. Day 42 *Hyalella azteca* Dry Weight Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 42 Dry Weight Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	0.915	0.759	1.117	11.74%
OC-SD-SDBK-002-XXX	20686-001	7	0.597	0.518	0.703	10.67%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	0.659	0.606	0.714	5.74%
OC-SD-ISCO.2-XXX	20686-003	7	0.446	0.240	0.605	32.72%

Day 42 Dry Weight Statistical Analysis			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	0.915	-	-	-
OC-SD-SDBK-002-XXX	20686-001	0.597	Yes	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	0.659	Yes	-	-
OC-SD-ISCO.2-XXX	20686-003	0.446	Yes	Yes	Yes

Table 13. Day 42 *Hyalella azteca* Dry Biomass Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 42 Dry Biomass Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	0.774	0.670	0.877	11.14%
OC-SD-SDBK-002-XXX	20686-001	7	0.549	0.414	0.703	19.58%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	0.591	0.500	0.685	11.08%
OC-SD-ISCO.2-XXX	20686-003	7	0.178	0.024	0.353	67.55%

Day 42 Dry Biomass Statistical Analysis			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	0.774	-	-	-
OC-SD-SDBK-002-XXX	20686-001	0.549	Yes	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	0.591	Yes	-	-
OC-SD-ISCO.2-XXX	20686-003	0.178	Yes	Yes	Yes

Table 14. Day 35 *Hyalella azteca* Juvenile Production per Amphipod* Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 35 Juvenile Production/Amphipod Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	0.85	0.13	1.80	63.06%
OC-SD-SDBK-002-XXX	20686-001	7	0.54	0.10	0.75	42.64%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	1.05	0.50	1.60	43.60%
OC-SD-ISCO.2-XXX	20686-003	7	0.00	0.00	0.00	0.00%

Day 35 Juvenile Production/Amphipod Statistical Analysis			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	0.85	-	-	-
OC-SD-SDBK-002-XXX	20686-001	0.54	No	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	1.05	No	-	-
OC-SD-ISCO.2-XXX	20686-003	0.00	Yes	Yes	Yes

*Note: The endpoint described here as “Day 35 *Hyalella azteca* Juvenile Production per Amphipod” is the equivalent to the CETIS endpoint identified as “35d Reproduction”.
It is calculated as: day 35 juveniles / day 35 survivors

Table 15. Total *Hyalella azteca* Juvenile Production per Day 42 Surviving Amphipods* Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Total Juveniles/Day 42 Surviving Amphipods Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	3.81	1.00	6.70	62.07%
OC-SD-SDBK-002-XXX	20686-001	7	3.28	1.20	6.30	51.16%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	4.05	1.13	6.00	46.58%
OC-SD-ISCO.2-XXX	20686-003	7	0.76	0.00	4.00	191.50%

Total Juveniles/Day 42 Surviving Amphipods Statistical Analysis

Field ID	ESI Code	Mean	Statistically Significant (less than) as Compared to Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	3.81	-	-	-
OC-SD-SDBK-002-XXX	20686-001	3.28	No	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	4.05	No	-	-
OC-SD-ISCO.2-XXX	20686-003	0.76	Yes	Yes	Yes

*Note: The endpoint described here as "Total *Hyalella azteca* Juvenile Production per Day 42 Surviving Amphipods" is the equivalent to the CETIS endpoint identified as "42d Reproduction-Overall ".
It is calculated as: day 35 + day 42 juveniles / day 42 survivors

Table 16. Day 42 *Hyalella azteca* Juvenile Production per Female Amphipod* Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Day 42 Juvenile Production/Female Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	6.33	2.00	12.40	63.22%
OC-SD-SDBK-002-XXX	20686-001	7	3.86	1.80	6.22	42.73%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	4.51	1.67	6.71	43.29%
OC-SD-ISCO.2-XXX	20686-003	6	0.50	0.00	1.67	138.20%

Day 42 Juvenile Production/Female Statistical Analysis

Field ID	ESI Code	Mean	Statistically Significant (less than) as Compared to Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	6.33	-	-	-
OC-SD-SDBK-002-XXX	20686-001	3.86	No	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	4.51	No	-	-
OC-SD-ISCO.2-XXX	20686-003	0.50	Yes	Yes	Yes

*Note: The endpoint described here as "Day 42 *Hyalella azteca* Juvenile Production per Female Amphipod" is the equivalent to the CETIS endpoint identified as "42 d Juveniles per Female".
It is calculated as: day 42 juveniles / day 42 females

Table 17. Total *Hyalella azteca* Juvenile Production per Female Amphipod Summary and Statistical Analysis. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Total Juveniles/Female Summary

Field ID	ESI Code	Reps	Mean	Minimum	Maximum	CV
Laboratory Control	20686-000	7	8.52	4.00	13.50	45.05%
OC-SD-SDBK-002-XXX	20686-001	7	4.68	2.40	7.00	36.17%
OC-SD-MMB-SW/SD-1-XXX	20686-002	7	6.20	2.83	8.57	37.20%
OC-SD-ISCO.2-XXX	20686-003	3	0.89	0.00	1.67	94.37%

Total Juveniles/Female Statistical Analysis

			Statistically Significant (less than) as Compared to		
Field ID	ESI Code	Mean	Lab Control (20686-000)	SDBK-002 (20686-001)	MMB-SW/SD (20686-002)
Laboratory Control	20686-000	8.52	-	-	-
OC-SD-SDBK-002-XXX	20686-001	4.68	Yes	-	-
OC-SD-MMB-SW/SD-1-XXX	20686-002	6.20	No	-	-
OC-SD-ISCO.2-XXX	20686-003	0.89	Yes	Yes	Yes

*Note: The endpoint described here as "Total *Hyalella azteca* Juvenile Production per Female Amphipod " is the equivalent to the CETIS endpoint identified as "42d Reproduction per Female ".
It is calculated as: day 35 + day 42 juveniles / day 42 females

Table 18. Summary of Overlying Water Qualities. *Hyalella azteca* Chronic Exposure Sediment Evaluation. South Ditch, Olin Chemical Superfund Site, Wilmington, Massachusetts. June 2011.

Field ID	Sample Number	Day	Conductivity (uS/cm)	Alkalinity (mg/L)	Hardness (mg/L)	Ammonia (mg/L)
Laboratory Control Sample	000	0	354	73	100	<0.1
OC-SD-SDBK-002-XXX	001	0	325	58	82	<0.1
OC-SD-MMB-SW/SD-1-XXX	002	0	323	52	78	<0.1
OC-SD-ISCO.2-XXX	003	0	355	41	91	0.11
Laboratory Control Sample	000	7	332	66	92	<0.1
OC-SD-SDBK-002-XXX	001	7	319	61	84	<0.1
OC-SD-MMB-SW/SD-1-XXX	002	7	306	52	77	<0.1
OC-SD-ISCO.2-XXX	003	7	314	48	82	<0.1
Laboratory Control Sample	000	14	350	70	90	<0.1
OC-SD-SDBK-002-XXX	001	14	328	66	85	<0.1
OC-SD-MMB-SW/SD-1-XXX	002	14	313	55	79	<0.1
OC-SD-ISCO.2-XXX	003	14	315	53	80	<0.1
Laboratory Control Sample	000	21	345	67	91	<0.1
OC-SD-SDBK-002-XXX	001	21	342	64	90	<0.1
OC-SD-MMB-SW/SD-1-XXX	002	21	321	53	78	<0.1
OC-SD-ISCO.2-XXX	003	21	323	55	82	<0.1
Laboratory Control Sample	000	28	346	62	81	<0.1
OC-SD-SDBK-002-XXX	001	28	329	55	79	<0.1
OC-SD-MMB-SW/SD-1-XXX	002	28	315	51	74	<0.1
OC-SD-ISCO.2-XXX	003	28	321	55	75	<0.1
Laboratory Control Sample	000	35	431	59	88	0.32
OC-SD-SDBK-002-XXX	001	35	396	56	89	0.31
OC-SD-MMB-SW/SD-1-XXX	002	35	398	57	89	0.29
OC-SD-ISCO.2-XXX	003	35	383	54	88	0.11
Laboratory Control Sample	000	42	371	60	84	0.35
OC-SD-SDBK-002-XXX	001	42	363	59	82	<0.1
OC-SD-MMB-SW/SD-1-XXX	002	42	346	60	80	<0.1
OC-SD-ISCO.2-XXX	003	42	335	57	79	<0.1

Additional water quality data are provided in Appendix A.

APPENDIX A:
RAW DATA & STATISTICAL SUPPORT

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Hyalella azteca
42 Day Sediment Assay (page 1 of 2)

Study Number: 20801	Client: MACTEC Engineering & Consulting, Inc.	Project: Olin Site

Day	Date	Renew/Feed	Initial
0	04/06/11	✓/✓	AM/JTP
1	04/07/11	✓/✓	JTP
2	04/08/11	✓/✓	JTP/AM
3	4/9/11	✓/✓	SJ
4	4-10-11	✓/✓	DM
5	4/11/11	✓/✓	JTP
6	4/12/11	✓/✓	JTP/AM
7	4/13/11	✓/✓	AM
8	4/14/11	✓/✓	JTP/AM
9	4/15/11	✓/✓	JTP
10	4.16	✓/✓	DM
11	4/17/11	✓/✓	AM
12	4/18/11	✓/✓	JTP
13	4/19/11	✓/✓	AM/JTP
14	4/20/11	✓/✓	AM/JTP
15	4/21/11	✓/✓	AM/JTP
16	4/22/11	✓/✓	AM
17	4/23/11	✓/✓	SJ
18	4-24-11	✓/✓	DM
19	4/25/11	✓/✓	AM
20	4/26/11	✓/✓	AM/JTP
21	4/27/11	✓/✓	AM
22	4/28/11	✓/✓	AM
23	4/29/11	✓/✓	JTP/AM
24	4/30/11	✓/✓	LB/ES
25	5-1-11	✓/✓	DM
26	5/2/11	✓/✓	AM
27	5/3/11	✓/✓	AM
28	5/4/11	✓/✓	AM

Overlying Water: Alkalinity, Hardness & Ammonia on Days 0, 7, 14, 21 and 28 TOC on Days 0 and 28		
	Day 0	Initial: AM/JTP
	Day 7	Initial: AM
	Day 14	Initial: AM
	Day 21	Initial: AM
	Day 28	Initial: AM/JTP

Notes: 23 °C	Feed 1 mL of YCT food mixture	Aerate if DO is below 2.5 mg/L	Two Volume Additions Daily

Hyalella azteca
42 Day Sediment Assay (page 2 of 2)

Study Number: 20801	Client: MACTEC Engineering & Consulting, Inc.	Project: Olin Site	
Day	**Date**	**Renew/Feed**	**Initial**
29	5/5/11	✓/✓	JTP/AM
30	5/6/11	✓/✓	JTP
31	5/7/11	✓/✓	SJ
32	5-8-11	✓/✓	DM
33	5/9/11	✓/✓	JTP
34	5/10/11	✓/✓	JTP
35	5/11/11	✓/✓	JTP/AM
36	5/12/11	✓/✓	JTP/AM
37	5/13/11	✓/✓	JTP
38	5/14/11	✓/✓	SJ
39	5/15/11	✓/✓	AM
40	5/16/11	✓/✓	JTP
41	5/17/11	✓/✓	JTP/AM
42	5/18/11	✓/✓	AM/JTP
Overlying Water: Alkalinity, Hardness & Ammonia on Days 35 and 42		**Day 35**	**Initial:** AM
		Day 42	**Initial:** AM
Notes: 23 °C	**Feed 1 mL of YCT food mixture**	**Aerate if DO is below 2.5 mg/L**	**Two Volume Additions Daily**

D.O.s in Lab surrogate vessel dropped below 2.5 mg/L on 04/28/11 AM. Aeration was added to all test vessels. Beaker tipped over in water bath during Day 35 counts. What could be recovered from positions 1-4 was counted. AM 05/11/11

YSI 556 MPS Sample Reading Order

Study: 20801

Client: MACTEC
Engineering & Consulting, Inc.

Project: Olin Site

Reading Number	Field ID	Receipt Number	Sample Number
0	Laboratory Control	20686-000	000
1	OC-SD-SDBK-002-XXX	20686-001	001
2	OC-SD-MMB-SW/SD-1-XXX	20686-002	002
3	OC-SD-ISCO.2-XXX	20686-003	003

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Daily Overlying Water Qualities

	Temp	DO Conc	pH	SpCond	Salinity
Minimum:	22.38	2.06	6.54	279	0.13
Mean:	22.82	6.74		362	0.17
Maximum:	23.42	8.67	8.24	1344	0.67

Field ID	Sample Number	Day	DateTime M/D/Y	Temp C	DO Conc mg/L	pH SU	SpCond uS/cm	Salinity ppt
Laboratory Control Sample	000	0	04/06/11 11:42:19	23.00	6.50	6.83	354	0.17
OC-SD-SDBK-002-XXX	001	0	04/06/11 11:43:49	22.93	6.54	7.07	325	0.15
OC-SD-MMB-SW/SD-1-XXX	002	0	04/06/11 11:44:03	22.94	6.70	7.08	323	0.15
OC-SD-ISCO.2-XXX	003	0	04/06/11 11:44:42	22.96	6.16	6.96	355	0.17
Laboratory Control Sample	000	1	04/07/11 11:00:18	23.10	5.89	6.83	348	0.17
OC-SD-SDBK-002-XXX	001	1	04/07/11 11:02:14	23.13	6.25	7.02	327	0.16
OC-SD-MMB-SW/SD-1-XXX	002	1	04/07/11 11:02:46	23.12	6.46	7.04	318	0.15
OC-SD-ISCO.2-XXX	003	1	04/07/11 11:03:37	23.15	5.92	6.93	337	0.16
Laboratory Control Sample	000	2	04/08/11 11:08:39	22.91	6.14	7.24	337	0.16
OC-SD-SDBK-002-XXX	001	2	04/08/11 11:10:32	22.87	6.45	7.16	315	0.15
OC-SD-MMB-SW/SD-1-XXX	002	2	04/08/11 11:11:16	22.89	6.43	7.11	305	0.14
OC-SD-ISCO.2-XXX	003	2	04/08/11 11:12:15	22.88	5.94	7.01	323	0.15
Laboratory Control Sample	000	3	04/09/11 13:51:14	22.93	6.21	7.10	311	0.15
OC-SD-SDBK-002-XXX	001	3	04/09/11 13:53:36	22.88	6.14	7.02	290	0.14
OC-SD-MMB-SW/SD-1-XXX	002	3	04/09/11 13:54:05	22.87	6.22	7.01	279	0.13
OC-SD-ISCO.2-XXX	003	3	04/09/11 13:54:49	22.85	6.03	6.97	294	0.14
Laboratory Control Sample	000	4	04/10/11 14:02:48	23.07	6.69	7.30	333	0.16
OC-SD-SDBK-002-XXX	001	4	04/10/11 14:05:01	22.92	6.48	7.11	311	0.15
OC-SD-MMB-SW/SD-1-XXX	002	4	04/10/11 14:05:26	22.92	6.48	7.10	300	0.14
OC-SD-ISCO.2-XXX	003	4	04/10/11 14:05:56	22.92	6.14	7.02	315	0.15
Laboratory Control Sample	000	5	04/11/11 11:20:52	23.09	5.64	6.71	337	0.16
OC-SD-SDBK-002-XXX	001	5	04/11/11 11:23:10	23.09	5.95	7.00	319	0.15
OC-SD-MMB-SW/SD-1-XXX	002	5	04/11/11 11:23:44	23.11	6.31	7.08	309	0.15
OC-SD-ISCO.2-XXX	003	5	04/11/11 11:24:36	23.11	5.59	6.99	320	0.15
Laboratory Control Sample	000	6	04/12/11 07:29:39	23.42	5.14	7.07	323	0.15
OC-SD-SDBK-002-XXX	001	6	04/12/11 07:32:21	23.40	5.82	7.02	312	0.15
OC-SD-MMB-SW/SD-1-XXX	002	6	04/12/11 07:32:47	23.42	5.94	7.08	303	0.14
OC-SD-ISCO.2-XXX	003	6	04/12/11 07:33:33	23.42	5.21	6.94	310	0.15
Laboratory Control Sample	000	7	04/13/11 10:51:57	23.06	3.66	6.76	332	0.16
OC-SD-SDBK-002-XXX	001	7	04/13/11 10:55:11	23.07	5.67	7.10	319	0.15
OC-SD-MMB-SW/SD-1-XXX	002	7	04/13/11 10:56:06	23.11	5.88	7.11	306	0.15
OC-SD-ISCO.2-XXX	003	7	04/13/11 10:56:59	23.08	5.39	7.05	314	0.15
Laboratory Control Sample	000	8	04/14/11 10:12:37	23.12	4.72	6.99	339	0.16
OC-SD-SDBK-002-XXX	001	8	04/14/11 10:15:16	23.09	6.64	7.36	325	0.15

Field ID	Sample Number	Day	DateTime M/D/Y	Temp C	DO Conc mg/L	pH SU	SpCond uS/cm	Salinity ppt
OC-SD-MMB-SW/SD-1-XXX	002	8	04/14/11 10:15:53	23.09	6.46	7.24	313	0.15
OC-SD-ISCO.2-XXX	003	8	04/14/11 10:16:44	23.08	5.92	7.10	320	0.15
Laboratory Control Sample	000	9	04/15/11 11:07:17	22.91	2.89	6.89	345	0.16
OC-SD-SDBK-002-XXX	001	9	04/15/11 11:09:56	22.84	6.18	7.42	331	0.16
OC-SD-MMB-SW/SD-1-XXX	002	9	04/15/11 11:10:15	22.81	6.09	7.37	316	0.15
OC-SD-ISCO.2-XXX	003	9	04/15/11 11:11:11	22.81	5.40	7.15	323	0.15
Laboratory Control Sample	000	10	04/16/11 10:49:41	23.08	4.01	6.97	325	0.15
OC-SD-SDBK-002-XXX	001	10	04/16/11 10:53:04	22.90	6.02	7.39	312	0.15
OC-SD-MMB-SW/SD-1-XXX	002	10	04/16/11 10:54:03	22.92	6.02	7.27	298	0.14
OC-SD-ISCO.2-XXX	003	10	04/16/11 10:54:59	22.90	5.06	7.11	302	0.14
Laboratory Control Sample	000	11	04/17/11 10:05:07	23.20	3.66	6.62	388	0.19
OC-SD-SDBK-002-XXX	001	11	04/17/11 10:06:14	23.15	6.22	7.15	329	0.16
OC-SD-MMB-SW/SD-1-XXX	002	11	04/17/11 10:06:26	23.16	6.04	7.17	313	0.15
OC-SD-ISCO.2-XXX	003	11	04/17/11 10:06:38	23.18	5.84	7.13	317	0.15
Laboratory Control Sample	000	12	04/18/11 11:08:10	22.98	3.84	7.06	348	0.17
OC-SD-SDBK-002-XXX	001	12	04/18/11 11:11:19	22.79	6.00	7.44	329	0.16
OC-SD-MMB-SW/SD-1-XXX	002	12	04/18/11 11:11:58	22.80	5.97	7.33	310	0.15
OC-SD-ISCO.2-XXX	003	12	04/18/11 11:12:52	22.80	5.10	7.15	314	0.15
Laboratory Control Sample	000	13	04/19/11 10:46:37	23.05	3.73	6.54	348	0.17
OC-SD-SDBK-002-XXX	001	13	04/19/11 10:47:48	22.92	6.49	7.17	330	0.16
OC-SD-MMB-SW/SD-1-XXX	002	13	04/19/11 10:47:58	22.92	6.14	7.19	314	0.15
OC-SD-ISCO.2-XXX	003	13	04/19/11 10:48:07	22.92	6.03	7.15	317	0.15
Laboratory Control Sample	000	14	04/20/11 06:25:49	22.72	4.03	6.71	350	0.17
OC-SD-SDBK-002-XXX	001	14	04/20/11 06:29:15	22.62	6.23	7.37	328	0.16
OC-SD-MMB-SW/SD-1-XXX	002	14	04/20/11 06:29:43	22.58	6.27	7.33	313	0.15
OC-SD-ISCO.2-XXX	003	14	04/20/11 06:30:44	22.56	5.13	7.18	315	0.15
Laboratory Control Sample	000	15	04/21/11 06:46:11	22.72	3.32	6.98	344	0.16
OC-SD-SDBK-002-XXX	001	15	04/21/11 06:47:41	22.63	5.62	7.31	332	0.16
OC-SD-MMB-SW/SD-1-XXX	002	15	04/21/11 06:47:55	22.65	5.55	7.31	315	0.15
OC-SD-ISCO.2-XXX	003	15	04/21/11 06:48:06	22.65	5.57	7.28	320	0.15
Laboratory Control Sample	000	16	04/22/11 06:53:35	22.47	3.67	6.91	342	0.16
OC-SD-SDBK-002-XXX	001	16	04/22/11 06:55:02	22.38	6.85	7.46	332	0.16
OC-SD-MMB-SW/SD-1-XXX	002	16	04/22/11 06:55:23	22.42	6.22	7.40	312	0.15
OC-SD-ISCO.2-XXX	003	16	04/22/11 06:56:05	22.42	5.27	7.23	316	0.15
Laboratory Control Sample	000	17	04/23/11 10:01:39	22.62	3.16	6.56	318	0.15
OC-SD-SDBK-002-XXX	001	17	04/23/11 10:07:05	22.57	6.58	7.34	307	0.15
OC-SD-MMB-SW/SD-1-XXX	002	17	04/23/11 10:07:30	22.58	6.27	7.24	287	0.14
OC-SD-ISCO.2-XXX	003	17	04/23/11 10:08:21	22.60	5.77	7.05	291	0.14
Laboratory Control Sample	000	18	04/24/11 10:18:40	22.93	4.45	7.20	365	0.17
OC-SD-SDBK-002-XXX	001	18	04/24/11 10:20:49	22.79	5.98	7.35	348	0.17
OC-SD-MMB-SW/SD-1-XXX	002	18	04/24/11 10:21:20	22.81	6.43	7.32	324	0.15
OC-SD-ISCO.2-XXX	003	18	04/24/11 10:22:06	22.80	5.93	7.19	323	0.15
Laboratory Control Sample	000	19	04/25/11 12:05:19	22.73	3.85	6.96	355	0.17

Field ID	Sample Number	Day	DateTime M/D/Y	Temp C	DO Conc mg/L	pH SU	SpCond uS/cm	Salinity ppt
OC-SD-SDBK-002-XXX	001	19	04/25/11 12:06:33	22.67	6.49	7.31	343	0.16
OC-SD-MMB-SW/SD-1-XXX	002	19	04/25/11 12:06:46	22.72	6.30	7.31	323	0.15
OC-SD-ISCO.2-XXX	003	19	04/25/11 12:07:01	22.71	6.31	7.28	326	0.16
Laboratory Control Sample	000	20	04/26/11 11:56:04	22.96	2.90	7.05	388	0.19
OC-SD-SDBK-002-XXX	001	20	04/26/11 11:59:05	22.98	6.24	7.55	373	0.18
OC-SD-MMB-SW/SD-1-XXX	002	20	04/26/11 12:00:17	23.01	6.85	7.46	359	0.17
OC-SD-ISCO.2-XXX	003	20	04/26/11 12:01:05	22.98	6.40	7.35	366	0.17
Laboratory Control Sample	000	21	04/27/11 11:58:32	22.90	3.16	6.97	345	0.16
OC-SD-SDBK-002-XXX	001	21	04/27/11 11:59:31	22.94	5.95	7.33	342	0.16
OC-SD-MMB-SW/SD-1-XXX	002	21	04/27/11 11:59:41	22.96	5.99	7.35	321	0.15
OC-SD-ISCO.2-XXX	003	21	04/27/11 11:59:52	22.98	6.07	7.34	323	0.15
Laboratory Control Sample	000	22	04/28/11 10:26:13	23.18	2.06	6.81	330	0.16
OC-SD-SDBK-002-XXX	001	22	04/28/11 10:27:46	23.14	7.03	7.39	324	0.15
OC-SD-MMB-SW/SD-1-XXX	002	22	04/28/11 10:28:01	23.16	6.68	7.38	310	0.15
OC-SD-ISCO.2-XXX	003	22	04/28/11 10:28:24	23.18	6.27	7.31	313	0.15
Laboratory Control Sample	000	23	04/29/11 12:02:11	22.93	7.53	7.43	349	0.17
OC-SD-SDBK-002-XXX	001	23	04/29/11 12:04:00	22.81	8.05	7.58	328	0.16
OC-SD-MMB-SW/SD-1-XXX	002	23	04/29/11 12:04:22	22.81	8.15	7.60	314	0.15
OC-SD-ISCO.2-XXX	003	23	04/29/11 12:05:11	22.90	8.24	7.61	314	0.15
Laboratory Control Sample	000	24	04/30/11 09:51:03	22.74	7.26	7.10	368	0.18
OC-SD-SDBK-002-XXX	001	24	04/30/11 09:52:08	22.70	7.36	7.50	344	0.16
OC-SD-MMB-SW/SD-1-XXX	002	24	04/30/11 09:52:27	22.68	7.45	7.59	331	0.16
OC-SD-ISCO.2-XXX	003	24	04/30/11 09:53:04	22.63	7.52	7.70	317	0.15
Laboratory Control Sample	000	25	05/01/11 13:37:09	22.90	7.89	7.54	360	0.17
OC-SD-SDBK-002-XXX	001	25	05/01/11 13:38:31	22.70	8.03	7.61	333	0.16
OC-SD-MMB-SW/SD-1-XXX	002	25	05/01/11 13:38:55	22.73	7.97	7.61	324	0.15
OC-SD-ISCO.2-XXX	003	25	05/01/11 13:39:37	22.81	7.80	7.63	353	0.17
Laboratory Control Sample	000	26	05/02/11 08:36:18	22.88	7.25	6.67	332	0.16
OC-SD-SDBK-002-XXX	001	26	05/02/11 08:37:35	22.87	7.70	7.18	304	0.14
OC-SD-MMB-SW/SD-1-XXX	002	26	05/02/11 08:37:50	22.88	7.85	7.28	298	0.14
OC-SD-ISCO.2-XXX	003	26	05/02/11 08:38:01	22.93	7.89	7.32	307	0.15
Laboratory Control Sample	000	27	05/03/11 11:29:17	23.00	7.68	6.79	375	0.18
OC-SD-SDBK-002-XXX	001	27	05/03/11 11:30:56	22.92	8.08	7.40	327	0.16
OC-SD-MMB-SW/SD-1-XXX	002	27	05/03/11 11:31:29	22.95	8.20	7.50	317	0.15
OC-SD-ISCO.2-XXX	003	27	05/03/11 11:32:15	23.00	8.22	7.52	324	0.15
Laboratory Control Sample	000	28	05/04/11 07:49:23	23.01	7.19	6.92	346	0.16
OC-SD-SDBK-002-XXX	001	28	05/04/11 07:50:19	22.91	7.47	7.27	329	0.16
OC-SD-MMB-SW/SD-1-XXX	002	28	05/04/11 07:50:32	22.92	7.61	7.37	315	0.15
OC-SD-ISCO.2-XXX	003	28	05/04/11 07:50:42	22.95	7.68	7.43	321	0.15
Laboratory Control Sample	000	29	05/05/11 10:29:26	22.89	7.74	6.81	345	0.16
OC-SD-SDBK-002-XXX	001	29	05/05/11 10:30:23	22.92	7.72	7.19	326	0.15
OC-SD-MMB-SW/SD-1-XXX	002	29	05/05/11 10:30:56	22.92	7.78	7.36	321	0.15
OC-SD-ISCO.2-XXX	003	29	05/05/11 10:31:14	22.93	7.85	7.43	325	0.15

Field ID	Sample Number	Day	DateTime M/D/Y	Temp C	DO Conc mg/L	pH SU	SpCond uS/cm	Salinity ppt
Laboratory Control Sample	000	30	05/06/11 10:55:38	22.51	7.24	6.60	354	0.17
OC-SD-SDBK-002-XXX	001	30	05/06/11 10:57:03	22.56	7.65	7.21	328	0.16
OC-SD-MMB-SW/SD-1-XXX	002	30	05/06/11 10:57:26	22.56	7.81	7.35	325	0.15
OC-SD-ISCO.2-XXX	003	30	05/06/11 10:57:54	22.57	7.83	7.44	322	0.15
Laboratory Control Sample	000	31	05/07/11 14:07:59	22.79	8.22	6.94	319	0.15
OC-SD-SDBK-002-XXX	001	31	05/07/11 14:10:12	22.78	8.67	7.57	306	0.15
OC-SD-MMB-SW/SD-1-XXX	002	31	05/07/11 14:10:35	22.81	8.61	7.59	302	0.14
OC-SD-ISCO.2-XXX	003	31	05/07/11 14:10:54	22.82	8.66	7.59	300	0.14
Laboratory Control Sample	000	32	05/08/11 12:13:05	22.88	7.99	7.86	339	0.16
OC-SD-SDBK-002-XXX	001	32	05/08/11 12:14:13	22.87	7.90	7.85	333	0.16
OC-SD-MMB-SW/SD-1-XXX	002	32	05/08/11 12:14:26	22.87	7.93	7.86	330	0.16
OC-SD-ISCO.2-XXX	003	32	05/08/11 12:14:40	22.87	7.95	7.85	325	0.15
Laboratory Control Sample	000	33	05/09/11 11:21:54	22.60	7.86	7.19	361	0.17
OC-SD-SDBK-002-XXX	001	33	05/09/11 11:23:06	22.69	8.10	7.53	334	0.16
OC-SD-MMB-SW/SD-1-XXX	002	33	05/09/11 11:23:34	22.69	8.21	7.63	332	0.16
OC-SD-ISCO.2-XXX	003	33	05/09/11 11:23:57	22.69	8.25	7.66	327	0.16
Laboratory Control Sample	000	34	05/10/11 08:27:00	22.48	7.81	7.19	589	0.29
OC-SD-SDBK-002-XXX	001	34	05/10/11 08:29:00	22.59	8.08	7.64	577	0.28
OC-SD-MMB-SW/SD-1-XXX	002	34	05/10/11 08:29:33	22.58	8.15	7.71	565	0.27
OC-SD-ISCO.2-XXX	003	34	05/10/11 08:30:05	22.57	8.18	7.72	579	0.28
Laboratory Control Sample	000	35	05/11/11 07:23:14	22.51	7.63	7.08	431	0.21
OC-SD-SDBK-002-XXX	001	35	05/11/11 07:24:33	22.60	7.92	7.57	396	0.19
OC-SD-MMB-SW/SD-1-XXX	002	35	05/11/11 07:25:10	22.57	8.02	7.67	398	0.19
OC-SD-ISCO.2-XXX	003	35	05/11/11 07:25:34	22.57	8.05	7.70	383	0.18
Laboratory Control Sample	000	36	05/12/11 10:48:18	22.49	8.16	7.21	344	0.16
OC-SD-SDBK-002-XXX	001	36	05/12/11 10:49:12	22.49	8.14	7.46	433	0.21
OC-SD-MMB-SW/SD-1-XXX	002	36	05/12/11 10:49:31	22.48	8.15	7.49	427	0.20
OC-SD-ISCO.2-XXX	003	36	05/12/11 10:49:44	22.50	8.16	7.53	468	0.22
Laboratory Control Sample	000	37	05/13/11 08:36:44	22.49	8.01	7.01	901	0.44
OC-SD-SDBK-002-XXX	001	37	05/13/11 08:38:12	22.46	8.13	7.50	1344	0.67
OC-SD-MMB-SW/SD-1-XXX	002	37	05/13/11 08:38:37	22.41	8.20	7.66	375	0.18
OC-SD-ISCO.2-XXX	003	37	05/13/11 08:38:56	22.42	8.16	7.61	1134	0.56
Laboratory Control Sample	000	38	05/14/11 13:42:12	22.42	8.21	8.16	914	0.45
OC-SD-SDBK-002-XXX	001	38	05/14/11 13:44:48	22.50	8.43	8.04	717	0.35
OC-SD-MMB-SW/SD-1-XXX	002	38	05/14/11 13:45:33	22.51	8.45	8.01	442	0.21
OC-SD-ISCO.2-XXX	003	38	05/14/11 13:46:02	22.55	8.40	7.98	439	0.21
Laboratory Control Sample	000	39	05/15/11 08:50:34	22.65	8.18	7.05	358	0.17
OC-SD-SDBK-002-XXX	001	39	05/15/11 08:52:03	22.64	8.15	7.38	428	0.21
OC-SD-MMB-SW/SD-1-XXX	002	39	05/15/11 08:52:20	22.65	8.20	7.44	358	0.17
OC-SD-ISCO.2-XXX	003	39	05/15/11 08:52:32	22.66	8.23	7.48	365	0.17
Laboratory Control Sample	000	40	05/16/11 11:35:43	22.62	8.25	8.24	456	0.22
OC-SD-SDBK-002-XXX	001	40	05/16/11 11:37:18	22.58	8.23	8.02	409	0.20
OC-SD-MMB-SW/SD-1-XXX	002	40	05/16/11 11:37:49	22.55	8.19	7.98	384	0.18
OC-SD-ISCO.2-XXX	003	40	05/16/11 11:38:25	22.58	8.16	7.93	394	0.19

Field ID	Sample Number	Day	DateTime M/D/Y	Temp C	DO Conc mg/L	pH SU	SpCond uS/cm	Salinity ppt
Laboratory Control Sample	000	41	05/17/11 12:09:52	22.67	8.23	6.90	390	0.19
OC-SD-SDBK-002-XXX	001	41	05/17/11 12:10:47	22.70	8.06	7.22	365	0.17
OC-SD-MMB-SW/SD-1-XXX	002	41	05/17/11 12:11:00	22.67	8.19	7.27	357	0.17
OC-SD-ISCO.2-XXX	003	41	05/17/11 12:11:13	22.68	8.18	7.34	348	0.17
Laboratory Control Sample	000	42	05/18/11 11:48:00	22.49	8.08	7.49	371	0.18
OC-SD-SDBK-002-XXX	001	42	05/18/11 11:49:18	22.52	8.16	7.78	363	0.17
OC-SD-MMB-SW/SD-1-XXX	002	42	05/18/11 11:49:48	22.51	8.18	7.83	346	0.17
OC-SD-ISCO.2-XXX	003	42	05/18/11 11:50:12	22.52	8.22	7.83	335	0.16

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

Start Date: 04 Mar-11 12:00 **Species:** Hyalella azteca **Sample Code:** 000
End Date: 15 Apr-11 12:00 **Protocol:** EPA/600/R-99/064 (2000) **Sample Source:** Olin Project Site
Sample Date: 01 Mar-11 **Material:** Laboratory Control Sediment **Sample Station:** Laboratory Control; 20686-000

Conc-NA	Rep	Pos	Exposed	Survivd	Survivd	Survivd	Total Weight-d	Tare Weight-d	Pan Cou	Total Weight-	Tare Weight-	42d Pan Count	# Females
001	1	1						0			0		0
000	1	2						0			0		0
003	1	3						0			0		0
002	1	4						0			0		0
000	2	5						0			0		0
002	2	6						0			0		0
003	2	7						0			0		0
001	2	8						0			0		0
000	3	9						0			0		0
002	3	10						0			0		0
003	3	11						0			0		0
001	3	12						0			0		0
001	4	13						0			0		0
002	4	14						0			0		0
003	4	15						0			0		0
000	4	16						0			0		0
002	5	17						0			0		0
000	5	18						0			0		0
003	5	19						0			0		0
001	5	20						0			0		0
002	6	21						0			0		0
000	6	22						0			0		0
001	6	23						0			0		0
003	6	24						0			0		0
003	7	25						0			0		0
000	7	26						0			0		0
001	7	27						0			0		0
002	7	28						0			0		0
000	8	29						0			0		0
002	8	30						0			0		0
003	8	31						0			0		0
001	8	32						0			0		0
002	9	33						0			0		0
003	9	34						0			0		0
001	9	35						0			0		0
000	9	36						0			0		0
000	10	37						0			0		0
002	10	38						0			0		0
001	10	39						0			0		0
003	10	40						0			0		0
002	11	41						0			0		0
003	11	42						0			0		0
000	11	43						0			0		0
001	11	44						0			0		0
001	12	45						0			0		0
002	12	46						0			0		0
000	12	47						0			0		0

Conc-NA	Rep	Pos	Exposed	Survivd	Survivd	Survivd	Total Weight-d	Tare Weight-d	Pan Cou	Total Weight-	Tare Weight-	42d Pan Count	# Females
003	12	48						0			0		0

Hyalella azteca Sediment Evaluation
Initial Weight

STUDY: 20801 **CLIENT:** MACTEC Engineering & Consulting, Inc.

PROJECT: Olin Site **START DATE:** 04/06/11

	REP	TARE WEIGHT (mg)	*H. azteca*+ FOIL (mg)	NET WEIGHT (mg)	# *H. azteca*	MEAN DRY WEIGHT PER Individual (mg)
START ORGANISMS	A	209.38	209.63	0.25	10	0.025
	B	207.77	207.95	0.18	10	0.018
	C	208.60	208.97	0.37	10	0.037
	D	207.09	207.32	0.23	10	0.023
RECORDED BY:		AM	AM	Overall Mean Dry Weight Per Individual:		
DATE:		04/07/11	04/08/11	0.02575		

NOTES: Start organisms preserved with formalin on 04/06/11 and prepped for weights on 04/07/11 AM 04/08/11

Hyalella azteca Day 28

STUDY NUMBER: 20686 **PROJECT:** Olin Site, Massachusetts

DATE: 05/04/11 **CLIENT:** MACTEC Engineering & Consulting, Inc.

Sample Code	Rep	Pos	Survived	Initials
001	1	1	9	AM
000	1	2	8	RAM
003	1	3	4	AM
002	1	4	8	AM
000	2	5	9	RAM
002	2	6	10	AM
003	2	7	6	AM
001	2	8	10	AM
000	3	9	9	RAM
002	3	10	10	AM
003	3	11	2	AM
001	3	12	9	AM
001	4	13	10	AM
002	4	14	10	AM
003	4	15	8	AM
000	4	16	10	RAM
002	5	17	10	AM
000	5	18	10	RAM
003	5	19	2	AM
001	5	20	8	AM
002	6	21	8	AM
000	6	22	9	RAM
001	6	23	10	AM
003	6	24	4 3 5/4	AM
003	7	25	6 3 5/4	AM
000	7	26	7	RAM
001	7	27	10	AM
002	7	28	10	AM
000	8	29	10	RAM
002	8	30	10	↑
003	8	31	3	JTP
001	8	32	10	↓
002	9	33	10	↓
003	9	34	5	↓
001	9	35	10	↓
000	9	36	10	RAM
000	10	37	10	↓
002	10	38	9	JTP
001	10	39	10	↓
003	10	40	5	↓

Hyalella azteca Day 28

STUDY NUMBER: 20686 **PROJECT: Olin Site, Massachusetts**

DATE: 05/04/11 **CLIENT: MACTEC Engineering & Consulting, Inc.**

Sample Code	Rep	Pos	Survived	Initials
002	11	41	10	JTP
003	11	42	3	↓
000	11	43	10	RAM
001	11	44	11	JTP
001	12	45	9	↓
002	12	46	9	↓
000	12	47	10	RAM
003	12	48	2	JTP

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Dry Weight Data - AccuSeries Balance Output File

Date/Init:			05/05/11 RAM	05/04/11 JTP	Duplicates	
Sample	**Rep.**	**Pos.**	**Total Wt (mg)**	**Tare Wt (mg)**	**Total Wt (mg)**	**Tare Wt (mg)**
000	9	36	218.18	210.15		
000	10	37	213.39	205.06		
000	11	43	217.00	209.03		
000	12	47	214.79	205.53		
001	9	35	208.40	204.59	208.38	
001	10	39	214.46	210.88		
001	11	44	214.38	210.51		
001	12	45	214.66	211.36		
002	9	33	210.42	205.43		
002	10	38	209.70	206.28		
002	11	41	209.77	205.22		
002	12	46	211.90	207.46		
003	9	34	208.68	207.80		
003	10	40	206.73	205.92		
003	11	42	210.78	210.32		
003	12	48	208.68	208.12		208.12

Hyalella azteca Day 35 Counts

STUDY NUMBER: 20686 **PROJECT: Olin Site, Massachusetts**

DATE: 05/11/11 **CLIENT: MACTEC Engineering & Consulting, Inc.**

Sample Code	Rep	Pos	Adult Count	Juvenile Count	Initials
001	1	1	2 *	1	JTP
000	1	2	0 *	0	
003	1	3	0 *	0	
002	1	4	8 *	13	
000	2	5	8	1	
002	2	6	10	7	
003	2	7	6	0	
001	2	8	10	4	
000	3	9	8	9	
002	3	10	10	13	
003	3	11	2	0	
001	3	12	8	6	
001	4	13	10	7	
002	4	14	9	5	
003	4	15	6	0	
000	4	16	10	18	
002	5	17	10	16	
000	5	18	10	7	
003	5	19	1	0	
001	5	20	8	5	
002	6	21	8	12	
000	6	22	9	9	
001	6	23	10	1	
003	6	24	4	0	
003	7	25	5	0	
000	7	26	6	4	
001	7	27	10	5	
002	7	28	10	12	
000	8	29	10	5	
002	8	30	8	4	
003	8	31	3	0	
001	8	32	10	7	

* Beakers tipped over, all that was recovered. 05/11/11 AM/JTP

Hyalella azteca Day 42 Counts

STUDY NUMBER: 20686 **PROJECT: Olin Site, Massachusetts**

DATE: 05/18/11 **CLIENT: MACTEC Engineering & Consulting, Inc.**

Sample Code	Rep	Pos	Adult Count	Juvenile Count	Female Count	Initials
001	1	1	2	5	1	RAM
000	1	2	0	2	-	
003	1	3	0	0	-	
002	1	4	8	27	6	
000	2	5	8	11	3	
002	2	6	9	31	5	
003	2	7	6	5	3	
001	2	8	10	35	7	
000	3	9	8	22	5	
002	3	10	10	47	7	
003	3	11	2	0	1	
001	3	12	8	9	5	
001	4	13	10	56	9	
002	4	14	9	12	6	
003	4	15	6	1	1	
000	4	16	9	33	5	
002	5	17	10	41	8	
000	5	18	10	12	3	
003	5	19	1	4	0	
001	5	20	8	24	6	
002	6	21	7	25	5	
000	6	22	9	45	4	
001	6	23	10	11	5	
003	6	24	4	0	1	
003	7	25	4	0	2	
000	7	26	6	2	1	
001	7	27	8	14	5	
002	7	28	10	29	6	
000	8	29	10	62	5	
002	8	30	8	5	3	
003	8	31	3	1	3	
001	8	32	10	30	6	

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Dry Weight Data - AccuSeries Balance Output File

Date/Init:			05/19/11 RAM	05/17/11 JTP	Duplicates	
Sample	**Rep.**	**Pos.**	**Total Wt (mg)**	**Tare Wt (mg)**	**Total Wt (mg)**	**Tare Wt (mg)**
000	1	2		208.26		
000	2	5	217.70	210.12	217.71	
000	3	9	217.17	209.86		
000	4	16	214.87	206.60		
000	5	18	220.28	211.54		
000	6	22	217.85	211.02		
000	7	26	215.02	208.32		214.99
000	8	29	219.09	210.32		
001	1	1	211.78	210.27	211.79	
001	2	8	214.51	207.93	214.51	
001	3	12	214.39	209.56	214.40	
001	4	13	214.04	208.44		208.43
001	5	20	213.73	209.59		
001	6	23	215.24	208.21		
001	7	27	212.09	207.61	212.07	
001	8	32	213.20	207.41		
002	1	4	218.12	211.85		
002	2	6	214.68	208.79		
002	3	10	215.95	209.89		
002	4	14	214.57	208.39	214.57	
002	5	17	215.08	208.79		
002	6	21	215.85	210.85	215.87	
002	7	28	213.95	207.10		
002	8	30	211.78	206.66		
003	1	3		208.77		
003	2	7	211.46	207.93		
003	3	11	211.89	210.68		
003	4	15	215.26	212.06		
003	5	19	208.23	207.99		
003	6	24	212.79	210.79		
003	7	25	208.25	206.86		
003	8	31	207.23	206.31		206.30

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
000	01-3601-3005	01 Mar-11	01 Mar-11	84h	MACTEC	Ecological Risk Asse
001	02-1859-0695	17 Feb-11 11:30	17 Feb-11 16:00	15d 1h		
002	03-0917-9671	17 Feb-11 13:30	17 Feb-11 16:00	14d 22h		
003	20-3924-8060	17 Feb-11 09:40	17 Feb-11 16:00	15d 2h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
000	Laboratory Control S	Olin Project Site	Laboratory Control; 20686-000		
001	Freshwater Sediment	Olin Project Site	OC-SD-SDBK-002-XXX; 20686-00		
002	Freshwater Sediment	Olin Project Site	OC-SD-MMB-SW/SD-/-XXX; 2068 (OC-SD-MMB-SW/SD-1-XXX)		
003	Freshwater Sediment	Olin Project Site	OC-SD-ISCO.2-XXX; 20686-003		

Sample Code	vs	Sample Code	P-Value	Alpha	Decision	Analysis ID	Method
000		001	0.6647	0.05	Non-Significant Effect	19-1425-5631	Wilcoxon Rank Sum Two-Sample Test
		002	0.6224	0.05	Non-Significant Effect	20-6834-2507	Wilcoxon Rank Sum Two-Sample Test
		003	<0.0001	0.05	Significant Effect	11-5558-9809	Equal Variance t Two-Sample Test
001		003	<0.0001	0.05	Significant Effect	05-8463-9922	Equal Variance t Two-Sample Test
002		003	<0.0001	0.05	Significant Effect	12-0253-6904	Equal Variance t Two-Sample Test

Test Acceptability

Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
11-5558-9809	28d Proportion Survived	Control Resp	0.9333	0.8 - NL	Yes	Passes Acceptibility Criteria
19-1425-5631	28d Proportion Survived	Control Resp	0.9333	0.8 - NL	Yes	Passes Acceptibility Criteria
20-6834-2507	28d Proportion Survived	Control Resp	0.9333	0.8 - NL	Yes	Passes Acceptibility Criteria

28d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	0.9333	0.8966	0.9701	0.7	1	0.02843	0.09847	10.55%	0.0%
001	12	0.9583	0.9334	0.9833	0.8	1	0.0193	0.06686	6.98%	-2.68%
002	12	0.95	0.9202	0.9798	0.8	1	0.02303	0.07977	8.4%	-1.79%
003	12	0.4167	0.3458	0.4876	0.2	0.8	0.05482	0.1899	45.58%	55.36%

28d Proportion Survived Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.8	0.9	0.9	1	1	0.9	0.7	1	1	1
	1	1								
001	0.9	1	0.9	1	0.8	1	1	1	1	1
	1	0.9								
002	0.8	1	1	1	1	0.8	1	1	1	0.9
	1	0.9								
003	0.4	0.6	0.2	0.8	0.2	0.4	0.6	0.3	0.5	0.5
	0.3	0.2								

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
000	01-3601-3005	01 Mar-11	01 Mar-11	84h	MACTEC	Ecological Risk Asse
001	02-1859-0695	17 Feb-11 11:30	17 Feb-11 16:00	15d 1h		
002	03-0917-9671	17 Feb-11 13:30	17 Feb-11 16:00	14d 22h		
003	20-3924-8060	17 Feb-11 09:40	17 Feb-11 16:00	15d 2h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
000	Laboratory Control S	Olin Project Site	Laboratory Control; 20686-000		
001	Freshwater Sediment	Olin Project Site	OC-SD-SDBK-002-XXX; 20686-00		
002	Freshwater Sediment	Olin Project Site	OC-SD-MMB-SW/SD-/-XXX; 2068 (OC-SD-MMB-SW/SD-1-XXX)		
003	Freshwater Sediment	Olin Project Site	OC-SD-ISCO.2-XXX; 20686-003		

Sample Code	vs	Sample Code	P-Value	Alpha	Decision	Analysis ID	Method
000		001	0.8391	0.05	Non-Significant Effect	12-2366-1260	Equal Variance t Two-Sample Test
		001	0.7894	0.05	Non-Significant Effect	08-1520-6878	Equal Variance t Two-Sample Test
		002	0.7789	0.05	Non-Significant Effect	19-9991-2262	Equal Variance t Two-Sample Test
		002	0.7263	0.05	Non-Significant Effect	02-3053-2760	Equal Variance t Two-Sample Test
		003	0.0001	0.05	Significant Effect	17-8938-5613	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	03-7603-9558	Equal Variance t Two-Sample Test
001		003	<0.0001	0.05	Significant Effect	20-2107-1588	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	06-0469-1421	Equal Variance t Two-Sample Test
002		003	<0.0001	0.05	Significant Effect	01-5007-9696	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	20-3336-0302	Equal Variance t Two-Sample Test

35d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8714	0.8156	0.9273	0.6	1	0.05654	0.1496	17.17%	0.0%
001	7	0.9429	0.9064	0.9793	0.8	1	0.03689	0.09759	10.35%	-8.2%
002	7	0.9286	0.8931	0.9641	0.8	1	0.03595	0.09512	10.24%	-6.56%
003	7	0.3857	0.3128	0.4586	0.1	0.6	0.07377	0.1952	50.6%	55.74%

42d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8571	0.805	0.9093	0.6	1	0.05281	0.1397	16.3%	0.0%
001	7	0.9143	0.8744	0.9542	0.8	1	0.04041	0.1069	11.69%	-6.67%
002	7	0.9	0.8569	0.9431	0.7	1	0.04364	0.1155	12.83%	-5.0%
003	7	0.3714	0.3009	0.442	0.1	0.6	0.07143	0.189	50.88%	56.67%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

35d Proportion Survived Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.8	0.8	1	1	0.9	0.6	1		
001	1	0.8	1	0.8	1	1	1		
002	1	1	0.9	1	0.8	1	0.8		
003	0.6	0.2	0.6	0.1	0.4	0.5	0.3		

42d Proportion Survived Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.8	0.8	0.9	1	0.9	0.6	1		
001	1	0.8	1	0.8	1	0.8	1		
002	0.9	1	0.9	1	0.7	1	0.8		
003	0.6	0.2	0.6	0.1	0.4	0.4	0.3		

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	19-1425-5631	**Endpoint:**	28d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 28d proportion survived endpoint	5.33%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
000		001	158		22	3	0.6647	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.599	4.695	0.1204	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.007643624	0.007643624	1	0.4833	0.4942	Non-Significant Effect
Error	0.3479507	0.01581594	22			
Total	0.3555943	0.02345956	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.872	5.32	0.3132	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.791	0.884	0.0002	Non-normal Distribution

28d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	0.9333	0.8959	0.9708	0.7	1	0.02843	0.09847	10.55%	0.0%
001	12	0.9583	0.9329	0.9838	0.8	1	0.0193	0.06686	6.98%	-2.68%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	1.311	1.256	1.365	0.9912	1.412	0.04145	0.1436	10.95%	0.0%
001	12	1.346	1.307	1.386	1.107	1.419	0.0303	0.1049	7.79%	-2.72%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	20-6834-2507	**Endpoint:**	28d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:28	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 28d proportion survived endpoint	5.71%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
000		002	156		22	3	0.6224	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.446	4.695	0.2172	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.003242502	0.003242502	1	0.1816	0.6742	Non-Significant Effect
Error	0.392849	0.01785677	22			
Total	0.3960915	0.02109927	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.366	5.32	0.6140	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7609	0.884	<0.0001	Non-normal Distribution

28d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	0.9333	0.8959	0.9708	0.7	1	0.02843	0.09847	10.55%	0.0%
002	12	0.95	0.9197	0.9803	0.8	1	0.02303	0.07977	8.4%	-1.79%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	1.311	1.256	1.365	0.9912	1.412	0.04145	0.1436	10.95%	0.0%
002	12	1.334	1.287	1.381	1.107	1.412	0.03547	0.1229	9.21%	-1.77%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	11-5558-9809	**Endpoint:**	28d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 28d proportion survived endpoint	7.79%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	8.587	1.717	22	0.1226	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.394	4.695	0.2616	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.256941	2.256941	1	73.74	<0.0001	Significant Effect
Error	0.6733559	0.03060709	22			
Total	2.930297	2.287548	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.969	5.32	0.2765	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9395	0.884	0.1589	Normal Distribution

28d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	0.9333	0.8959	0.9708	0.7	1	0.02843	0.09847	10.55%	0.0%
003	12	0.4167	0.3444	0.4889	0.2	0.8	0.05482	0.1899	45.58%	55.36%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	12	1.311	1.256	1.365	0.9912	1.412	0.04145	0.1436	10.95%	0.0%
003	12	0.6975	0.6208	0.7741	0.4636	1.107	0.05816	0.2015	28.89%	46.79%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	05-8463-9922	**Endpoint:**	28d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 28d proportion survived endpoint	7.06%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	9.896	1.717	22	0.1126	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.608	4.695	0.1162	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.527272	2.527272	1	97.94	<0.0001	Significant Effect
Error	0.5677077	0.0258049	22			
Total	3.09498	2.553077	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	3.686	5.32	0.0406	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9159	0.884	0.0474	Normal Distribution

28d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	12	0.9583	0.9329	0.9838	0.8	1	0.0193	0.06686	6.98%	0.0%
003	12	0.4167	0.3444	0.4889	0.2	0.8	0.05482	0.1899	45.58%	56.52%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	12	1.346	1.307	1.386	1.107	1.419	0.0303	0.1049	7.79%	0.0%
003	12	0.6975	0.6208	0.7741	0.4636	1.107	0.05816	0.2015	28.89%	48.2%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	12-0253-6904	**Endpoint:**	28d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:19	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 28d proportion survived endpoint	7.37%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	9.344	1.717	22	0.117	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.51	4.695	0.1706	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.431276	2.431276	1	87.31	<0.0001	Significant Effect
Error	0.612606	0.02784573	22			
Total	3.043882	2.459121	23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.689	5.32	0.1156	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9005	0.884	0.0220	Normal Distribution

28d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	12	0.95	0.9197	0.9803	0.8	1	0.02303	0.07977	8.4%	0.0%
003	12	0.4167	0.3444	0.4889	0.2	0.8	0.05482	0.1899	45.58%	56.14%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	12	1.334	1.287	1.381	1.107	1.412	0.03547	0.1229	9.21%	0.0%
003	12	0.6975	0.6208	0.7741	0.4636	1.107	0.05816	0.2015	28.89%	47.72%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	12-2366-1260	**Endpoint:**	35d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 35d proportion survived endpoint	13.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	-1.033	1.782	12	0.1697	0.8391	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.989	3.474	0.4540	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.03389972	0.03389972	1	1.068	0.3218	Non-Significant Effect
Error	0.3809115	0.03174262	12			
Total	0.4148112	0.06564234	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.869	11.07	0.4659	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8729	0.8239	0.0460	Normal Distribution

35d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8714	0.8145	0.9283	0.6	1	0.05654	0.1496	17.17%	0.0%
001	7	0.9429	0.9057	0.98	0.8	1	0.03689	0.09759	10.35%	-8.2%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	1.226	1.149	1.304	0.8861	1.412	0.07686	0.2034	16.58%	0.0%
001	7	1.325	1.268	1.381	1.107	1.412	0.05623	0.1488	11.23%	-8.02%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	19-9991-2262	**Endpoint:**	35d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 35d proportion survived endpoint	12.9%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	-0.7948	1.782	12	0.1685	0.7789	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.004	3.474	0.4321	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.01975799	0.01975799	1	0.6318	0.4421	Non-Significant Effect
Error	0.3752856	0.0312738	12			
Total	0.3950436	0.05103179	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.951	11.07	0.4361	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.895	0.8239	0.0954	Normal Distribution

35d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8714	0.8145	0.9283	0.6	1	0.05654	0.1496	17.17%	0.0%
002	7	0.9286	0.8924	0.9648	0.8	1	0.03595	0.09512	10.24%	-6.56%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	1.226	1.149	1.304	0.8861	1.412	0.07686	0.2034	16.58%	0.0%
002	7	1.302	1.246	1.357	1.107	1.412	0.05502	0.1456	11.18%	-6.13%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	17-8938-5613	**Endpoint:**	35d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 35d proportion survived endpoint	16.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	5.078	1.782	12	0.1995	0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.692	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.130411	1.130411	1	25.78	0.0003	Significant Effect
Error	0.5260934	0.04384111	12			
Total	1.656504	1.174252	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.12	11.07	0.8939	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8971	0.8239	0.1024	Normal Distribution

35d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8714	0.8145	0.9283	0.6	1	0.05654	0.1496	17.17%	0.0%
003	7	0.3857	0.3115	0.46	0.1	0.6	0.07377	0.1952	50.6%	55.74%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	1.226	1.149	1.304	0.8861	1.412	0.07686	0.2034	16.58%	0.0%
003	7	0.6582	0.5763	0.7401	0.3218	0.8861	0.08135	0.2152	32.7%	46.34%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	20-2107-1588	**Endpoint:**	35d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 35d proportion survived endpoint	11.7%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	6.742	1.782	12	0.1763	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.893	3.474	0.6155	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.555823	1.555823	1	45.45	<0.0001	Significant Effect
Error	0.4107365	0.03422804	12			
Total	1.96656	1.590052	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.093	11.07	0.3904	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8903	0.8239	0.0818	Normal Distribution

35d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	0.9429	0.9057	0.98	0.8	1	0.03689	0.09759	10.35%	0.0%
003	7	0.3857	0.3115	0.46	0.1	0.6	0.07377	0.1952	50.6%	59.09%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	1.325	1.268	1.381	1.107	1.412	0.05623	0.1488	11.23%	0.0%
003	7	0.6582	0.5763	0.7401	0.3218	0.8861	0.08135	0.2152	32.7%	50.32%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	01-5007-9696	**Endpoint:**	35d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 35d proportion survived endpoint	12.2%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	6.552	1.782	12	0.175	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.906	3.474	0.5913	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.449064	1.449064	1	42.92	<0.0001	Significant Effect
Error	0.4051106	0.03375922	12			
Total	1.854175	1.482823	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.186	11.07	0.3638	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9121	0.8239	0.1689	Normal Distribution

35d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	0.9286	0.8924	0.9648	0.8	1	0.03595	0.09512	10.24%	0.0%
003	7	0.3857	0.3115	0.46	0.1	0.6	0.07377	0.1952	50.6%	58.46%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	1.302	1.246	1.357	1.107	1.412	0.05502	0.1456	11.18%	0.0%
003	7	0.6582	0.5763	0.7401	0.3218	0.8861	0.08135	0.2152	32.7%	49.43%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	08-1520-6878	**Endpoint:**	42d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 42d proportion survived endpoint	13.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	-0.8328	1.782	12	0.1672	0.7894	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.88	3.474	0.6390	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02137303	0.02137303	1	0.6936	0.4212	Non-Significant Effect
Error	0.3697634	0.03081362	12			
Total	0.3911364	0.05218665	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.321	11.07	0.7442	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9029	0.8239	0.1243	Normal Distribution

42d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8571	0.804	0.9103	0.6	1	0.05281	0.1397	16.3%	0.0%
001	7	0.9143	0.8736	0.955	0.8	1	0.04041	0.1069	11.69%	-6.67%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	1.203	1.132	1.274	0.8861	1.412	0.07078	0.1873	15.56%	0.0%
001	7	1.281	1.219	1.343	1.107	1.412	0.06159	0.163	12.72%	-6.5%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	02-3053-2760	**Endpoint:**	42d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 42d proportion survived endpoint	13.8%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	-0.6193	1.782	12	0.1685	0.7263	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.866	3.474	0.6678	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.01200403	0.01200403	1	0.3835	0.5473	Non-Significant Effect
Error	0.3756155	0.03130129	12			
Total	0.3876195	0.04330532	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.274	11.07	0.7763	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9294	0.8239	0.2993	Normal Distribution

42d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8571	0.804	0.9103	0.6	1	0.05281	0.1397	16.3%	0.0%
002	7	0.9	0.8561	0.9439	0.7	1	0.04364	0.1155	12.83%	-5.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	1.203	1.132	1.274	0.8861	1.412	0.07078	0.1873	15.56%	0.0%
002	7	1.262	1.199	1.325	0.9912	1.412	0.06271	0.1659	13.15%	-4.87%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	03-7603-9558	**Endpoint:**	42d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 42d proportion survived endpoint	15.9%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	5.28	1.782	12	0.1888	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.691	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.095287	1.095287	1	27.88	0.0002	Significant Effect
Error	0.4714631	0.03928859	12			
Total	1.56675	1.134576	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.24	11.07	0.8003	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9187	0.8239	0.2108	Normal Distribution

42d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8571	0.804	0.9103	0.6	1	0.05281	0.1397	16.3%	0.0%
003	7	0.3714	0.2995	0.4433	0.1	0.6	0.07143	0.189	50.88%	56.67%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	1.203	1.132	1.274	0.8861	1.412	0.07078	0.1873	15.56%	0.0%
003	7	0.6438	0.5645	0.7231	0.3218	0.8861	0.07884	0.2086	32.4%	46.49%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	06-0469-1421	**Endpoint:**	42d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 42d proportion survived endpoint	12.9%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	6.373	1.782	12	0.1783	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.791	3.474	0.8291	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.422664	1.422664	1	40.61	<0.0001	Significant Effect
Error	0.4203652	0.03503044	12			
Total	1.843029	1.457695	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.638	11.07	0.5638	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9098	0.8239	0.1566	Normal Distribution

42d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	0.9143	0.8736	0.955	0.8	1	0.04041	0.1069	11.69%	0.0%
003	7	0.3714	0.2995	0.4433	0.1	0.6	0.07143	0.189	50.88%	59.38%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	1.281	1.219	1.343	1.107	1.412	0.06159	0.163	12.72%	0.0%
003	7	0.6438	0.5645	0.7231	0.3218	0.8861	0.07884	0.2086	32.4%	49.76%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	20-3336-0302	**Endpoint:**	42d Proportion Survived	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Angular (Corrected)	0	C > T	Not Run	Sample passes 42d proportion survived endpoint	13.4%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	6.134	1.782	12	0.1795	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.779	3.474	0.8581	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.336619	1.336619	1	37.63	<0.0001	Significant Effect
Error	0.4262173	0.03551811	12			
Total	1.762837	1.372138	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.58	11.07	0.5924	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9446	0.8239	0.4800	Normal Distribution

42d Proportion Survived Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	0.9	0.8561	0.9439	0.7	1	0.04364	0.1155	12.83%	0.0%
003	7	0.3714	0.2995	0.4433	0.1	0.6	0.07143	0.189	50.88%	58.73%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	1.262	1.199	1.325	0.9912	1.412	0.06271	0.1659	13.15%	0.0%
003	7	0.6438	0.5645	0.7231	0.3218	0.8861	0.07884	0.2086	32.4%	48.98%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
000	01-3601-3005	01 Mar-11	01 Mar-11	84h	MACTEC	Ecological Risk Asse
001	02-1859-0695	17 Feb-11 11:30	17 Feb-11 16:00	15d 1h		
002	03-0917-9671	17 Feb-11 13:30	17 Feb-11 16:00	14d 22h		
003	20-3924-8060	17 Feb-11 09:40	17 Feb-11 16:00	15d 2h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
000	Laboratory Control S	Olin Project Site	Laboratory Control; 20686-000		
001	Freshwater Sediment	Olin Project Site	OC-SD-SDBK-002-XXX; 20686-00		
002	Freshwater Sediment	Olin Project Site	OC-SD-MMB-SW/SD-/-XXX; 2068(OC-SD-MMB-SW/SD-1-XXX)		
003	Freshwater Sediment	Olin Project Site	OC-SD-ISCO.2-XXX; 20686-003		

Sample Code	vs	Sample Code	P-Value	Alpha	Decision	Analysis ID	Method
000		001	<0.0001	0.05	Significant Effect	15-7187-4877	Equal Variance t Two-Sample Test
		001	<0.0001	0.05	Significant Effect	09-6029-7908	Equal Variance t Two-Sample Test
		001	<0.0001	0.05	Significant Effect	08-6012-0232	Equal Variance t Two-Sample Test
		001	<0.0001	0.05	Significant Effect	12-4349-1206	Equal Variance t Two-Sample Test
		001	<0.0001	0.05	Significant Effect	13-9740-9784	Equal Variance t Two-Sample Test
		001	0.0005	0.05	Significant Effect	06-1906-3446	Equal Variance t Two-Sample Test
		002	0.0004	0.05	Significant Effect	11-2063-0270	Equal Variance t Two-Sample Test
		002	<0.0001	0.05	Significant Effect	11-8274-6299	Equal Variance t Two-Sample Test
		002	<0.0001	0.05	Significant Effect	06-2363-1695	Equal Variance t Two-Sample Test
		002	<0.0001	0.05	Significant Effect	01-5251-6918	Equal Variance t Two-Sample Test
		003	0.0143	0.05	Significant Effect	12-5107-1820	Wilcoxon Rank Sum Two-Sample Test
		003	<0.0001	0.05	Significant Effect	15-4467-8177	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	02-8707-6180	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	20-8596-8284	Equal Variance t Two-Sample Test
001		003	0.0135	0.05	Significant Effect	07-1114-2177	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	07-7488-0862	Equal Variance t Two-Sample Test
		003	0.0006	0.05	Significant Effect	08-5353-1692	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	06-9643-6169	Equal Variance t Two-Sample Test
002		003	0.0048	0.05	Significant Effect	02-6550-2301	Unequal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	13-6775-4243	Equal Variance t Two-Sample Test
		003	0.0003	0.05	Significant Effect	07-8516-2592	Equal Variance t Two-Sample Test
		003	<0.0001	0.05	Significant Effect	14-6899-6147	Equal Variance t Two-Sample Test

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

28d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8175	0.862	0.797	0.926	0.02981	0.05962	7.1%	0.0%
001	4	0.3552	0.3474	0.363	0.33	0.381	0.01049	0.02098	5.91%	57.7%
002	4	0.435	0.4102	0.4598	0.342	0.499	0.0332	0.0664	15.26%	48.2%
003	4	0.06775	0.06029	0.07521	0.046	0.088	0.009986	0.01997	29.48%	91.93%

28d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8175	0.862	0.797	0.926	0.02981	0.05962	7.1%	0.0%
001	4	0.3644	0.3596	0.3691	0.3518	0.381	0.006324	0.01265	3.47%	56.61%
002	4	0.4568	0.4364	0.4773	0.38	0.499	0.02741	0.05482	12.0%	45.6%
003	4	0.1928	0.1709	0.2148	0.1533	0.28	0.02943	0.05886	30.52%	77.04%

42d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.7743	0.7421	0.8065	0.67	0.877	0.03259	0.08624	11.14%	0.0%
001	7	0.5493	0.5091	0.5894	0.414	0.703	0.04065	0.1075	19.58%	29.06%
002	7	0.5913	0.5668	0.6158	0.5	0.685	0.02477	0.06552	11.08%	23.63%
003	7	0.1784	0.1334	0.2234	0.024	0.353	0.04555	0.1205	67.55%	76.96%

42d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.9152	0.8751	0.9554	0.7589	1.117	0.0406	0.1074	11.74%	0.0%
001	7	0.5973	0.5735	0.6211	0.5175	0.703	0.0241	0.06375	10.67%	34.74%
002	7	0.6593	0.6452	0.6735	0.606	0.7143	0.0143	0.03783	5.74%	27.96%
003	7	0.4458	0.3914	0.5003	0.24	0.605	0.05513	0.1459	32.72%	51.29%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

28d Mean Dry Biomass Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10	
000								0.803	0.833	0.797
	0.926									
001								0.381	0.358	0.3518
	0.33									
002								0.499	0.342	0.455
	0.444									
003								0.088	0.081	0.046
	0.056									

28d Mean Dry Weight Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.803	0.833	0.797	0.926					
001	0.381	0.358	0.3518	0.3667					
002	0.499	0.38	0.455	0.4933					
003	0.176	0.162	0.1533	0.28					

42d Mean Dry Biomass Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.758	0.731	0.827	0.874	0.683	0.67	0.877		
001	0.658	0.483	0.56	0.414	0.703	0.448	0.579		
002	0.589	0.606	0.618	0.629	0.5	0.685	0.512		
003	0.353	0.121	0.32	0.024	0.2	0.139	0.092		

42d Mean Dry Weight Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.9475	0.9137	0.9189	0.874	0.7589	1.117	0.877		
001	0.658	0.6038	0.56	0.5175	0.703	0.56	0.579		
002	0.6544	0.606	0.6867	0.629	0.7143	0.685	0.64		
003	0.5883	0.605	0.5333	0.24	0.5	0.3475	0.3067		

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	15-7187-4877	**Endpoint:**	28d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry weight endpoint	7.05%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	15.6	1.943	6	0.05921	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.162	2.475	0.0367	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.4519692	0.4519692	1	243.4	<0.0001	Significant Effect
Error	0.01114258	0.001857097	6			
Total	0.4631118	0.4538263	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	22.22	47.47	0.0300	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8542	0.6451	0.1049	Normal Distribution

28d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8171	0.8624	0.797	0.926	0.02981	0.05962	7.1%	0.0%
001	4	0.3644	0.3596	0.3692	0.3518	0.381	0.006324	0.01265	3.47%	56.61%

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	06-2363-1695	**Endpoint:**	28d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry weight endpoint	9.37%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	9.456	1.943	6	0.07869	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.627	2.475	0.6124	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2932505	0.2932505	1	89.41	<0.0001	Significant Effect
Error	0.01967963	0.003279938	6			
Total	0.3129301	0.2965304	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.183	47.47	0.8937	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9767	0.6451	0.9447	Normal Distribution

28d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8171	0.8624	0.797	0.926	0.02981	0.05962	7.1%	0.0%
002	4	0.4568	0.436	0.4777	0.38	0.499	0.02741	0.05482	12.0%	45.6%

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	12-5107-1820	**Endpoint:**	28d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry weight endpoint	9.69%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
000		003	10		6	0	0.0143	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.589	2.475	0.6879	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.8370064	0.8370064	1	238.5	<0.0001	Significant Effect
Error	0.0210551	0.003509184	6			
Total	0.8580615	0.8405156	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.026	47.47	0.9837	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7353	0.6451	0.0056	Non-normal Distribution

28d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8171	0.8624	0.797	0.926	0.02981	0.05962	7.1%	0.0%
003	4	0.1928	0.1704	0.2152	0.1533	0.28	0.02943	0.05886	30.52%	77.04%

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	08-5353-1692	**Endpoint:**	28d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry weight endpoint	16.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	5.699	1.943	6	0.05849	0.0006	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.212	2.475	0.0222	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.05885183	0.05885183	1	32.48	0.0013	Significant Effect
Error	0.01087237	0.001812061	6			
Total	0.0697242	0.0606639	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	21.65	47.47	0.0311	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8363	0.6451	0.0689	Normal Distribution

28d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	4	0.3644	0.3596	0.3692	0.3518	0.381	0.006324	0.01265	3.47%	0.0%
003	4	0.1928	0.1704	0.2152	0.1533	0.28	0.02943	0.05886	30.52%	47.08%

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	07-8516-2592	**Endpoint:**	28d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry weight endpoint	17.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	6.564	1.943	6	0.07815	0.0003	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.655	2.475	0.5578	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1393935	0.1393935	1	43.09	0.0006	Significant Effect
Error	0.01940942	0.003234903	6			
Total	0.158803	0.1426284	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.153	47.47	0.9098	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9769	0.6451	0.9460	Normal Distribution

28d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	4	0.4568	0.436	0.4777	0.38	0.499	0.02741	0.05482	12.0%	0.0%
003	4	0.1928	0.1704	0.2152	0.1533	0.28	0.02943	0.05886	30.52%	57.79%

28d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	13-9740-9784	**Endpoint:**	28d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry biomass endpoint	7.31%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	15.33	1.943	6	0.0614	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.085	2.475	0.0694	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.4695678	0.4695678	1	235.1	<0.0001	Significant Effect
Error	0.01198258	0.001997096	6			
Total	0.4815504	0.4715649	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	8.078	47.47	0.1199	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8841	0.6451	0.2062	Normal Distribution

28d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8171	0.8624	0.797	0.926	0.02981	0.05962	7.1%	0.0%
001	4	0.3552	0.3472	0.3632	0.33	0.381	0.01049	0.02098	5.91%	57.7%

28d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	01-5251-6918	**Endpoint:**	28d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry biomass endpoint	10.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	9.072	1.943	6	0.0867	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.592	2.475	0.6824	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.3276452	0.3276452	1	82.29	0.0001	Significant Effect
Error	0.02388875	0.003981458	6			
Total	0.3515339	0.3316267	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.24	47.47	0.8636	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9806	0.6451	0.9656	Normal Distribution

28d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8171	0.8624	0.797	0.926	0.02981	0.05962	7.1%	0.0%
002	4	0.435	0.4097	0.4603	0.342	0.499	0.0332	0.0664	15.26%	48.2%

28d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	15-4467-8177	**Endpoint:**	28d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry biomass endpoint	7.27%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	24.56	1.943	6	0.06109	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.095	2.475	0.0640	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.19197	1.19197	1	603.1	<0.0001	Significant Effect
Error	0.0118594	0.001976567	6			
Total	1.203829	1.193946	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	8.91	47.47	0.1055	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8858	0.6451	0.2137	Normal Distribution

28d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	4	0.8397	0.8171	0.8624	0.797	0.926	0.02981	0.05962	7.1%	0.0%
003	4	0.06775	0.06015	0.07535	0.046	0.088	0.009986	0.01997	29.48%	91.93%

28d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	06-9643-6169	**Endpoint:**	28d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry biomass endpoint	7.92%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	19.85	1.943	6	0.02814	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.36	2.475	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1652613	0.1652613	1	394	<0.0001	Significant Effect
Error	0.002516667	0.0004194445	6			
Total	0.1677779	0.1656807	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.103	47.47	0.9377	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.949	0.6451	0.7007	Normal Distribution

28d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	4	0.3552	0.3472	0.3632	0.33	0.381	0.01049	0.02098	5.91%	0.0%
003	4	0.06775	0.06015	0.07535	0.046	0.088	0.009986	0.01997	29.48%	80.93%

28d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	14-6899-6147	**Endpoint:**	28d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	06 May-11 12:20	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 28d mean dry biomass endpoint	15.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	10.59	1.943	6	0.06737	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.049	2.475	0.0893	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2697458	0.2697458	1	112.2	<0.0001	Significant Effect
Error	0.01442284	0.002403806	6			
Total	0.2841686	0.2721496	7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	11.05	47.47	0.0791	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9023	0.6451	0.3032	Normal Distribution

28d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	4	0.435	0.4097	0.4603	0.342	0.499	0.0332	0.0664	15.26%	0.0%
003	4	0.06775	0.06015	0.07535	0.046	0.088	0.009986	0.01997	29.48%	84.43%

28d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	09-6029-7908	**Endpoint:**	42d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry weight endpoint	9.19%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	6.734	1.782	12	0.08415	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.374	3.474	0.0991	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.3537573	0.3537573	1	45.34	<0.0001	Significant Effect
Error	0.09362168	0.007801807	12			
Total	0.4473789	0.3615591	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.839	11.07	0.2297	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9358	0.8239	0.3671	Normal Distribution

42d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.9152	0.8744	0.9561	0.7589	1.117	0.0406	0.1074	11.74%	0.0%
001	7	0.5973	0.5731	0.6216	0.5175	0.703	0.0241	0.06375	10.67%	34.74%

42d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	11-8274-6299	**Endpoint:**	42d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry weight endpoint	8.38%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	5.945	1.782	12	0.07672	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.603	3.474	0.0285	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2291957	0.2291957	1	35.34	<0.0001	Significant Effect
Error	0.07782534	0.006485444	12			
Total	0.307021	0.2356811	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	8.062	11.07	0.0226	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8845	0.8239	0.0675	Normal Distribution

42d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.9152	0.8744	0.9561	0.7589	1.117	0.0406	0.1074	11.74%	0.0%
002	7	0.6593	0.645	0.6737	0.606	0.7143	0.0143	0.03783	5.74%	27.96%

42d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	02-8707-6180	**Endpoint:**	42d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry weight endpoint	13.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	6.856	1.782	12	0.122	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.673	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.7712075	0.7712075	1	47.01	<0.0001	Significant Effect
Error	0.196878	0.0164065	12			
Total	0.9680855	0.7876139	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.844	11.07	0.4756	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.976	0.8239	0.9454	Normal Distribution

42d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.9152	0.8744	0.9561	0.7589	1.117	0.0406	0.1074	11.74%	0.0%
003	7	0.4458	0.3904	0.5013	0.24	0.605	0.05513	0.1459	32.72%	51.29%

42d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	07-1114-2177	**Endpoint:**	42d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry weight endpoint	18.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	2.518	1.782	12	0.1072	0.0135	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.903	3.474	0.5956	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.08032078	0.08032078	1	6.34	0.0270	Significant Effect
Error	0.1520248	0.01266874	12			
Total	0.2323456	0.09298951	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.235	11.07	0.0639	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9743	0.8239	0.9281	Normal Distribution

42d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	0.5973	0.5731	0.6216	0.5175	0.703	0.0241	0.06375	10.67%	0.0%
003	7	0.4458	0.3904	0.5013	0.24	0.605	0.05513	0.1459	32.72%	25.36%

42d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	02-6550-2301	**Endpoint:**	42d Mean Dry Weight	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry weight endpoint	16.8%

Unequal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	3.749	1.943	6	0.1107	0.0048	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.011	3.474	0.4217	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1595526	0.1595526	1	14.05	0.0028	Significant Effect
Error	0.1362285	0.01135237	12			
Total	0.295781	0.1709049	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	14.86	11.07	0.0045	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9777	0.8239	0.9590	Normal Distribution

42d Mean Dry Weight Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	0.6593	0.645	0.6737	0.606	0.7143	0.0143	0.03783	5.74%	0.0%
003	7	0.4458	0.3904	0.5013	0.24	0.605	0.05513	0.1459	32.72%	32.38%

42d Mean Dry Weight Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	06-1906-3446	**Endpoint:**	42d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry biomass endpoint	12.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	4.318	1.782	12	0.09286	0.0005	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.641	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1771875	0.1771875	1	18.65	0.0010	Significant Effect
Error	0.1140187	0.009501557	12			
Total	0.2912062	0.1866891	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.555	11.07	0.6051	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.942	0.8239	0.4448	Normal Distribution

42d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.7743	0.7415	0.8071	0.67	0.877	0.03259	0.08624	11.14%	0.0%
001	7	0.5493	0.5084	0.5902	0.414	0.703	0.04065	0.1075	19.58%	29.06%

42d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	11-2063-0270	**Endpoint:**	42d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry biomass endpoint	9.42%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	4.47	1.782	12	0.07296	0.0004	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.417	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1172112	0.1172112	1	19.99	0.0008	Significant Effect
Error	0.07037868	0.005864889	12			
Total	0.1875899	0.1230761	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.732	11.07	0.5211	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9234	0.8239	0.2458	Normal Distribution

42d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.7743	0.7415	0.8071	0.67	0.877	0.03259	0.08624	11.14%	0.0%
002	7	0.5913	0.5664	0.6162	0.5	0.685	0.02477	0.06552	11.08%	23.63%

42d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	20-8596-8284	**Endpoint:**	42d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry biomass endpoint	12.9%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	10.64	1.782	12	0.09983	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.734	3.474	0.9696	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.242659	1.242659	1	113.2	<0.0001	Significant Effect
Error	0.1317736	0.01098113	12			
Total	1.374432	1.25364	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.953	11.07	0.4355	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9538	0.8239	0.6214	Normal Distribution

42d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.7743	0.7415	0.8071	0.67	0.877	0.03259	0.08624	11.14%	0.0%
003	7	0.1784	0.1326	0.2243	0.024	0.353	0.04555	0.1205	67.55%	76.96%

42d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	07-7488-0862	**Endpoint:**	42d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry biomass endpoint	19.8%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	6.074	1.782	12	0.1088	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.591	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.4813717	0.4813717	1	36.9	<0.0001	Significant Effect
Error	0.1565538	0.01304615	12			
Total	0.6379255	0.4944178	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.256	11.07	0.7892	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.934	0.8239	0.3470	Normal Distribution

42d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	0.5493	0.5084	0.5902	0.414	0.703	0.04065	0.1075	19.58%	0.0%
003	7	0.1784	0.1326	0.2243	0.024	0.353	0.04555	0.1205	67.55%	67.52%

42d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	13-6775-4243	**Endpoint:**	42d Mean Dry Biomass	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d mean dry biomass endpoint	15.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	7.963	1.782	12	0.09241	<0.0001	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.873	3.474	0.6531	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.5965783	0.5965783	1	63.4	<0.0001	Significant Effect
Error	0.1129138	0.009409485	12			
Total	0.7094921	0.6059878	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	3.383	11.07	0.1636	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9684	0.8239	0.8549	Normal Distribution

42d Mean Dry Biomass Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	0.5913	0.5664	0.6162	0.5	0.685	0.02477	0.06552	11.08%	0.0%
003	7	0.1784	0.1326	0.2243	0.024	0.353	0.04555	0.1205	67.55%	69.82%

42d Mean Dry Biomass Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
000	01-3601-3005	01 Mar-11	01 Mar-11	84h	MACTEC	Ecological Risk Asse
001	02-1859-0695	17 Feb-11 11:30	17 Feb-11 16:00	15d 1h		
002	03-0917-9671	17 Feb-11 13:30	17 Feb-11 16:00	14d 22h		
003	20-3924-8060	17 Feb-11 09:40	17 Feb-11 16:00	15d 2h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
000	Laboratory Control S	Olin Project Site	Laboratory Control; 20686-000		
001	Freshwater Sediment	Olin Project Site	OC-SD-SDBK-002-XXX; 20686-00		
002	Freshwater Sediment	Olin Project Site	OC-SD-MMB-SW/SD-/-XXX; 2068 (OC-SD-MMB-SW/SD-1-XXX)		
003	Freshwater Sediment	Olin Project Site	OC-SD-ISCO.2-XXX; 20686-003		

Sample Code	vs	Sample Code	P-Value	Alpha	Decision	Analysis ID	Method
000		001	0.0942	0.05	Non-Significant Effect	14-9684-5654	Equal Variance t Two-Sample Test
		001	0.0785	0.05	Non-Significant Effect	20-2181-4004	Equal Variance t Two-Sample Test
		001	0.3206	0.05	Non-Significant Effect	17-4351-2502	Equal Variance t Two-Sample Test
		002	0.7730	0.05	Non-Significant Effect	18-7781-1631	Equal Variance t Two-Sample Test
		002	0.1497	0.05	Non-Significant Effect	15-8313-8736	Equal Variance t Two-Sample Test
		002	0.5815	0.05	Non-Significant Effect	15-1651-3216	Equal Variance t Two-Sample Test
		003	0.0006	0.05	Significant Effect	14-4447-8324	Equal Variance t Two-Sample Test
		003	0.0045	0.05	Significant Effect	19-0252-0780	Unequal Variance t Two-Sample Test
		003	0.0067	0.05	Significant Effect	21-1058-6696	Equal Variance t Two-Sample Test
001		003	0.0003	0.05	Significant Effect	18-3124-3597	Wilcoxon Rank Sum Two-Sample Test
		003	0.0004	0.05	Significant Effect	11-4733-6843	Equal Variance t Two-Sample Test
		003	0.0056	0.05	Significant Effect	16-5121-5649	Equal Variance t Two-Sample Test
002		003	0.0005	0.05	Significant Effect	17-8179-7106	Unequal Variance t Two-Sample Test
		003	0.0003	0.05	Significant Effect	16-6520-9797	Equal Variance t Two-Sample Test
		003	0.0017	0.05	Significant Effect	17-9538-5153	Equal Variance t Two-Sample Test

35d Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8452	0.6462	1.044	0.125	1.8	0.2015	0.533	63.06%	0.0%
001	7	0.5393	0.4534	0.6252	0.1	0.75	0.08692	0.23	42.64%	36.2%
002	7	1.051	0.8797	1.222	0.5	1.6	0.1732	0.4582	43.6%	-24.32%
003	7	0	0	0	0	0	0	0		100.0%

42 d Juveniles per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	6.331	4.836	7.826	2	12.4	1.513	4.003	63.22%	0.0%
001	7	3.86	3.244	4.476	1.8	6.222	0.6234	1.649	42.73%	39.02%
002	7	4.506	3.777	5.234	1.667	6.714	0.7371	1.95	43.29%	28.83%
003	6	0.5	0.2419	0.7581	0	1.667	0.2822	0.6912	138.2%	92.1%

42d Reproduction-Overall Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	3.806	2.924	4.688	1	6.7	0.8928	2.362	62.07%	0.0%
001	7	3.282	2.655	3.909	1.2	6.3	0.6347	1.679	51.16%	13.76%
002	7	4.046	3.342	4.75	1.125	6	0.7123	1.885	46.58%	-6.31%
003	7	0.7619	0.2172	1.307	0	4	0.5514	1.459	191.5%	79.98%

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

35d Reproduction Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	0.125	1.125	1.8	0.7	1	0.6667	0.5		
001	0.4	0.75	0.7	0.625	0.1	0.5	0.7		
002	0.7	1.3	0.5556	1.6	1.5	1.2	0.5		
003	0	0	0	0	0	0	0		

42 d Juveniles per Female Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	3.667	4.4	6.6	4	11.25	2	12.4		
001	5	1.8	6.222	4	2.2	2.8	5		
002	6.2	6.714	2	5.125	5	4.833	1.667		
003	1.667	0	1	0	0	0.3333			

42d Reproduction-Overall Detail

Sample Code	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000	1.5	3.875	5.667	1.9	6	1	6.7		
001	3.9	1.875	6.3	3.625	1.2	2.375	3.7		
002	4.222	6	1.889	5.7	5.286	4.1	1.125		
003	0.8333	0	0.1667	4	0	0	0.3333		

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	14-9684-5654	**Endpoint:**	35d Reproduction	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 35d reproduction endpoint	46.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	1.394	1.782	12	0.3911	0.0942	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.421	3.474	0.0787	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.327624	0.327624	1	1.944	0.1885	Non-Significant Effect
Error	2.022024	0.168502	12			
Total	2.349648	0.496126	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.372	11.07	0.0602	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9395	0.8239	0.4114	Normal Distribution

35d Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8452	0.6425	1.048	0.125	1.8	0.2015	0.533	63.06%	0.0%
001	7	0.5393	0.4518	0.6268	0.1	0.75	0.08692	0.23	42.64%	36.2%

35d Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	18-7781-1631	**Endpoint:**	35d Reproduction	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 35d reproduction endpoint	56.0%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	-0.7738	1.782	12	0.4735	0.7730	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.999	3.474	0.4381	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1478858	0.1478858	1	0.5987	0.4541	Non-Significant Effect
Error	2.964173	0.2470144	12			
Total	3.112059	0.3949002	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.354	11.07	0.7226	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9697	0.8239	0.8730	Normal Distribution

35d Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8452	0.6425	1.048	0.125	1.8	0.2015	0.533	63.06%	0.0%
002	7	1.051	0.8765	1.225	0.5	1.6	0.1732	0.4582	43.6%	-24.32%

35d Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	14-4447-8324	**Endpoint:**	35d Reproduction	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 35d reproduction endpoint	42.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	4.195	1.782	12	0.3591	0.0006	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.637	3.474	0.0231	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.500496	2.500496	1	17.6	0.0012	Significant Effect
Error	1.704702	0.1420585	12			
Total	4.205198	2.642555	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	8.295	10.04	0.0164	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8376	0.8239	0.0152	Normal Distribution

35d Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	0.8452	0.6425	1.048	0.125	1.8	0.2015	0.533	63.06%	0.0%
003	7	0	0	0	0	0	0	0		100.0%

35d Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	18-3124-3597	**Endpoint:**	35d Reproduction	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Nonparametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 35d reproduction endpoint	28.7%

Wilcoxon Rank Sum Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	Ties	P-Value	Decision(α:5%)
001		003	28		12	0	0.0003	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.812	3.474	0.0064	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.017902	1.017902	1	38.49	<0.0001	Significant Effect
Error	0.3173214	0.02644345	12			
Total	1.335223	1.044345	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	7.43	10.04	0.0213	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.805	0.8239	0.0058	Non-normal Distribution

35d Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	0.5393	0.4518	0.6268	0.1	0.75	0.08692	0.23	42.64%	0.0%
003	7	0	0	0	0	0	0	0		100.0%

35d Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	17-8179-7106	**Endpoint:**	35d Reproduction	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 35d reproduction endpoint	32.0%

Unequal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	6.068	1.943	6	0.3365	0.0005	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.77	3.474	0.8800	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	3.864586	3.864586	1	36.82	<0.0001	Significant Effect
Error	1.259471	0.1049559	12			
Total	5.124057	3.969542	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	23.33	10.04	0.0007	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9011	0.8239	0.1170	Normal Distribution

35d Reproduction Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	1.051	0.8765	1.225	0.5	1.6	0.1732	0.4582	43.6%	0.0%
003	7	0	0	0	0	0	0	0		100.0%

35d Reproduction Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test **EnviroSystems, Inc.**

Analysis ID:	17-4351-2502	**Endpoint:**	42d Reproduction-Overall	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction-overall endpoint	51.3%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	0.4782	1.782	12	1.952	0.3206	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.533	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.9603174	0.9603174	1	0.2286	0.6411	Non-Significant Effect
Error	50.39946	4.199955	12			
Total	51.35978	5.160273	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.979	11.07	0.4268	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9359	0.8239	0.3683	Normal Distribution

42d Reproduction-Overall Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	3.806	2.907	4.704	1	6.7	0.8928	2.362	62.07%	0.0%
001	7	3.282	2.643	3.921	1.2	6.3	0.6347	1.679	51.16%	13.76%

42d Reproduction-Overall Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	15-1651-3216	**Endpoint:**	42d Reproduction-Overall	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction-overall endpoint	53.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	-0.2101	1.782	12	2.036	0.5815	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.423	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.2016381	0.2016381	1	0.04416	0.8371	Non-Significant Effect
Error	54.78988	4.565824	12			
Total	54.99152	4.767462	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.571	11.07	0.5970	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8981	0.8239	0.1058	Normal Distribution

42d Reproduction-Overall Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	3.806	2.907	4.704	1	6.7	0.8928	2.362	62.07%	0.0%
002	7	4.046	3.329	4.763	1.125	6	0.7123	1.885	46.58%	-6.31%

42d Reproduction-Overall Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	21-1058-6696	**Endpoint:**	42d Reproduction-Overall	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction-overall endpoint	49.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	2.901	1.782	12	1.87	0.0067	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.717	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	32.43179	32.43179	1	8.415	0.0133	Significant Effect
Error	46.24966	3.854139	12			
Total	78.68146	36.28593	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.622	11.07	0.2659	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9269	0.8239	0.2759	Normal Distribution

42d Reproduction-Overall Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	3.806	2.907	4.704	1	6.7	0.8928	2.362	62.07%	0.0%
003	7	0.7619	0.207	1.317	0	4	0.5514	1.459	191.5%	79.98%

42d Reproduction-Overall Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	16-5121-5649	**Endpoint:**	42d Reproduction-Overall	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction-overall endpoint	45.7%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	2.998	1.782	12	1.498	0.0056	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.143	3.474	0.2635	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	22.2306	22.2306	1	8.985	0.0111	Significant Effect
Error	29.68948	2.474124	12			
Total	51.92008	24.70472	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.325	11.07	0.7413	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8595	0.8239	0.0300	Normal Distribution

42d Reproduction-Overall Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	3.282	2.643	3.921	1.2	6.3	0.6347	1.679	51.16%	0.0%
003	7	0.7619	0.207	1.317	0	4	0.5514	1.459	191.5%	76.79%

42d Reproduction-Overall Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	17-9538-5153	**Endpoint:**	42d Reproduction-Overall	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:40	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction-overall endpoint	39.7%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	3.646	1.782	12	1.605	0.0017	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2	3.474	0.4374	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	37.74791	37.74791	1	13.29	0.0034	Significant Effect
Error	34.0799	2.839992	12			
Total	71.82782	40.58791	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.669	11.07	0.5494	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9632	0.8239	0.7757	Normal Distribution

42d Reproduction-Overall Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	4.046	3.329	4.763	1.125	6	0.7123	1.885	46.58%	0.0%
003	7	0.7619	0.207	1.317	0	4	0.5514	1.459	191.5%	81.17%

42d Reproduction-Overall Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	20-2181-4004	**Endpoint:**	42 d Juveniles per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42 d juveniles per female endpoint	46.1%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	1.51	1.782	12	2.916	0.0785	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.064	3.474	0.3517	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	21.36413	21.36413	1	2.28	0.1569	Non-Significant Effect
Error	112.4419	9.370161	12			
Total	133.8061	30.73429	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.889	11.07	0.0486	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9359	0.8239	0.3678	Normal Distribution

42 d Juveniles per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	6.331	4.808	7.853	2	12.4	1.513	4.003	63.22%	0.0%
001	7	3.86	3.233	4.488	1.8	6.222	0.6234	1.649	42.73%	39.02%

42 d Juveniles per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	15-8313-8736	**Endpoint:**	42 d Juveniles per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42 d juveniles per female endpoint	47.4%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	1.085	1.782	12	2.999	0.1497	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.006	3.474	0.4280	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	11.66153	11.66153	1	1.177	0.2994	Non-Significant Effect
Error	118.9426	9.911882	12			
Total	130.6041	21.57342	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.212	11.07	0.1037	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.933	0.8239	0.3361	Normal Distribution

42 d Juveniles per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	6.331	4.808	7.853	2	12.4	1.513	4.003	63.22%	0.0%
002	7	4.506	3.764	5.247	1.667	6.714	0.7371	1.95	43.29%	28.83%

42 d Juveniles per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	19-0252-0780	**Endpoint:**	42 d Juveniles per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42 d juveniles per female endpoint	47.2%

Unequal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	3.789	1.943	6	2.99	0.0045	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		2.118	3.328	0.2515	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	109.8462	109.8462	1	12.27	0.0050	Significant Effect
Error	98.50912	8.955375	11			
Total	208.3553	118.8015	12			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	33.53	14.51	0.0014	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.9076	0.8138	0.1700	Normal Distribution

42 d Juveniles per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	6.331	4.808	7.853	2	12.4	1.513	4.003	63.22%	0.0%
003	6	0.5	0.2371	0.7629	0	1.667	0.2822	0.6912	138.2%	92.1%

42 d Juveniles per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	11-4733-6843	**Endpoint:**	42 d Juveniles per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42 d juveniles per female endpoint	36.8%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	4.631	1.796	11	1.303	0.0004	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.892	3.328	0.5553	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	36.48098	36.48098	1	21.45	0.0007	Significant Effect
Error	18.71058	1.700962	11			
Total	55.19157	38.18195	12			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.694	14.51	0.0758	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.972	0.8138	0.9170	Normal Distribution

42 d Juveniles per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	3.86	3.233	4.488	1.8	6.222	0.6234	1.649	42.73%	0.0%
003	6	0.5	0.2371	0.7629	0	1.667	0.2822	0.6912	138.2%	87.05%

42 d Juveniles per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	16-6520-9797	**Endpoint:**	42 d Juveniles per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42 d juveniles per female endpoint	33.6%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	4.756	1.796	11	1.513	0.0003	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.959	3.328	0.4467	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	51.83746	51.83746	1	22.62	0.0006	Significant Effect
Error	25.21124	2.291931	11			
Total	77.04871	54.12939	12			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	7.961	14.51	0.0379	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9293	0.8138	0.3333	Normal Distribution

42 d Juveniles per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	4.506	3.764	5.247	1.667	6.714	0.7371	1.95	43.29%	0.0%
003	6	0.5	0.2371	0.7629	0	1.667	0.2822	0.6912	138.2%	88.9%

42 d Juveniles per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	14-1549-8068	**Endpoint:**	42d Reproduction per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction per female endpoint	33.2%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		001	2.42	1.782	12	2.826	0.0162	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.748	3.474	0.9342	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	51.54014	51.54014	1	5.858	0.0323	Significant Effect
Error	105.5878	8.798985	12			
Total	157.128	60.33912	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.137	11.07	0.0668	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9406	0.8239	0.4267	Normal Distribution

42d Reproduction per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	8.519	7.059	9.979	4	13.5	1.451	3.838	45.05%	0.0%
001	7	4.682	4.037	5.326	2.4	7	0.6401	1.693	36.17%	45.05%

42d Reproduction per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
001										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	08-6368-0901	**Endpoint:**	42d Reproduction per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:42	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction per female endpoint	35.4%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		002	1.374	1.782	12	3.016	0.0973	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.638	3.474	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	18.90862	18.90862	1	1.887	0.1946	Non-Significant Effect
Error	120.2366	10.01971	12			
Total	139.1452	28.92833	13			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.775	11.07	0.2398	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9286	0.8239	0.2913	Normal Distribution

42d Reproduction per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	8.519	7.059	9.979	4	13.5	1.451	3.838	45.05%	0.0%
002	7	6.195	5.318	7.071	2.833	8.571	0.8709	2.304	37.2%	27.28%

42d Reproduction per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
002										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	20-2911-0245	**Endpoint:**	42d Reproduction per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction per female endpoint	50.5%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
000		003	3.3	1.86	8	4.299	0.0054	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.577	2.846	0.9652	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	122.2606	122.2606	1	10.89	0.0109	Significant Effect
Error	89.78931	11.22366	8			
Total	212.0499	133.4842	9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	20.93	199.3	0.0926	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9316	0.7411	0.4641	Normal Distribution

42d Reproduction per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
000	7	8.519	7.059	9.979	4	13.5	1.451	3.838	45.05%	0.0%
003	3	0.8889	0.5698	1.208	0	1.667	0.4843	0.8389	94.37%	89.57%

42d Reproduction per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
000										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	03-0685-1616	**Endpoint:**	42d Reproduction per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction per female endpoint	41.8%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
001		003	3.603	1.86	8	1.957	0.0035	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.612	2.846	0.8779	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	30.2083	30.2083	1	12.98	0.0069	Significant Effect
Error	18.61332	2.326665	8			
Total	48.82162	32.53497	9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.075	199.3	0.4202	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9784	0.7411	0.9560	Normal Distribution

42d Reproduction per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
001	7	4.682	4.037	5.326	2.4	7	0.6401	1.693	36.17%	0.0%
003	3	0.8889	0.5698	1.208	0	1.667	0.4843	0.8389	94.37%	81.01%

42d Reproduction per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
001										
003										

Hyalella 42-d Survival, Growth, and Reproduction Sediment Test — **EnviroSystems, Inc.**

Analysis ID:	18-6955-2623	**Endpoint:**	42d Reproduction per Female	**CETIS Version:**	CETISv1.8.0
Analyzed:	20 May-11 9:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	13-8121-2761	**Test Type:**	Hyalella (42d)	**Analyst:**	
Start Date:	04 Mar-11 12:00	**Protocol:**	EPA/600/R-99/064 (2000)	**Diluent:**	Not Applicable
Ending Date:	15 Apr-11 12:00	**Species:**	Hyalella azteca	**Brine:**	Not Applicable
Duration:	42d 0h	**Source:**	ARO - Aquatic Research Organisms, NH	**Age:**	

Data Transform	Zeta	Alt Hyp	MC Trials	Test Result	PMSD
Untransformed	0	C > T	Not Run	Sample passes 42d reproduction per female endpoint	42.2%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	DF	MSD	P-Value	Decision(α:5%)
002		003	3.771	1.86	8	2.617	0.0027	Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value		1.749	2.846	0.5878	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	59.11905	59.11905	1	14.22	0.0055	Significant Effect
Error	33.26207	4.157758	8			
Total	92.38112	63.27681	9			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	7.545	199.3	0.2433	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8638	0.7411	0.0847	Normal Distribution

42d Reproduction per Female Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
002	7	6.195	5.318	7.071	2.833	8.571	0.8709	2.304	37.2%	0.0%
003	3	0.8889	0.5698	1.208	0	1.667	0.4843	0.8389	94.37%	85.65%

42d Reproduction per Female Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
002										
003										

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Overlying Water Alkalinity Summary
METHOD: EPA 310.2

Field ID	Sample Number	Day	LAB ID	MATRIX	RESULT	QLIMIT	UNITS	SAMPLED	ANALYZED
Laboratory Control Sample	000	0	20801-100	Water	73	2	mg/L	04/06/11 1100	04/08/11 1122
OC-SD-SDBK-002-XXX	001	0	20801-102	Water	58	2	mg/L	04/06/11 1100	04/08/11 1128
OC-SD-MMB-SW/SD-1-XXX	002	0	20801-103	Water	52	2	mg/L	04/06/11 1100	04/08/11 1130
OC-SD-ISCO.2-XXX	003	0	20801-104	Water	41	2	mg/L	04/06/11 1100	04/08/11 1131
Laboratory Control Sample	000	7	20801-200	Water	66	2	mg/L	04/13/11 1215	04/14/11 1438
OC-SD-SDBK-002-XXX	001	7	20801-202	Water	61	2	mg/L	04/13/11 1215	04/14/11 1443
OC-SD-MMB-SW/SD-1-XXX	002	7	20801-203	Water	52	2	mg/L	04/13/11 1215	04/14/11 1445
OC-SD-ISCO.2-XXX	003	7	20801-204	Water	48	2	mg/L	04/13/11 1215	04/14/11 1446
Laboratory Control Sample	000	14	20801-300	Water	70	2	mg/L	04/20/11 0745	04/22/11 1417
OC-SD-SDBK-002-XXX	001	14	20801-302	Water	66	2	mg/L	04/20/11 0745	04/22/11 1420
OC-SD-MMB-SW/SD-1-XXX	002	14	20801-303	Water	55	2	mg/L	04/20/11 0745	04/22/11 1421
OC-SD-ISCO.2-XXX	003	14	20801-304	Water	53	2	mg/L	04/20/11 0745	04/22/11 1426
Laboratory Control Sample	000	21	20801-400	Water	67	2	mg/L	04/27/11 1400	05/04/11 1326
OC-SD-SDBK-002-XXX	001	21	20801-402	Water	64	2	mg/L	04/27/11 1400	05/04/11 1332
OC-SD-MMB-SW/SD-1-XXX	002	21	20801-403	Water	53	2	mg/L	04/27/11 1400	05/04/11 1333
OC-SD-ISCO.2-XXX	003	21	20801-404	Water	55	2	mg/L	04/27/11 1400	05/04/11 1335
Laboratory Control Sample	000	28	20801-500	Water	62	2	mg/L	05/04/11 0845	05/04/11 1336
OC-SD-SDBK-002-XXX	001	28	20801-502	Water	55	2	mg/L	05/04/11 0845	05/04/11 1339
OC-SD-MMB-SW/SD-1-XXX	002	28	20801-503	Water	51	2	mg/L	05/04/11 0845	05/04/11 1340
OC-SD-ISCO.2-XXX	003	28	20801-504	Water	55	2	mg/L	05/04/11 0845	05/04/11 1439
Laboratory Control Sample	000	35	20801-600	Water	59	2	mg/L	05/11/11 0800	05/11/11 1346
OC-SD-SDBK-002-XXX	001	35	20801-602	Water	56	2	mg/L	05/11/11 0800	05/11/11 1352
OC-SD-MMB-SW/SD-1-XXX	002	35	20801-603	Water	57	2	mg/L	05/11/11 0800	05/11/11 1356
OC-SD-ISCO.2-XXX	003	35	20801-604	Water	54	2	mg/L	05/11/11 0800	05/11/11 1358
Laboratory Control Sample	000	42	20801-700	Water	60	2	mg/L	05/18/11 1230	05/23/11 1559
OC-SD-SDBK-002-XXX	001	42	20801-702	Water	59	2	mg/L	05/18/11 1230	05/23/11 1602
OC-SD-MMB-SW/SD-1-XXX	002	42	20801-703	Water	60	2	mg/L	05/18/11 1230	05/23/11 1603
OC-SD-ISCO.2-XXX	003	42	20801-704	Water	57	2	mg/L	05/18/11 1230	05/23/11 1605

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Overlying Water Hardness Summary
METHOD: SW846 3rd Ed. 6020

Field ID	Sample Number	Day	LAB ID	MATRIX	RESULT	QLIMIT	UNITS	SAMPLED	ANALYZED
Laboratory Control Sample	000	0	20801-105	Water	100	0.4	mg/L	04/06/11 1100	04/11/11
OC-SD-SDBK-002-XXX	001	0	20801-107	Water	82	0.4	mg/L	04/06/11 1100	04/11/11
OC-SD-MMB-SW/SD-1-XXX	002	0	20801-108	Water	78	0.4	mg/L	04/06/11 1100	04/11/11
OC-SD-ISCO.2-XXX	003	0	20801-109	Water	91	0.4	mg/L	04/06/11 1100	04/11/11
Laboratory Control Sample	000	7	20801-205	Water	92	0.4	mg/L	04/13/11 1215	04/20/11
OC-SD-SDBK-002-XXX	001	7	20801-207	Water	84	0.4	mg/L	04/13/11 1215	04/20/11
OC-SD-MMB-SW/SD-1-XXX	002	7	20801-208	Water	77	0.4	mg/L	04/13/11 1215	04/20/11
OC-SD-ISCO.2-XXX	003	7	20801-209	Water	82	0.4	mg/L	04/13/11 1215	04/20/11
Laboratory Control Sample	000	14	20801-305	Water	90	0.4	mg/L	04/20/11 0745	04/20/11
OC-SD-SDBK-002-XXX	001	14	20801-307	Water	85	0.4	mg/L	04/20/11 0745	04/20/11
OC-SD-MMB-SW/SD-1-XXX	002	14	20801-308	Water	79	0.4	mg/L	04/20/11 0745	04/20/11
OC-SD-ISCO.2-XXX	003	14	20801-309	Water	80	0.4	mg/L	04/20/11 0745	04/20/11
Laboratory Control Sample	000	21	20801-405	Water	91	0.4	mg/L	04/27/11 1400	05/02/11
OC-SD-SDBK-002-XXX	001	21	20801-407	Water	90	0.4	mg/L	04/06/11 1100	05/02/11
OC-SD-MMB-SW/SD-1-XXX	002	21	20801-408	Water	78	0.4	mg/L	04/27/11 1400	05/02/11
OC-SD-ISCO.2-XXX	003	21	20801-409	Water	82	0.4	mg/L	04/27/11 1400	05/02/11
Laboratory Control Sample	000	28	20801-505	Water	81	0.4	mg/L	05/04/11 0845	05/09/11
OC-SD-SDBK-002-XXX	001	28	20801-507	Water	79	0.4	mg/L	05/04/11 0845	05/09/11
OC-SD-MMB-SW/SD-1-XXX	002	28	20801-508	Water	74	0.4	mg/L	05/04/11 0845	05/09/11
OC-SD-ISCO.2-XXX	003	28	20801-509	Water	75	0.4	mg/L	05/04/11 0845	05/09/11
Laboratory Control Sample	000	35	20801-605	Water	88	0.4	mg/L	05/11/11 0800	05/13/11
OC-SD-SDBK-002-XXX	001	35	20801-607	Water	89	0.4	mg/L	05/11/11 0800	05/13/11
OC-SD-MMB-SW/SD-1-XXX	002	35	20801-608	Water	89	0.4	mg/L	05/11/11 0800	05/13/11
OC-SD-ISCO.2-XXX	003	35	20801-609	Water	88	0.4	mg/L	05/11/11 0800	05/13/11
Laboratory Control Sample	000	42	20801-705	Water	84	0.4	mg/L	05/18/11 1230	05/26/11
OC-SD-SDBK-002-XXX	001	42	20801-707	Water	82	0.4	mg/L	05/18/11 1230	05/26/11
OC-SD-MMB-SW/SD-1-XXX	002	42	20801-708	Water	80	0.4	mg/L	05/18/11 1230	05/26/11
OC-SD-ISCO.2-XXX	003	42	20801-709	Water	79	0.4	mg/L	05/18/11 1230	05/26/11

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Overlying Water Ammonia Summary
METHOD: SM 4500-NH3 G

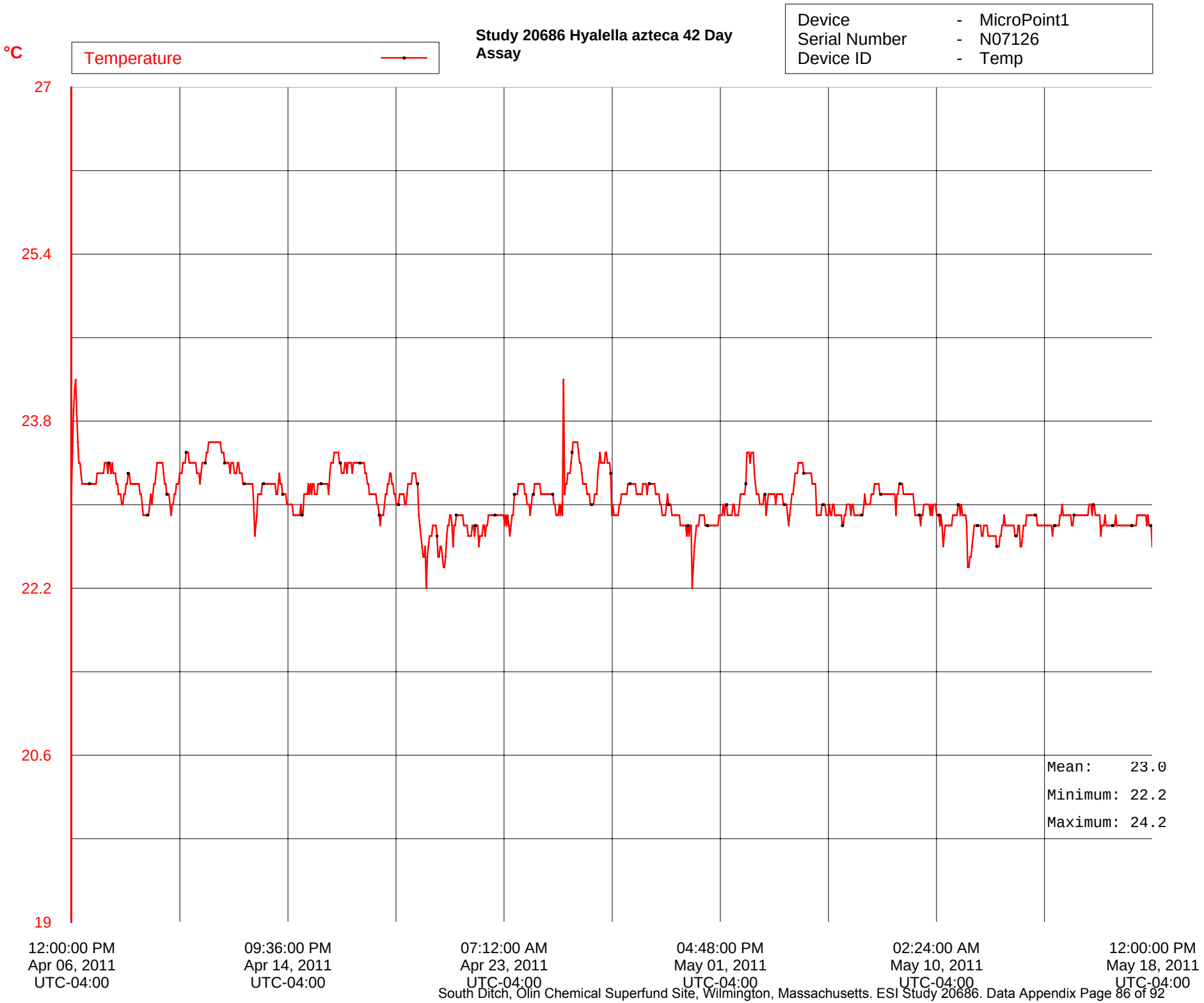
Field ID	Sample Number	Day	LAB ID	MATRIX	RESULT	QLIMIT	UNITS	SAMPLED	ANALYZED
Laboratory Control Sample	000	0	20801-110	Water	ND	0.1	mg/L as N	04/06/11 1100	04/07/11 1225
OC-SD-SDBK-002-XXX	001	0	20801-112	Water	ND	0.1	mg/L as N	04/06/11 1100	04/07/11 1226
OC-SD-MMB-SW/SD-1-XXX	002	0	20801-113	Water	ND	0.1	mg/L as N	04/06/11 1100	04/07/11 1227
OC-SD-ISCO.2-XXX	003	0	20801-114	Water	0.11	0.1	mg/L as N	04/06/11 1100	04/07/11 1233
Laboratory Control Sample	000	7	20801-210	Water	ND	0.1	mg/L as N	04/13/11 1215	04/18/11 1651
OC-SD-SDBK-002-XXX	001	7	20801-212	Water	ND	0.1	mg/L as N	04/13/11 1215	04/18/11 1659
OC-SD-MMB-SW/SD-1-XXX	002	7	20801-213	Water	ND	0.1	mg/L as N	04/13/11 1215	04/18/11 1700
OC-SD-ISCO.2-XXX	003	7	20801-214	Water	ND	0.1	mg/L as N	04/13/11 1215	04/18/11 1701
Laboratory Control Sample	000	14	20801-310	Water	ND	0.1	mg/L as N	04/20/11 0745	04/20/11 1244
OC-SD-SDBK-002-XXX	001	14	20801-312	Water	ND	0.1	mg/L as N	04/20/11 0745	04/20/11 1246
OC-SD-MMB-SW/SD-1-XXX	002	14	20801-313	Water	ND	0.1	mg/L as N	04/20/11 0745	04/20/11 1249
OC-SD-ISCO.2-XXX	003	14	20801-314	Water	ND	0.1	mg/L as N	04/20/11 0745	04/20/11 1250
Laboratory Control Sample	000	21	20801-410	Water	ND	0.1	mg/L as N	04/27/11 1400	05/03/11 1534
OC-SD-SDBK-002-XXX	001	21	20801-412	Water	ND	0.1	mg/L as N	04/27/11 1400	05/03/11 1540
OC-SD-MMB-SW/SD-1-XXX	002	21	20801-413	Water	ND	0.1	mg/L as N	04/27/11 1400	05/03/11 1541
OC-SD-ISCO.2-XXX	003	21	20801-414	Water	ND	0.1	mg/L as N	04/27/11 1400	05/03/11 1542
Laboratory Control Sample	000	28	20801-510	Water	ND	0.1	mg/L as N	05/04/11 0845	05/10/11 1536
OC-SD-SDBK-002-XXX	001	28	20801-512	Water	ND	0.1	mg/L as N	05/04/11 0845	05/10/11 1537
OC-SD-MMB-SW/SD-1-XXX	002	28	20801-513	Water	ND	0.1	mg/L as N	05/04/11 0845	05/10/11 1538
OC-SD-ISCO.2-XXX	003	28	20801-514	Water	ND	0.1	mg/L as N	05/04/11 0845	05/10/11 1544
Laboratory Control Sample	000	35	20801-601	Water	0.32	0.1	mg/L as N	05/11/11 0800	05/17/11 1511
OC-SD-SDBK-002-XXX	001	35	20801-612	Water	0.31	0.1	mg/L as N	05/11/11 0800	05/17/11 1512
OC-SD-MMB-SW/SD-1-XXX	002	35	20801-613	Water	0.29	0.1	mg/L as N	05/11/11 0800	05/17/11 1513
OC-SD-ISCO.2-XXX	003	35	20801-614	Water	0.11	0.1	mg/L as N	05/11/11 0800	05/17/11 1514
Laboratory Control Sample	000	42	20801-710	Water	0.35	0.1	mg/L as N	05/18/11 1230	05/25/11 1510
OC-SD-SDBK-002-XXX	001	42	20801-712	Water	ND	0.1	mg/L as N	05/18/11 1230	05/25/11 1513
OC-SD-MMB-SW/SD-1-XXX	002	42	20801-713	Water	ND	0.1	mg/L as N	05/18/11 1230	05/25/11 1514
OC-SD-ISCO.2-XXX	003	42	20801-714	Water	ND	0.1	mg/L as N	05/18/11 1230	05/25/11 1515

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Overlying Water Total Organic Carbon Summary
METHOD: SM 5310 C

Field ID	Sample Number	Day	LAB ID	MATRIX	RESULT	QLIMIT	UNITS	SAMPLED	ANALYZED
Laboratory Control Sample	000	0	20801-115	Water	4.5	0.4	mg/L	04/06/11 1100	04/20/11
OC-SD-SDBK-002-XXX	001	0	20801-117	Water	4	0.4	mg/L	04/06/11 1100	04/20/11
OC-SD-MMB-SW/SD-1-XXX	002	0	20801-118	Water	4.2	0.4	mg/L	04/06/11 1100	04/20/11
OC-SD-ISCO.2-XXX	003	0	20801-119	Water	7	0.4	mg/L	04/06/11 1100	04/20/11
Laboratory Control Sample	000	28	20801-515	Water	6.5	0.4	mg/L	05/04/11 0845	05/06/11 1143
OC-SD-SDBK-002-XXX	001	28	20801-517	Water	5	0.4	mg/L	05/04/11 0845	05/06/11 1143
OC-SD-MMB-SW/SD-1-XXX	002	28	20801-518	Water	5	0.4	mg/L	05/04/11 0845	05/06/11 1143
OC-SD-ISCO.2-XXX	003	28	20801-519	Water	4.7	0.4	mg/L	05/04/11 0845	05/06/11 1143

STUDY: 20686
CLIENT: MACTEC Engineering & Consulting, Inc.
PROJECT: Olin Site, Massachusetts
ASSAY: Hyalella azteca Sediment Assay
TASK: Sediment Total Volatile Solids Summary
METHOD: AASHTO T 267-86 (2004)

Field ID	Sample Number	LAB ID	MATRIX	RESULT	QLIMIT	UNITS	SAMPLED	ANALYZED
OC-SD-SDBK-002-XXX	001	20686-001	Solid	2.7	0.1	% dry wt	02/17/11 1130	03/04/11
OC-SD-SDBK-002-XXX	001	20686-001D	Solid	2.7	0.1	% dry wt	02/17/11 1130	03/04/11
OC-SD-MMB-SW/SD-1-XXX	002	20686-002	Solid	6.9	0.1	% dry wt	02/17/11 1330	03/04/11
OC-SD-ISCO.2-XXX	003	20686-003	Solid	6.3	0.1	% dry wt	02/17/11 0940	03/04/11


°C
Temperature
Study 20686 Hyalella azteca 42 Day Assay
Device - MicroPoint1
Serial Number - N07126
Device ID - Temp
27
25.4
23.8
22.2
20.6
19
Mean: 23.0
Minimum: 22.2
Maximum: 24.2
12:00:00 PM Apr 06, 2011 UTC-04:00
09:36:00 PM Apr 14, 2011 UTC-04:00
07:12:00 AM Apr 23, 2011 UTC-04:00
04:48:00 PM May 01, 2011 UTC-04:00
02:24:00 AM May 10, 2011 UTC-04:00
12:00:00 PM May 18, 2011 UTC-04:00

Rec. 04/05/11

Aquatic Research Organisms

DATA SHEET

I. Organism History

Species Hyalella azteca

Source: Lab reared X Hatchery reared_____ Field collected_____

Hatch date 3/30/11 Receipt date_____

Lot number 033011HA Strain ARO

Brood origination USFWS MO

II. Water Quality

Temperature 24 °C Salinity — ppt D.O. 5.97 ppm

pH 7.4 su Hardness ≈120 ppm Alkalinity ≈140 ppm

III. Culture Conditions

Freshwater X Saltwater_____ Other_____

Recirculating_____ Flow through_____ Static renewal X

DIET: Flake food X Phytoplankton_____ Trout chow X

Artemia_____ Rotifers_____ YCT_____ Other_____

Prophylactic treatments:_____

Comments:_____

_____

IV. Shipping Information

Client: ESI # of Organisms 700+

Carrier: PICK UP Date shipped 4/5/11

Biologist: Stan Smitka

PO BOX 1271 HAMPTON NH 03843-1271 (603) 926-1650 AROFISH@AOL.COM

Pre-Assay Monitoring
Hyalella azteca
42 Day Sediment Evaluation

Study: 20801	Client: MACTEC Engineering & Consulting, Inc.	Project: Olin Site		
Day	**Date**	**Renewed**	**Initial**	**Overlying Water Ammonia Checked**
0	03/30/11	✓	JTP/AM	—
1	03/31/11	✓	JTP/AM	with kit ≈0 mg/L as CaCO3
2	04/01/11	✓	JTP	—
3	04/02/11	✓	SJ	—
4	4-3-11	✓	DM	—
5	4/4/11	✓	AM/JTP	with kit ≈ 3 mg/L as CaCO3
6	4/5/11	✓	AM	—
7				
8				
9				
10				
11				
12				
13				
14				

Two Volume Additions Daily	Overlying Water: MHR Pond	Temperature: 23°C

Test Sediment Preparation Notes

Study Number: 20686

Client: MACTEC
Engineering & Consulting, Inc.

Project: Olin

Field ID	ESI Code	Sample Number	Notes
OC-SD-SDBK-002-XXX	20686-001	001	Some headspace (1/4"). Sandy with some organics, low % moisture. Sieved to 2mm. Added to beakers after sieving event. *
OC-SD-MMB-SW/SD-XXX -1- RAM 02/24/11	20686-002	002	1-1 1/2" head space. Rocks, twigs, debris. End result wet, dark pudding texture. 1 Gallon bucket x 75% full after sieving.
OC-SD-ISCO.2-XXX	20686-003	003	70% recovered after sieving. Some headspace (1 1/2") when opened. High percent moisture and organics Sieved
			to 2mm and immediately added to beakers.
Date: 02/22/11 **Initial:** AM/JTP			

* 80% recovered after sieving

ESI
EnviroSystems, Inc.
1 Lafayette Road
P.O. Box 778
Hampton, N.H. 03843
Voice: 603-926-3345
FAX: 603-926-3521

ESI Job No: 20686

CHAIN OF CUSTODY DOCUMENTATION

Client: Mactec	Contact: Janet Keating-Connolly	Project Name: Olin	Page 1 of 1
Report to: Mactec	Address: 107 Audubon Rd	Project Number: 6107110016	
Invoice to: Mactec	Address: Wakefield MA 01880	Project Manager: Janet Keating-Connolly	
Voice: 781 245 6606	Fax: 781 246 5060	email:	P.O. No: Quote No:

Protocol: RCRA SDWA NPDES USCOE Other

Lab Number (assigned by lab)	Your Field ID: (must agree with container)	Date Sampled	Time Sampled	Sampled By	Grab or composit (G/C)	Container Size (ml.)	Container Type (P/G/T)	Field Preservation	Matrix S=Solid W=Water	Filter N=Not needed F=Done in field L=Lab to do	Analyses Requested\ Special Instructions:
-001	OC-SD-SDBK-002-xxx	2/17/11	1130	CTM/DLC	G	1 Gal	P	-	S	N	Tox. Testing
-002	OC-SD-MMB-SW/SD-1-xxx	2/17/11	1330	CTM/DLC	G	1 Gal	P	-	S	N	Tox. Testing
-003	OC-SD-ISCO.2-xxx	2/17/11	0940	CTM/DLC	G	1 Gal	P	-	S	N	Tox. Testing

Relinquished By: [signature] Date: 2/17/11 Time: 1600 Received By: [signature] Date: 02/17/11 Time: 1600

Relinquished By: Date: Time: Received at Lab By: Date: Time:

Comments:

0°C

Sample Delivery Group No: Page of

COC Doc No: 422

SAMPLE RECEIPT AND CONDITION DOCUMENTATION

STUDY NO:	20686		
SDG No:			
Project:	Olin		
Delivered via:	**ESI**		
Date and Time Received:	02/17/11 1600	Date and TIme Logged into Lab:	02/17/11 1600
Recieved By:	RAM	Logged into Lab by:	RAM
Air bill / Way bill:	No	Air bill included in folder if received?	NA
Cooler on ice/packs:	Yes	Custody Seals present?	NA
Cooler Blank Temp (C) at arrival:	0C	Custody Seals intact?	NA
Number of COC Pages:	1		
COC Serial Number(s):			
COC Complete:	Yes	Does the info on the COC match the samples?	Yes
Sampled Date:	Yes	Were samples received within holding time?	Yes
Field ID complete:	Yes	Were all samples properly labeled?	Yes
Sampled Time:	Yes	Were proper sample containers used?	Yes
Analysis request:	Yes	Were samples received intact? (none broken or leaking)	Yes
COC Signed and dated:	Yes	Were sample volumes sufficient for requested analysis?	Yes
Were all samples received?	Yes	Were VOC vials free of headspace?	NA
Client notification/authorization:	Not required		

Field ID	Lab ID	Mx	Analysis Requested	Bottle	Req'd Pres'n	Verified Pres'n
OC-SD-SDBK-002-XXX	20686-001	S	Ha42T;	3 x 1 gallon I	4C	Yes
OC-SD-MMB-SW/SD-1-XXX	20686-002	S	Ha42T;	3 x 1 gallon I	4C	Yes
OC-SD-ISCO.2-XXX	20686-003	S	Ha42T;	3 x 1 gallon I	4C	Yes

Notes and qualifications:

Subject: RE: Olin Sediment Evaluation
From: "Keating-Connolly, Janet" <JKEATING-CONNOLLY@mactec.com>
Date: Fri, 18 Feb 2011 13:55:51 -0500
To: Renee McIsaac <r.mcisaac@envirosystems.com>
CC: Kenneth Simon <ksimon@envirosystems.com>

2 reference samples: SD-BK002 and MMB-SD-001

Janet Keating-Connolly, LSP
MACTEC Engineering & Consulting, Inc.
107 Audubon Road, Suite 301
Wakefield, MA 01880
(781) 213-5654 office
(978) 855-1885 mobile
jkconnolly@mactec.com

From: Renee McIsaac [mailto:r.mcisaac@envirosystems.com]
Sent: Friday, February 18, 2011 12:39 PM
To: Keating-Connolly, Janet
Cc: Kenneth Simon
Subject: Olin Sediment Evaluation

Hello Janet,

Can you tell me which of the samples are reference sample(s) for the Olin sediment evaluation?
I would like to enter them into the statistical database so that tables can be generated.
Thanks,
Renee McIsaac
ERA Project Manager

EnviroSystems, Inc.
Specialists in Environmental Toxicology and Chemistry
PO Box 778 / 1 Lafayette Road
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Voice: 603-926-3345 ext. 212 / Fax: 603-926-3521

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ATTACHMENT 7

SCREENING LEVELECOLOGICAL RISK ASSESSMENT
EAST DITCH

(Provided on CD ROM)

SCREENING LEVEL
ECOLOGICAL RISK ASSESSMENT
EAST DITCH

OLIN CHEMICAL SUPERFUND SITE

51 EAMES STREET
WILMINGTON, MASSACHUSETTS

SCREENING LEVEL
ECOLOGICAL RISK ASSESSMENT
EAST DITCH

OLIN CHEMICAL SUPERFUND SITE

51 EAMES STREET
WILMINGTON, MASSACHUSETTS

Prepared for:

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Prepared by:

AMEC Environment & Infrastructure, Inc.
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Westford, MA 01886

Project No. 6107130016.01

July 26, 2013

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Attachment 2 Endangered, Threatened or State Listed Species Review
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LIST OF ACRONYMS

AMEC	AMEC Environment & Infrastructure Inc.
BERA	Baseline Ecological Risk Assessment
CSM	Conceptual Site Model
COPECs	Chemicals of Potential Ecological Concern
ECOSAR	Ecological Structure Activity Relationships
MBTA	Massachusetts Bay Transit Authority
mg/kg	milligrams per kilogram
NOAEL	No-Adverse-Effect-Level
OCSS	Olin Chemical Superfund Site
Olin	Olin Corporation
OU	Operable Unit
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
SLERA	Screening Level Ecological Risk Assessment
SQL	Sample Quantitation Limit
SVOCs	Semivolatile Organic Compounds
TNRCC	Texas Natural Resources Conservation Commission
TRV	Toxicity Reference Value
TSWQS	Texas Surface Water Quality Standards
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WDW	West Ditch Wetland

1.0 INTRODUCTION

Olin Corporation (Olin) is conducting a Remedial Investigation/Feasibility Study (RI/FS) under the *Settlement Agreement and Administrative Order on Consent* (AOC) (USEPA, 2007) in accordance with the *Statement Of Work (SOW), RI/FS, Olin Chemical Superfund Site* (Site), prepared by the United States Environmental Protection Agency (USEPA) Region I – New England and dated June 2007 (USEPA, 2007).

The AOC and SOW identify RI requirements for three Operable Units (OUs). As part of the RI/FS a Baseline Ecological Risk Assessment (BERA) has been developed for OU 1 and OU 2, which Olin and USEPA have agreed to address in a combined Remedial Investigation (RI) Report. The East Ditch is a portion of OU2 (defined as off-Property surface water and sediment areas, including, at a minimum, the off-Property East Ditch, South Ditch and West Ditch). This document is the Screening Level Ecological Risk Assessment (SLERA) for the East Ditch.

This SLERA has been developed by AMEC Environment and Infrastructure, Inc. (AMEC) on behalf of Olin in accordance with the USEPA *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (USEPA, 1997), herein referred to as the "Process Document". The following documents were also used as guidance for conducting the SLERA:

- Framework for Ecological Risk Assessment. USEPA, Risk Assessment Forum, Washington, DC, EPA/630/R-92/001. February 1992 (USEPA, 1992);
- Risk Assessment Guidance for Superfund (RAGS), Volume II: Environmental Evaluation Manual (USEPA, 1989);
- Guidelines for Ecological Risk Assessment (USEPA, 1998);
- The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update (USEPA, 2001a); and
- EcoUpdates published by USEPA between 1991 and 2008 (USEPA, 1991-2008).

The Process Document outlines an iterative two tier approach to ecological risk assessment. The SLERA is the first tier and includes the Screening-Level Problem Formulation and Screening Level Exposure Estimate and Risk Calculation. The SLERA identifies the contaminants of potential concern. The second tier is a Baseline Ecological Risk Assessment (BERA) that evaluates Chemicals of Potential Ecological Concern (COPECs) in greater detail and in the context of site specific factors.

As described in the Process Document, the purpose of the SLERA is to identify all complete exposure pathways and to conduct a conservative assessment of all COPECs. COPECs are selected from all analytes detected in environmental media in the East Ditch. However, the focus of this SLERA is on Contaminants of Interest (COIs) associated with historical operations at the Property. COIs are chemicals that have been associated with the former facility (as a raw material, product, or a constituent of waste streams or accidental releases) and that have been released to one or more environmental media. COIs include:

- 2,4,4,-trimethyl-1-pentene,
- 2,4,4,-trimethyl-2-pentene,
- 2-ethylhexoic acid,
- ammonia,
- benzonitrile,
- bis(2-ethylhexyl) phthalate,
- butanol,
- chlorosulfonic acid,
- chromium,
- diisobutylene,
- dimethylformamide,
- diphenyl oxide,
- dioctyldiphenylamine,
- dinonylphenol,
- di-n-octylphthalate,
- dibutyl phthalate,
- formaldehyde,
- hydrazine,
- hydrochloric acid,
- hydroxide,
- kempore,
- nitrosodiphenylamine,
- nitrosodipropylamine,
- nitropore,
- nonylphenol,
- opex,
- polychlorinated biphenyls (PCBs),
- phenol,
- sodium nitrite,
- sodium dichromate,
- sodium nitrite,
- sulfuric acid,
- sodium dichromate,
- sulfuric acid,
- sodium and ammonium salts (sulfates, chlorides, nitrates, and nitrites),
- trisnonylphenyl phosphate, and
- trimethylpentene.

Following the initial selection of COPECs, the Process Document provides for the use of additional calculations and analyses to incorporate additional site-specific data in order to refine the initial list of COPECs. This refinement step goes beyond the requirements of a typical SLERA and helps to focus activities needed to support a BERA (if needed). Taken together, the results of the initial COPEC screening and additional COPEC refinement are used to determine whether the available information is adequate to make risk management decisions. Thus, in accordance with the Process Document, this SLERA:

- Characterizes Site conditions;
- Summarizes Site data;
- Identifies complete exposure pathways;
- Selects COPECs using conservative exposure estimates and risk calculations;
- Refines the list of COPECs using additional calculations, analyses, and site-specific information including:
  - Comparison of average concentrations to effects benchmarks; and
  - Comparison of East Ditch concentrations to Reference Area Concentrations.
- Identifies which COPECs could not be ruled out and where further action is required.

Based on the SLERA, possible conclusions may fall into three broad categories:

- There is a negligible ecological risk and therefore the East Ditch requires no further study;

- The information is not adequate to make a decision, but the ecological risk assessment process will continue (i.e., additional information will be collected and evaluated); or
- The risk of adverse ecological effects could not be ruled out and further action is warranted, either in the form of additional ecological risk assessment (i.e., a BERA) or remediation.

2.0 PREVIOUS ECOLOGICAL RISK ASSESSMENTS

This section summarizes the previous ecological risk assessments conducted for the Site, specifically detailing the findings relevant to the East Ditch.

1993 Screening Level Ecological Risk Assessment

ABB Environmental Services, Inc. (ABB-ES) completed a SLERA for the Site in December 1993 as part of a Phase II Comprehensive Site Assessment (ABB-ES, 1993). The SLERA evaluated risks to aquatic receptors in the East Ditch and concluded that adverse effects were possible from exposure to contaminants in surface water and sediments. Endrin aldehyde and ammonia were identified as the major contributors to risk from exposure to surface water in the upstream near site and downstream portions of the East Ditch. Endrin aldehyde, chromium, lead, manganese, mercury, nickel, ammonia, and zinc were identified as major contributors to risk from exposure to sediments in the upstream near Site area, and endrin, endrin ketone, arsenic, and chromium were identified as primary risk drivers for sediments in the downstream area.

2004 Phase II Focused Environmental Risk Characterization

MACTEC Engineering and Consulting, Inc. (MACTEC) completed a Phase II Focused Environmental Risk Characterization (ERC) in August 2004 for the East Ditch and the downstream areas of the New Boston Street Drainway. The ERC evaluated risk to aquatic invertebrates and amphibians from exposure to contaminants in surface water and sediments in the East Ditch. Risks to aquatic invertebrates could not be ruled out by comparing contaminant concentrations in surface water and sediment to toxicological screening benchmarks. However, a benthic invertebrate community assessment found no indication of impacts relative to upstream “background” conditions. The findings of the benthic community assessment supported a conclusion of no significant risk of harm to aquatic invertebrates in the East Ditch.

Risks to amphibians could not be ruled out by comparing contaminants concentrations in surface water and sediment to toxicological screening benchmarks. However, the findings of the Frog Embryo Teratogenesis Assay – Xenopus (FETAX) and qualitative amphibian survey supported a conclusion of no significant risk of harm to amphibians in the East Ditch.

A qualitative risk evaluation was also conducted for fish and aquatic plants in the East Ditch. This evaluation concluded that these receptors were unlikely to have significant exposure to chemicals in environmental media in the East Ditch; therefore significant population level effects are unlikely.

3.0 PROBLEM FORMULATION

The problem formulation provides the framework upon which the risk assessment is organized. The problem formulation:

- Describes the nature and extent of contaminants at the Site (Section 3.1);
- Describes the environmental setting of the East Ditch (Section 3.2);
- Identifies any endangered, threatened or State-listed species (Section 3.3);
- Identifies ecological receptors and complete exposure pathways (Section 3.4);
- Identifies assessment and measurement endpoints (Section 3.5);
- Describes the ecological conceptual site model (CSM) (Section 3.6);
- Presents the data evaluation for the SLERA (Section 3.7);

The problem formulation is based on the findings of numerous Site investigations, risk assessments and remedial actions conducted since 1978 to develop an understanding of the nature of environmental impacts at the Site.

3.1 Nature and Extent of Contamination

The sources, nature and extent of contaminants at the Site, and the fate and transport of those contaminants are discussed in detail in Section 4.0 of the OU1/OU2 RI report.

3.2 Environmental Setting

This section describes environmental setting of the East Ditch. The East Ditch study area evaluated in this SLERA is the reach extending from approximately 825 feet north of the Eames Street overpass at sample location EDSD/SW0 1,125 feet south of the confluence of Landfill Brook and the New Boston Street Drainway (downstream portion of the East Ditch) at sample location EDSD/SW7 (**Figure** 3.2-1). The total length of the study area evaluated is approximately 1.1 miles.

The current environmental setting was characterized by two AMEC ecologists on June 20, 2013 as an update to previous characterizations of the East Ditch presented in the report *Phase II Focused Environmental Risk Characterization Addendum East Ditch and Downstream Areas, 51 Eames Street, Wilmington Massachusetts, RTN 3-0471 (*MACTEC, 2004), herein referred to as the Focused ERC. The Focused ERC conducted in 2004 included habitat assessments, a benthic invertebrate community assessment, and a screening level comparison of chemicals concentrations in environmental media to screening benchmarks.

The 2013 Focused ERC included:

- Habitat assessments conducted following methods presented in the guidance document *Rapid Bioassessment Protocols for Wadeable Streams and Rivers* (USEPA, 1999); and

- A wetland functional assessment of the East Ditch conducted using the methodology presented in the *U.S. Army Corps of Highway Methodology Workbook Supplement – Wetland Functions and Values, A Descriptive Approach* (USACE, 1995).

All observations were made from the Eames Street overpass, the berm to the west of the East Ditch, and other vantage points at least 25 ft from the centerline of the nearest railroad tracks. None of the vantage points were within the railroad right of way.

3.2.1 Habitat Assessment

AMEC characterized habitat in the East Ditch at five locations from north of the Eames Street overpass to the confluence of Landfill Brook with the East Ditch. Habitat was characterized using the *Rapid Bioassessment Protocols for Wadeable Streams and Rivers Habitat Assessment Field Sheets for Low Gradient Streams* (USEPA, 1999). Using these field sheets (**Attachment** 1), habitat at each location was scored for ten habitat parameters using numeric scales corresponding with condition categories of poor, marginal, suboptimal, and optimal (**Table** 3.2-1). The remainder of this section describes the habitat conditions observed and discusses the corresponding condition categories.

The East Ditch is a man-made channel engineered to convey surface water runoff along the MBTA railroad tracks. The East Ditch runs parallel to the railroad tracks, at the base of the railroad embankment. From the Eames Street overpass, the East Ditch runs straight along the railroad tracks for approximately 1,500 feet to the confluence with South Ditch at the outfall. From the South Ditch outfall, East Ditch runs another 1,375 feet along the railroad tracks before entering a culvert 500 feet north of Anderson Station and conveyed 100 feet to the west. The East Ditch then daylights immediately to the west of New Boston Street. From there it runs approximately 200 feet south to the confluence with Landfill Brook. At this confluence is an approximately 20 foot diameter pool. Twenty five feet downstream of the pool, East Ditch enters another culvert that conveys it approximately 1,300 feet to the south. Channel alteration was scored as poor throughout the East Ditch as it is clearly an engineered drainage feature. Channel sinuosity was also scored as poor as the ditch is straight and highly channelized.

Throughout the East Ditch from north of the Eames Street overpass to the first culvert near Anderson Station, channel substrate and banks consists primarily of railroad ballast with some fine particulates (sand and silt). The absence of islands or point bars in East Ditch formed by sediment deposition resulted in a marginal or poor sediment deposition score.

The ballast forming the banks and channel of the East Ditch is a homogenous crushed stone, with most particles one two inches in diameter. Submerged logs, snags, large rocks, or undercut banks that provide cover or habitat for benthic invertebrates are generally absent from the East Ditch. Epifaunal (*i.e.,* benthic invertebrate) substrate/available cover was therefore scored as marginal or poor throughout the East Ditch.

The East Ditch channel is one long, straight run. No pools or riffles were observed, so pool substrate could not be scored, and pool variability was scored as poor throughout the East Ditch.

At the time of the habitat assessment, the width and depth of the East Ditch were fairly consistent throughout the reach. The wetted width of the East Ditch ranged from 2 to 4 feet, with only marginally wider bankfull widths. Despite water depths of 0.5 to 1.5 feet, surface velocity was negligible with no noticeable flow throughout most of the reach. The surface velocity of the East Ditch was observed to increase immediately downstream of the South Ditch outfall to approximately 6 inches per second, but stagnated again only a few hundred feet further south. Channel flow status was therefore characterized as poor or marginal throughout the East Ditch.

Emergent vegetation in the East Ditch channel was limited to broad leaf cattails (*Typha latifolia*). Most of the cattails throughout the channel were only one to two feet high with only a few areas having larger, more established plants. Green algae (*Chlorophyta*) were observed in the deeper portions of the channel. A mat of diatomaceous algae (*Bacillariophyta*) covered the bottom of the channel throughout the reach.

The eastern bank of the East Ditch throughout the reach from north of the Eames Street overpass to the first culvert is ballast rising 2 to 3 feet above the waterline, and free of vegetation. The eastern bank shows no evidence of erosion, therefore bank stability was scored as optimal, though this score is largely attributable to the qualities of the ballast. The western bank of the East Ditch is a steeply sloped 6 to 8 foot tall berm covered in ballast and overgrown with vegetation. The western bank was scored as suboptimal for bank stability, as some small areas of the berm showed evidence of erosion.

The eastern bank, lacking any vegetation, was scored as poor for vegetative cover and riparian vegetative zone width.

The western bank was scored as marginal for vegetative cover, as most of the bank is covered in herbs, shrubs and saplings. The herbaceous vegetation was dominated by ferns and golden rod (*Solidago sp.*), with small patches of *Phragmites* and brambles (*Rubus sp.*) occurring along the reach. Shrubs present included high bush blueberry (*Vaccinium corymbosum*), and the invasives glossy buckthorn (*Rhamnus frangula*) and multiflora rose (*Rosa multiflora*). Saplings present included red oak samplings (*Quercus rubra*), sweet birch saplings (*Betula lenta*), tree of heaven (*Ailanthus altissima*), and staghorn sumac (*Rhus typhina*). Vegetation on the western bank provides no canopy cover for the East Ditch.

The western bank was scored as poor for riparian zone width, as the riparian zone throughout most of the reach extends only fifteen to twenty feet to the chain link fence along the Olin property boundary.

3.2.2 Wetland Functions and Values Assessment

The wetlands functional assessment (**Attachment** 1) found that the East Ditch is an engineered surface water drainage channel that provides little to no habitat of value. The functional wetland assessment concluded that none of the thirteen wetland functions were present:

Wetland Functions or Values	Present
Groundwater Recharge/Discharge	No
Floodflow Alteration	No
Fish and Shellfish Habitat	No
Sediment/Toxicant/Pathogen Retention	No
Nutrient Removal/Retention/Transformation	No
Production Export	No
Sediment/Shoreline Stabilization	No
Wildlife Habitat	No
Recreation	No
Education/Scientific Value	No
Uniqueness/Heritage	No
Visual Quality/Aesthetics	No
Threatened or Endangered Species Habitat	No

3.3 Endangered, Threatened or State Listed Species

Past consultations with the United States Fish and Wildlife Service (USFWS) have indicated that no federally-listed and proposed, endangered or threatened species are known to occur within the general vicinity of the site (Smith, 1997; MACTEC, 2002; and MACTEC, 2004). The Mystic Valley amphipod (*Crangonyx aberrans*) has historically been reported as occurring in the vicinity of the Property; however this species was delisted in 1997 by the Massachusetts Natural Heritage and Endangered Species Program (NHESP).

On March 13, 2013, AMEC reviewed the information available on the USFWS Information, Planning, and Conservation System and confirmed that there are currently no federally-listed rare, threatened, or endangered species known to occur on or in the vicinity of OU1 or OU2. AMEC also reviewed the information available on the MassDEP NHESP Interactive Priority and Estimated Habitats Online Viewer and confirmed that there are no estimated or priority habitats of State-listed species on or in the vicinity of OU1 or OU2. **Attachment** 2 presents the results of the USFWS and MassDEP endangered species reviews.

3.4 Ecological Receptors and Exposure Pathways

Ecological receptors in the East Ditch are limited to benthic invertebrates and amphibians. No fish have ever been observed in the East Ditch. Considering the habitat conditions described in Section 3.2, East Ditch is likely incapable of supporting fish. The East Ditch is also likely incapable of supporting semi-aquatic birds and mammals, considering its condition and proximity to the MBTA railroad tracks. The East Ditch does support aquatic plants, and they were observed to be in good condition and free of obvious signs of stress during the habitat assessment, as documented in Section 3.2.2, and therefore require no further evaluation.

Benthic invertebrates and amphibians may be exposed to chemicals in environmental media through several major biological exposure mechanisms (*i.e.,* exposure pathways):

- Ingestion of chemicals bound to sediment;
- Ingestion of dissolved and particulate chemicals in surface water; and
- Ingestion of chemicals through consumption of contaminated plants and prey items.

Although inhalation and dermal absorption pathways are possibly complete pathways, they are considered minor in comparison to ingestion and are not evaluated.

3.5 Assessment and Measurement Endpoints

Endpoints in the SLERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has occurred or may occur.

Assessment endpoints for the SLERA are generic assessment endpoints that pertain to the sustainability of receptor populations or communities. The endpoints are considered generic because they are based on a variety of organisms and are therefore considered to be representative of entire communities.

The assessment and measurement endpoints for this SLERA are presented below:

Assessment Endpoint	Measurement Endpoints
1. Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates and amphibians in surface water and sediment.	a. Comparison of maximum surface water concentrations to surface water quality benchmarks. b. Comparison of maximum sediment concentrations to sediment quality benchmarks.

3.6 Ecological Conceptual Site Model

The ecological conceptual site models for the East Ditch (**Figure** 3.6-1) illustrates initial estimates of contaminant fate and transport mechanisms, complete exposure pathways, and primary and secondary receptors. Specific assessment and measurement endpoints are not identified because generic endpoints were used, as discussed in Section 3.5. Ecological conceptual site models are based on the current understanding of Site conditions, and serve as a framework for evaluating ecological exposure and risk.

The ecological conceptual site model for the East Ditch describes:

- The source areas - historical releases from plant operations;
- Transport mechanisms - processes that partition chemicals among various environmental media;

- Exposure media - those environmental media through which organisms may be exposed to constituents; and
- Receptors – receptor organisms based on ecological investigations.

3.7 Data Evaluation

The data evaluation:

- Identifies data suitable to be used in the SLERA;
- Identifies data not used in the SLERA and explains the reasons for their exclusion; and
- Presents the methods used to group and summarize data for use in the SLERA.

A summary of media and areas sampled and a description of the data quality is provided in Section 2.0 of the RI report.

3.7.1 Data Used in the SLERA

Available data were selected for use in the SLERA using the criteria established by USEPA in "*Guidance for Data Usability in Risk Assessment*" (USEPA, 1992) as presented in **Attachment** 3. Sample collection and handling, laboratory analyses, and data QA/QC procedures were performed in accordance with USEPA methods, as described in the project QAPP. Section 2.0 of the RI report provides a detailed description of the sampling and analytical methods that were used to generate the data for the RI.

As shown in **Table 3.7-1,** the following data were used to evaluate the East Ditch:

- 19 exposure area surface water samples collected from 2010 to 2012;
- 3 exposure area sediment samples collected from 2010 to 2012;
- 2 reference area surface water samples collected from 2010 to 2011; and
- 1 reference sediment sample collected in 2010.

3.7.2 Data Not Used in the SLERA

Biological data and toxicity testing data for which conclusions about ecological risk have already been reached, as presented in previous submittals to USEPA, are not used in this SLERA.

3.7.3 Data Summary Methods

The following procedures were applied when summarizing the analytical data for the BERA:

- Rejected data ("R" qualified results) were not used in the risk assessment.
- Results qualified as estimated ("J" qualified) were used in the risk assessment as detected values.

- For samples in which analyte concentrations were detected outside the calibration range, and the samples were diluted and reanalyzed, only the re-analysis results for the analytes responsible for the dilution were used in the risk assessment. The results of the original run were used for analytes that had results within the calibration range in the original, undiluted sample run.
- When calculating the arithmetic mean concentrations, one-half the value reported as the non-detect value (usually the sample quantitation limits (SQL)) was used for results reported as not detected.
- Metal data for unfiltered (total) and filtered (dissolved) surface water samples were summarized separately.
- For datasets with fewer than 20 samples, duplicate samples were used along with their corresponding field samples to calculate composite “risk samples”.

4.0 SCREENING LEVEL EFFECTS EVALUATION

COPECs were selected by comparing maximum detected concentrations of chemical constituents in surface water and sediment to ecological screening benchmarks. Constituents with maximum detected concentrations greater than their corresponding benchmarks were selected as COPECs and retained for further evaluation. Constituents with maximum detected concentrations less than corresponding benchmarks pose a negligible risk to ecological receptors and were eliminated from further evaluation.

Constituents for which screening benchmarks were not available were retained as COPECs. Constituents identified as essential nutrients including calcium, magnesium, potassium, and sodium were eliminated from further evaluation in the SLERA. Essential nutrients are chemical elements that are required by most organisms for growth and maintenance of life, naturally present in the environment in high concentrations, and generally considered to be innocuous. Constituents with a low frequency of detection (*i.e.,* detected in less than 5% of samples for a given exposure area and medium), were not identified as COPECs. Comparison to background concentrations was not a component of this COPEC selection process.

4.1 Surface Water Screening Benchmarks

Ecological surface water screening benchmarks (**Table 4.1-1**) were selected for detected chemicals using a multi-tiered hierarchy. Benchmarks were preferentially selected as the lowest value among these sources:

- USEPA, 2013a. Freshwater Ambient Water Quality Criteria - Chronic Continuous Concentration.
- Suter, G.W, & C.L. Tsao, 1997. Oak Ridge National Laboratory Tier II Secondary Chronic Values. Cited in Buchman, 2008, *Screening Quick Reference Tables* (SQuiRTs from NOAA).
- USEPA, 2001b. USEPA Region 4 freshwater chronic values. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment.
- USEPA, 2007. USEPA Region 3 BTAG Screening Benchmarks for Freshwater.

Calculations for hardness dependent surface water screening benchmarks are presented in **Table 4.1-2.**

Lacking a value from the sources listed above, benchmarks were estimated based on structure activity relationships using the methodology developed by the Texas Natural Resources Conservation Commission (TNRCC) for the Texas Surface Water Quality Standards (TSWQS) (TNRCC, 2000). This methodology uses predicted toxicity levels for surface water obtained from USEPA's 2012 *ECOSAR Database* (*v.1.11*). Predicted toxicity levels are presented in the ECOSAR database as chronic toxicity values (CHVs) equal to $1/10^{th}$ of an LC50 (*i.e.,* the lethal concentrations affecting 50% of the test population). To derive screening benchmarks, these values were converted to NOAELs as shown in the following equations:

$$LC50 = CHV * 0.10 \qquad \textit{(Equation 1)}$$

Where:

LC50 = lethal concentrations affecting 50% of the test population (mg/L)
CHV = Chronic toxicity value equal to 1/10th of an LC50 for 30 to 60 day toxicity to fish

$$NOAEL = LC50 / f \qquad \textit{(Equation 2)}$$

Where:

NOAEL = No-Observable-Adverse-Effects-Level (mg/L); and
f = factor to convert LC50s to NOAELs

The conversion factor, f, was obtained from TNRCC (2000) and depends on the chemical's degree of persistence and tendency to bioaccumulate. The f value for a given chemical was selected as follows:

- f = 10 for non-persistent chemicals;
- f = 20 for persistent but non-bioaccumulating chemicals; and
- f = 100 for persistent and bioaccumulating chemicals.

Persistent chemicals are defined as those that are either listed as Persistent Organic Pollutants under the Stockholm Convention (UNEP, 2001a) or have half lives in soil or surface water longer than 2 months, as calculated in *Persistent, Bio-accumulating, and Toxic, Profiler v.1.301* (USEPA, 2010e). Calculations of persistence in the PBT Profiler excluded net advection and sediment burial and organic compounds with Log K_{OW}< 3.0 which are assumed to not significantly accumulate in biological tissue (Jager, 1998).

Attachment 4 presents the ECOSAR values and calculations used to derive screening benchmarks using this methodology.

4.2 Sediment Screening Benchmarks

Ecological sediment screening benchmarks (**Table 4.2-1**) were selected for detected chemicals from the sources listed below in order of preference:

- USEPA Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures ($C_{OC,PAHi,FCVi}$) (USEPA, 2003a).
- USEPA Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Compendium of Tier 2 Values for Nonionic Organics. Freshwater Conventional ESBs (USEPA, 2008).
- MacDonald, *et al.* Threshold Effects Concentrations (TECs) (MacDonald, *et al.,* 2000).
- USEPA Region 4 Sediment Screening Values (USEPA, 2001b).

- Ontario Ministry of Energy and Environment (OMEE) Low-Effect Levels (LELs) (Persaud *et al.,* 1993; cited in Jones, Suter & Hull, 1997).
- USEPA Region 5 Ecological Screening Levels (USEPA, 2003b).
- Assessment and Remediation of Contaminated Sediments (ARCS) Program Threshold Effects Concentrations (TECs) (USEPA, 1996).
- USEPA Region 3 BTAG Screening Benchmarks for Freshwater and Sediment (USEPA, 2007).
- Oak Ridge National Laboratory (ORNL) Lowest Chronic Values (LCVs) (Jones, Suter, & Hull, 1997).
- Sediment Toxicity of Petroleum Hydrocarbon Fractions (MassDEP, 2007).

4.3 COPEC Screening Results

This section summarizes COPECs selected for the East Ditch by exposure medium. Parameters are identified as COPECs if maximum detected concentrations are above screening values or if there is no screening value available. The COPEC selection process does not include comparison of detected concentrations to background conditions.

4.3.1 Surface Water

Analytes identified as COPECs in East Ditch surface water (**Table 4.3-1**) include:

- Volatile organic compounds (VOCs): 1,1,2- trichlor-1,2,2-trifluoroethane, chloroethane, and xylenes (m&p);
- Semivolatile organic compounds (SVOCs): caprolactam and n-nitrosodi-n-propylamine;
- Metals: aluminum, barium, iron, manganese, silver, and thallium;
- Inorganics: bromide, chloride, and ammonia; and
- Specialty compounds: kempore.

4.3.2 Sediment

Analytes identified as COPECs in East Ditch sediment (**Table 4.3-2**) include:

- VOCs: 1,1,2- trichlor-1,2,2-trifluoroethane, 2,4,4-trimethyl-2-pentene, acetaldehyde, acetone, and formaldehyde;
- SVOCs: bis(2-ethylhexyl)phthalate, carbazole and diphenyl ether;
- Metals: arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, silver, tin, vanadium and zinc;
- Inorganics: chloride, ammonia, and sulfate; and
- Specialty compounds: hydrazine.

5.0 REFINEMENT OF COPECS

Ecological risk assessment is an iterative process and allows and encourages modification as additional site information becomes available. At this stage of the risk assessment process, following the Screening Level Exposure Estimate and Risk Calculation, the Process Document provides for the use of additional calculations, analyses, and data review to refine the list of COPECs based on other site specific information. This refinement step goes beyond the requirements of a typical SLERA and helps to focus further evaluations of ecological risk.

Additional measurement endpoints evaluated in this refinement step include:

Assessment Endpoint	Measurement Endpoints
1. Sustainability (survival, growth, reproduction) of local populations of benthic invertebrates and amphibians in surface water and sediment.	c. Comparison of average surface water concentrations to effects benchmarks and reference area concentrations. d. Comparison of average sediment concentrations to effects benchmarks and reference area concentrations.

Comparing maximum analyte concentrations to conservative screening benchmarks provided the most conservative estimate of risk. Average concentrations are more accurate representations of the concentrations to which populations of ecological receptors would be exposed to in the East Ditch. Maximum concentrations reflect exposure at just a single point. While an individual receptor may be exposed to this point, the receptor population as a whole is expected to encounter the full range of concentrations throughout the exposure area and over time. Comparing average concentrations to effects benchmarks therefore provides a more realistic estimate of risk to receptor populations.

5.1 Effects Benchmarks

Effects benchmarks represent concentrations at or above which adverse effects are likely to occur. Effects benchmarks are typically based on toxicity tests and experimental observations published and summarized in the scientific literature. Effects benchmarks are typically reported based on the degree of measured response observed (*e.g.*, EC50, concentration effecting 50% of the test organisms). Effects benchmarks differ from screening benchmarks that identify concentrations below which adverse effects are not expected to occur.

The likelihood that an effect will occur if a COPEC concentration is above a benchmark depends on a number of factors including bioavailability, similarity of species used to measure effect, and similarity between experimental conditions and site conditions. Both screening and effects benchmarks generally assume 100 percent bioavailability. Bioavailability is the extent to which a substance can be absorbed from an environmental medium by a living organism, potentially causing an adverse response. The bioavailability of metals is related to the extent to which a

metal can desorb, dissolve, or otherwise dissociate from the environmental medium in which it occurs (Bernhard & Neff, 2001). When available, studies with species and habitats similar to those at the Property were examined to establish effects benchmarks.

5.1.1 Surface Water Effects Benchmarks

Ecological surface water effects benchmarks (**Table 5.1-1**) were selected for COPECs using a multi-tiered hierarchy. Benchmarks were preferentially selected from the same hierarchy used to select screening benchmarks; however, acute values were used for effects benchmarks whereas chronic values were used for screening.

Benchmarks were preferentially selected as the lowest value among these sources:

- USEPA, 2013a. Freshwater Ambient Water Quality Criteria - Chronic Maximum Concentrations.
- Suter, G.W, & C.L. Tsao, 1997.Oak Ridge National Laboratory Tier II Secondary Acute Values. Cited in Buchman, 2008, *Screening Quick Reference Tables* (SQuiRTs from NOAA).
- USEPA, 2001b. Acute - USEPA Region 4 freshwater acute values. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment.
- USEPA, 2007. USEPA Region 3 BTAG Screening Benchmarks for Freshwater.

Lacking a value from the sources listed above, benchmarks were estimated based on structure activity relationships using the methodology described in Section 4.1 and applying a multiple of 10 to convert from a NOAEL to a LOAEL. Calculations of hardness dependent criteria are shown in **Table 4.1-2**.

5.1.2 Sediment Effects Benchmarks

Ecological sediment effects benchmarks (**Table 5.1-2**) were selected for COPECs using a multi-tiered hierarchy. Benchmarks were preferentially selected from a similar hierarchy to that used to select screening benchmarks; however, where possible, acute values were used for effects benchmarks where as chronic values were used for screening.

Ecological sediment effects benchmarks were selected for detected chemicals from the sources listed below in order of preference:

- MacDonald, *et al.* Probable Effects Concentrations (PECs) (MacDonald, *et al.,* 2000).
- USEPA Region 4 Sediment Screening Values (USEPA, 2001b).
- USEPA Region 3 BTAG Screening Benchmarks for Freshwater and Sediment (USEPA, 2007).
- Oak Ridge National Laboratory (ORNL) Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).

- Assessment and Remediation of Contaminated Sediments (ARCS) Program Probable Effects Concentrations (PECs) (USEPA, 1996).
- Sediment Toxicity of Petroleum Hydrocarbon Fractions (MassDEP, 2007).

5.2 Method Used to Calculate Hazard Quotients

For chemical constituents selected as COPECs, average (arithmetic mean) concentrations were compared to effects benchmarks in order to calculate Hazard Quotients (HQs):

$$\text{Average HQ} = \frac{\text{Average Concentration}}{\text{Effects Benchmark Value}} \qquad \textit{(Equation 3)}$$

Average HQs (*i.e.,* the HQ calculated using the average concentration) of ≤1 conservatively indicate that the chemical constituent alone is unlikely to cause adverse ecological effects and can be eliminated from further evaluation.

To account for the contribution to COPEC concentrations from sources upstream of the Olin Property, Average Incremental Risk (IR) HQs were calculated:

$$\text{Average IR HQ} = \text{Average HQ} - \text{Average Reference Area HQ} \qquad \textit{(Equation 4)}$$

Incremental Risk HQs ≤ 0 indicate that HQs in East Ditch HQs are less than reference area HQs, and that the COPEC poses a negligible site-related risk. COPECs with incremental risk HQs ≤ 0 were eliminated from further ecological review.

HQs could not be calculated for COPECs that lacked effects benchmarks. In those cases, average concentrations in the East Ditch were directly compared to corresponding Reference Area concentrations and retained if concentrations in the East Ditch were greater than Reference Area concentrations.

5.3 Surface Water COPEC Refinement

COPECs in East Ditch surface water (**Table 5.3-1**) with average HQs ≤1 that can be eliminated from further review include:

- Metals: aluminum, barium, manganese, silver and thallium; and
- Inorganics: chloride and ammonia.

No screening benchmark was available for bromide and therefore an HQ could not be calculated. However, the average concentration of bromine in East Ditch surface water (0.069 mg/L) is less than the average Reference Area concentration (0.09 mg/L). Bromide is also not considered site-related COI. Therefore, bromide can be eliminated from further review of East Ditch surface water.

Iron was selected as a COPEC in East Ditch surface water as the maximum detected concentration (11 mg/L) was greater than the screening benchmark (1.0 mg/L). No effects

benchmark was available. However, the average concentration (1.9 mg/L) is less than the average reference area concentration (3.9 mg/L). Also, iron is not considered a site-related COI. Therefore iron can be eliminated from further review in East Ditch surface water.

The remaining COPECs in East Ditch surface water were retained as COPECs as no screening benchmarks were available. Effects benchmarks for these COPECs were also unavailable. In addition, these COPECs were not detected in Reference Area samples; therefore they were not eliminated from further review at this point:

- VOCs: 1,1,2- trichlor-1,2,2-trifluoroethane, chloroethane and xylenes (m&p);
- SVOCs: caprolactam and n-nitrosodi-n-propylamine; and
- Specialty Compounds: kempore.

Of these, only n-nitrosodi-n-propylamine and kempore are considered site-related COI.

5.4 Sediment COPEC Refinement

COPECs in East Ditch sediment (**Table 5.4-1**) with average HQs ≤1 (Equation 3) or average incremental risk HQs ≤ 0 (Equation 4) that can be eliminated from further review include:

- Metals: chromium, nickel and silver.

COPECs that were not eliminated using Equation 3 or Equation 4 include:

- Acetone and bis(2-ethylhexyl)phthalate - average HQs were >1 and were not detected in Reference Area samples;
- Arsenic, cadmium, copper, iron, lead, manganese, and zinc - average incremental risks HQs >1;
- Barium, beryllium, vanadium, and chloride - lacked effects benchmarks and were detected at concentrations greater than those in the Reference Area; and
- 1,1,2-trichlor-1,2,2-trifluoroethane, 2,4,4-trimethyl-2-pentene, acetaldehyde, formaldehyde, carbazole, diphenyl ether, tin, sulfate and hydrazine - lacked effects benchmarks and were not detected in Reference Area samples.

Of these, only BEHP, chloride, 2,4,4-trimethyl-2-pentene, hydrazine, and the aldehydes and diphenyls and are considered site-related COI.

6.0 RISK CHARATERIZATION

This section integrates the results of the benchmark screening and refinement steps, considers uncertainties, and summarizes final conclusions and recommendations.

6.1 Surface Water Risk Characterization

This section presents the risk characterization for East Ditch surface water by chemical class.

6.1.1 Volatile Organic Compounds

Three VOCs (1,1,2-Trichloro-1,2,2-Trifluoroethane, chloroethane, and m&p xylenes) were retained as COPECs in East Ditch surface water following the Refinement Step. These VOCs are not considered site-related COIs. Benchmarks were unavailable for those analytes and they were not detected in the Reference Area samples. While present, these analytes are not widespread, and where they infrequently occur, are found at low concentrations close to reporting limits. 1,1,2-Trichloro-1,2,2-Trifluoroethane was detected in 5 of 10 samples at a maximum concentration of 0.003 mg/L and an average concentration of 0.0011 mg/L. Chloroethane was detected in only 2 of 10 samples at a maximum concentration of 0.0026 mg/L and an average concentration of 0.0011 mg/L. Xylenes were detected in even fewer samples (1 of 10) and at lower concentrations; the maximum detected concentration was 0.00052 mg/L, and the average concentration (using ½ SQLs for non-detects) was 0.00095 mg/L.

In addition, these VOCs are not expected to persist in aquatic environments or significantly bioconcentrate in aquatic organisms (ATSDR, 1998; USEPA, 2013b). VOCs readily volatilize from surface water to air, and 1,1,2-Trichloro-1,2,2-Trifluoroethane, chloroethane and xylenes all have half lives of less than 1 day in surface water (USEPA, 1994; USEPA, 1988; USEPA, 2013b). Considering the lack of persistence of these VOCs in aquatic environments, their low frequency and magnitude of detections in East Ditch surface water, and that they have not been identified as COI, site-related adverse population level effects on ecological receptors are unlikely

6.1.2 Semivolatile Organic Compounds

Two SVOCs (caprolactam and n-nitrosodi-n-propylamine) were retained as COPECs in East Ditch surface water following the Refinement Step. Caprolactam is not considered a site-related COI. N-nitrosodi-n-propylamine is considered a site-related COI. Benchmarks were unavailable for those analytes and they were not detected in the Reference Area samples. While present, these analytes are not widespread, and where they infrequently occur, are found at low concentrations close to reporting limits. Caprolactam was detected in only 1 of 6 surface water samples at a concentration of 0.00073 mg/L. N-nitrosodi-n-propylamine was detected in only 1 of 10 samples at a concentration of 0.0000021 mg/L.

In addition, these SVOCs are not expected to be persistent in aquatic environments. N-nitrosodi-n-propylamine breaks down in surface water within hours (ATSDR, 1999).

Biodegradation of caprolactam in surface water is slightly slower (82% after 14 days), however, given its partitioning coefficient (log P_{OW} 0.12), it is not expected to bioaccumulate in organisms (UNEP, 2001b). Considering the lack of persistence of these SVOCs in aquatic environments and their low frequency and magnitude of detections in East Ditch surface water, adverse site-related population level effects on ecological receptors are unlikely.

6.1.3 Kempore

Kempore was retained as a COPEC in East Ditch surface water following the Refinement Step. Kempore is considered a site-related COI. No benchmarks were available for Kempore and it was not detected in the Reference Area samples. Kempore was detected in 2 of 10 East Ditch surface water samples at concentrations of 1.2 mg/L and 4.1 mg/L. Although no screening benchmarks were available for Kempore, acute toxicity tests have demonstrated no effects on aquatic organisms at concentrations greater than those detected in the East Ditch (WHO, 1999; REACH, 2013). Uniroyal (1992) found a No-Adverse-Effect-Concentration (NOEC) of 50 mg/L for the fathead minnow (*Pimephales promelas*) following 96 hours of exposure. For the water flea (*Daphnia magna*), following 48 hours of exposure, Uniroyal (1992) found NOEC of 4.8 mg/L and an EC50 values of 11 mg/L. Considering that the detected concentrations of Kempore in East Ditch surface water are less than NOEC values for fish and invertebrates, adverse population level effects on the ecological receptors evaluated (benthic invertebrates and amphibians) are unlikely.

6.2 Sediment Risk Characterization

This section presents the risk characterization for East Ditch sediment by chemical class.

6.2.1 Volatile Organic Compounds

Five VOCs (1,1,2-trichlor-1,2,2-trifluoroethane, 2,4,4-trimethyl-2-pentene, acetaldehyde, acetone, and formaldehyde) were retained as COPECs in East Ditch sediment following the Refinement Step. Acetone and 1,1,2-trichlor-1,2,2-trifluoroethane are not considered a site-related COI. None of these five VOCs were detected in the Reference Area sample. Benchmarks were available for acetone only. The maximum (0.43 mg/kg) and average (0.23 mg/kg) detected concentrations of acetone in East Ditch sediment exceeded the effects benchmark (0.0091 mg/kg). However, based on an extensive review of the aquatic toxicity (Staples, 2000) and bioavailability (Fuchsman, 2003), a more appropriate sediment quality benchmark for acetone is closer to 10 mg/kg (based on an organic content of one percent). Acetone is highly hydrophilic, does not bioaccumulate, and is readily biodegradable in aquatic systems (WHO, 1998). The detected concentrations of acetone in East Ditch sediment are therefore unlikely to have adverse population level effects on ecological receptors.

As discussed in Section 6.1.1, 1,1,2- trichlor-1,2,2-trifluoroethane is not persistent in the aquatic environment; therefore, concentrations in sediment are unlikely to have adverse population level effects on ecological receptors.

Ecotoxicological information for 2,4,4-trimethyl-2-pentene, acetaldehyde, and formaldehyde in the scientific literature is limited, therefore risk to ecological receptors from detected concentrations of the COPECs in sediment is uncertain. However, average concentrations of these COPECs in sediment are low (<1 mg/kg) and none of these COPECs were detected in surface water. This indicates that the concentrations of the COPECs present in the East Ditch may be strongly sorbed to the sediment, limiting their bioavailability to benthic invertebrates and amphibians and limiting potential population level effects. Considering their low concentrations in sediment and absence in surface water, the risk of adverse population level effects on ecological receptors from these COPECs is likely negligible.

Additionally, the habitat conditions of the East Ditch, documented in Section 3.2, are very poor. The East Ditch is a man-made channel that runs parallel to active MBTA railroad tracks, at the base of the railroad embankment. Much of the land use surrounding East Ditch is industrial. The East Ditch provides no wetland functions or values (Section 3.2.3). The purpose of the East Ditch is to convey surface water runoff along the MBTA railroad tracks. The East Ditch is a straight channel with little to no epifaunal cover, no canopy cover and little to no riparian buffer zone. The development and exposure of benthic invertebrate and amphibian communities in the East Ditch are likely greatly limited due to these restrictive habitat conditions. As such, any potential adverse site-related effects on these communities from low levels of VOCs in sediment are likely negligible.

6.2.2 Semivolatile Organic Compounds

Three SVOCs (bis(2-ethylhexyl)phthalate, carbazole and diphenyl ether) were retained as COPECs in East Ditch sediment following the Refinement Step. None of these three SVOCs were detected in the Reference Area sample. Benchmarks were available for bis(2-ethylhexyl)phthalate only. Carbazole is not a site-related COI. The average concentration of bis(2-ethylhexyl)phthalate in East Ditch sediment (4.2 mg/kg) is an order of magnitude greater than the effects benchmark (0.182 mg/kg). Although risk from concentrations of bis(2-ethylhexyl)phthalate in East Ditch sediment cannot be ruled out, concentrations of bis(2-ethylhexyl)phthalate in East Ditch surface water were less than the conservative screening benchmark. Absence of bis(2-ethylhexyl)phthalate in surface water indicates that the bis(2-ethylhexyl)phthalate present in the East Ditch may be strongly sorbed to the sediment, limiting its bioavailability to benthic invertebrates and amphibians and limiting potential population level effects.

Risk diphenyl ether in East Ditch sediment is uncertain as ecotoxicological information in the scientific literature is limited. However, the detected concentrations of the COPECs are low and as discussed in Section 6.2.1 above, risks from low levels of COPECs in East Ditch sediment are likely greatly mitigated by the poor habitat conditions of the East Ditch.

6.2.3 Metals

Thirteen metals (arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, tin, vanadium, and zinc) were retained as COPECs in East Ditch sediment

following the Refinement Step. Chromium is the only one of these metals identified as a site-related COI. All thirteen of the metals retained were detected in the Reference Area sample. Concentrations in the Reference Area sample were less than those in the East Ditch study area, with average incremental HQs ranging from 0.91 (chromium) to 17 (arsenic). Although HQs for metals in East Ditch sediment were > 1, average HQs from metals in East Ditch were all <1, indicating that exposure of benthic and amphibian populations across the entire exposure area and over time is unlikely to result in adverse effects. Additionally, as discussed in Section 6.2.1 above, risks from low levels of COPECs in East Ditch sediment are likely greatly mitigated by the poor habitat conditions of the East Ditch.

Chromium and nickel were eliminated as COPECs in East Ditch sediment following the Refinement Step as average concentrations were less than their respective concentrations in the reference sample. While only one reference sample may not rise to a strict definition of "reference", it does provide some local context. The East Ditch and East Ditch reference sediment datasets are small because very little sediment is deposited in the railroad ballast that forms the bottom and banks of East Ditch, limiting the amount of sediment available to sample. Considering that chromium and nickel in East Ditch sediment are only marginally higher than their respective effects benchmarks (average HQs are 1.1 and 1.0, respectively), and considering the very poor habitat quality of the East Ditch, site-related adverse population level effects to ecological receptors from concentrations of chromium and nickel in the East Ditch are unlikely to occur.

6.2.4 Inorganics

Three inorganics (chloride, ammonia, and sulfate) were retained as COPECs in East Ditch sediment following the Refinement Step. These inorganics are all considered site-related COIs. These COPECs were eliminated for surface water as concentrations were consistent with Reference Area concentrations or were less than effects benchmarks. This indicates that these COPECs in the East Ditch may be strongly sorbed to the sediment, limiting its bioavailability to benthic invertebrates and amphibians. Additionally, as discussed in Section 6.2.1 above, risks from low levels of COPECs in East Ditch sediment are likely greatly mitigated by the poor habitat conditions of the East Ditch.

6.2.5 Hydrazine

Hydrazine was retained as a COPEC in East Ditch sediment following the Refinement Step. Hydrazine is considered a site-related COI. No benchmarks were available for hydrazine and it was not detected in the Reference Area samples. Hydrazine was detected in 1 of 2 East Ditch sediment samples at a concentration of 0.0014 mg/kg. Hydrazine rapidly biodegrades in water and is unlikely to biomagnify through the food chain (ATSDR, 1997). Given the low detected concentration of Hydrazine and its lack of persistence in the aquatic environment, risk to benthic invertebrate and amphibian populations are likely negligible. Risk is likely even further mitigated by the poor habitat conditions of the East Ditch.

6.3 Uncertainty Analysis

This section presents and discusses the uncertainties associated with the various measurements, calculations, and assumptions which form the basis of the risk characterization. Awareness of the uncertainties involved in each step of the risk assessment is critical to interpreting and understanding ecological risk. Major uncertainties and assumptions are summarized below.

6.3.1 Data Summary/Exposure Point Concentrations

Exposure point concentrations were selected in various steps as either the maximum or average (arithmetic mean) concentrations of a given analyte in a given medium. Averages were calculated using ½ the SQL for non-detected concentrations and may overestimate risk by incorporating estimated, not measured, concentrations. In instances where frequency of detection is low and sample quantitation limits are high, average concentrations calculated using ½ the sample quantitation limits may actually exceed detected concentrations. Average concentrations were greater than maximum concentrations for:

- Xylenes, caprolactam and silver in East Ditch surface water; and
- 1,1,2- trichlor-1,2,2-trifluoroethane, 2,4,4-trimethyl-2-pentene, and acetaldehyde in East Ditch sediment.

Risks for these COPECs were therefore characterized based on their detected concentrations and not the overestimated average concentrations.

6.3.2 Exposure Estimates and Effects Benchmarks

The exposure estimates and effects benchmarks used in this SLERA likely overestimate risk as they incorporate several conservative assumptions including:

- Bioavailability of 100 percent for all COPECs; and
- Presence of the most sensitive receptors and receptor life stage.

The degree of certainty that an effect will occur if a COPEC concentration is above an effect benchmark depends on a number of factors including bioavailability, similarity of species used to measure the effect, and similarity between experimental conditions and Site conditions. Bioavailability is the extent to which a substance can be absorbed or otherwise ingested by a living organism, potentially causing an adverse response. Factors such as the organic carbon content of the sediment, the sediment grain size, pH, and presence of acid volatile sulfides, all affect the bioavailability of COPECs in sediment. The assumption of 100 percent bioavailability when applying benchmarks likely overestimates risk.

6.3.3 Characterization of Risk to Benthic Invertebrates

Risks based on average concentrations were evaluated in the COPEC Refinement Step to better characterize potential impacts to benthic invertebrates. Many benthic invertebrates maintain very small home ranges and thus it is possible that some individuals could be exposed repeatedly to the maximum concentration. However, maximum concentrations do not represent exposures that would reasonably be expected to occur for an entire population over a given study area and over time.

6.4 Conclusions

This SLERA evaluated the potential for COPECs detected in surface water and sediment in the East Ditch to adversely affect ecological receptors. The SLERA followed the approach outlined in Ecological Risk Assessment Guidance for Superfund Sites (USEPA, 1997). In accordance with the guidance, this SLERA:

- Characterizes Site conditions;
- Summarizes Site data;
- Identifies complete exposure pathways;
- Selects COPECs using conservative exposure estimates and risk calculations;
- Refines the list of COPECs using additional calculations, analyses, and site-specific information including:
  - Comparison of average concentrations to effects benchmarks; and
  - Comparison of East Ditch concentrations to Reference Area Concentrations.
- Identifies which COPECs could not be ruled out and where further action is required.

Based on the evaluation of risk to ecological receptors in the East Ditch, there is negligible ecological risk, therefore, East Ditch requires no further study.

7.0 REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR), 1999. TOXFAQs: N-nitrosodi-n-propylamine Cas # 621-64-7. Available at: http://www.atsdr.cdc.gov/toxfaqs/tfacts142.pdf

ATSDR, 1998. Toxicological Profile for Chloroethane. U.S. Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. December 1998.

ATSDR, 1997. Toxicological Profile for Hydrazines. U.S. Department of Health and Human Services. Public Health Service. Agency for Toxic Substances and Disease Registry. September 1997. Available at: http://www.atsdr.cdc.gov/ToxProfiles/tp100.pdf

Fuchsman, P.C., 2003. Modification of the Equilibrium Partitioning Approach for Volatile Organic Compounds in Sediment. *Environmental Toxicology and Chemistry* 22:1532-1534.

Jager, T, 1998. Mechanistic approach for estimating bioconcentration of organic chemicals in earthworms. *Environmental Toxicology and Chemistry* 17: 2080-2090.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger, 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20-31.

Massachusetts Department of Environmental Protection (MassDEP), 2007. Sediment Toxicity of Petroleum Hydrocarbon Fractions. Office of Research and Standards. September, 2007.

Persaud, D., R. Jaagumagi, and A. Hayton, 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto. *Cited in* Jones, Suter and Hull, 1997.

Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), 2013. Dossier for C, C'-azodi(formamide), CasNo.123-77-3. Accessed: 11/11/2013. Available at: (http://echa.europa.eu/web/guest/information-on-chemicals/registered-substances).

Staples, C.A., 2000. A screening level examination of the potential risks of acetone in aquatic and terrestrial environments using multi-media modeling. *Chemosphere* 41: 1529 – 1533.

Texas Natural Resource Conservation Commission (TNRCC), 2000. Texas Natural Resource Conservation Commission (TNRCC) Texas Surface Water Quality Standards. 30 TAC Chapter 307. Effective August 17, 2000.

US Army Corps of Engineers (USACE), 1995. Highway Methodology Workbook Supplement – Wetland Functions and Values, A Descriptive Approach. U.S. Army Corps of Engineers, New England Division. NENEP-360-1-30a. 32 pp.

United Nations Environmental Programme (UNEP), 2001a. Stockholm Convention on Persistent Organic Pollutants. May 22, 2001.

UNEP, 2001b. Caprolactum: CasNo: 105-60-2. SIDS Initial Assessment Profile. Available at: http://www.chem.unep.ch/irptc/sids/OECDSIDS/105602.pdf

Uniroyal (1992) Unpublished report from the Uniroyal Chemical Company Inc., Middlebury, CN. As cited in: World Health Organization (WHO), 1999. Concise International Chemical Assessment Document 16: Azodicarbonamide. World Health Organization. Geneva, 1999. Available at: http://www.inchem.org/documents/cicads/cicads/cicad16.htm#SectionNumber:6.1

United States Environmental Protection Agency (USEPA), 1991-2008. ECO Updates. USEPA Office of Solid Waste and Emergency Response. Various publications, 1991-2001.

USEPA, 2013a. Nationally Recommended Water Quality Criteria. Office of Science and Technology. 2013.

USEPA, 2013b. Technical Factsheet on Xylenes. National Primary Drinking Water Regulations. Available from:

http://www.epa.gov/safewater/pdfs/factsheets/voc/tech/xylenes.pdf

USEPA, 2003a. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA/600/R-02/013. November 2003.

USEPA, 2003b. USEPA Region 5 RCRA Ecological Screening Levels. August 22, 2003 (http://www.epa.gov/reg5rcra/ca/ESL.pdf)

USEPA, 2001a. The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments, ECO Update. 2001a.

USEPA, 2001b. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. 2001b.

USEPA, 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

USEPA, 1998. Guidelines for Ecological Risk Assessment. Office of Research and Development.EPA-630-R-95-002F. April, 1998.

USEPA, 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 540-R-97-007. June 1997.

USEPA, 1994. Chemical Summary for Freon 113. Office of Pollution Prevention and Toxics. EPA 749-F-94. August, 1994.

USEPA, 1992. Framework for Ecological Risk Assessment. EPA-630-R-92-001. February, 1992.

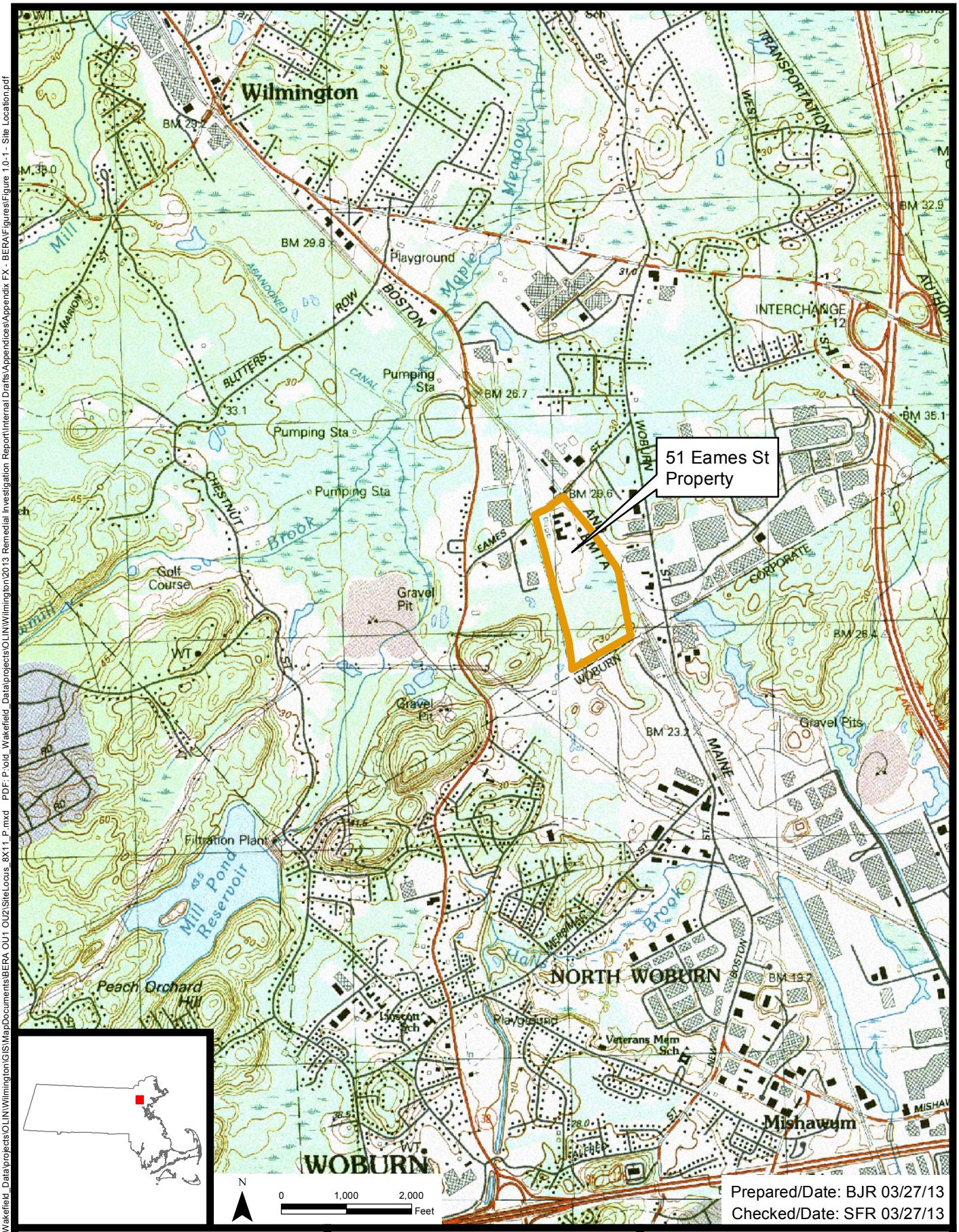
USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS), Volume II: Environmental Evaluation Manual. 1989.

USEPA, 1988. Summary of Emissions Associated with Sources of Ethyl Chloride. Emissions Standards Department. EPA-450/3-88-005. June 1988.

World Health Organization (WHO), 1999. Concise International Chemical Assessment Document 16: Azodicarbonamide. World Health Organization. Geneva, 1999. Available at: http://www.inchem.org/documents/cicads/cicads/cicad16.htm#SectionNumber:6.1

WHO, 1998. International Programme on Chemical Safety. Environmental Health Criteria 207: Acetone. ISBN 92 4 157207 8.

FIGURES



Prepared/Date: BJR 03/27/13
Checked/Date: SFR 03/27/13

Baseline Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, MA

amec

Figure 1.0-1
Site Locus

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SDBK-001
EDSD/SW0
EDSD/SW1 (EDBS5)
EDSD/SW2 (EDBS6)
ISCO3
EDSD/SW5 (EDBS11)
EDSD/SW7
Main Street
Eames Street
Olin Property
South Ditch
Landfill Brook
New Boston Street
Merrimac Street
Anderson Station

Legend

- Sediment Sample
- Surface Water Sample
- Culvert
- 51 Eames St. Property Boundary
- Water
- Railroad
- Paved Road
- Unpaved Road
- Wetland Boundary

AMEC Environment & Infrastructure
2 Robbins Rd
Westford, MA 01886

N

0 250 500
Feet

Figure 3.2-1
Surface Water and Sediment Samples Used in the SLERA Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 07/17/13 | Checked/Date: SFR 07/17/13

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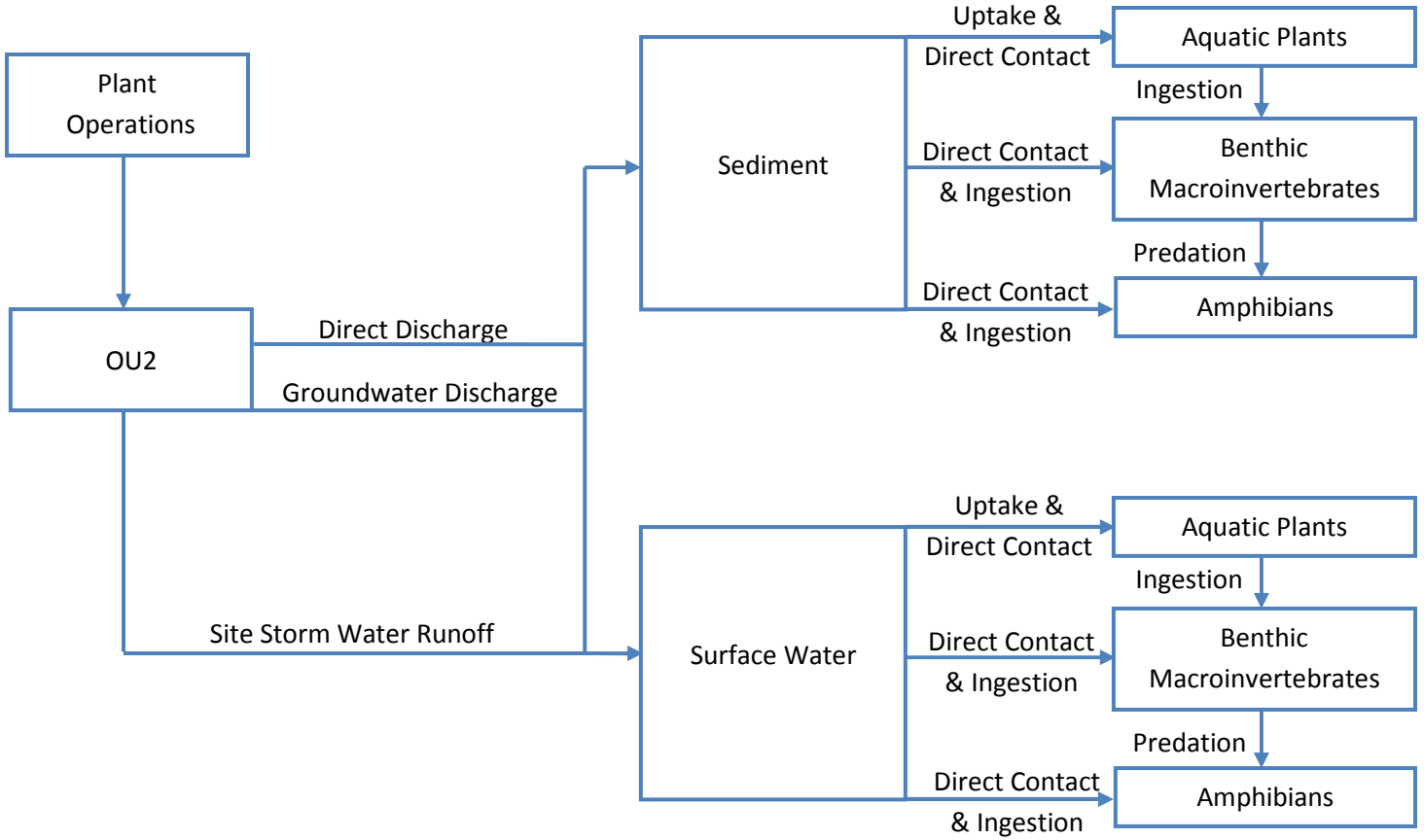

Legend Complete Pathway	amec	**Figure 3.6-1** **Ecological Conceptual Site Model** **Screening Level Ecological Risk Assessment** **Olin Chemical Superfund Site** **Wilmington, Massachusetts**
		Prepared by: SFR 7/16/2013 | Checked by:

TABLES

Table 3.2-1
Habitat Assessment Summary
Screening Level Ecological Risk Assessment
Olin Chemical Superfund Site
Wilmington, Massachusetts

	Habitat Assessment Locations					
	Upstream →				Downstream	
Habitat Parameter	North of Eames St. Overpass	South of Eames St. Overpass	1,000 ft South of Eames St. Overpass	200 ft South of South Ditch Outfall	500 ft North of Anderson Station	Notes
Epifaunal Substrate/ Available Cover	marginal	marginal	marginal	marginal	poor	Overall condition is marginal defined as "10-30% mix of stable habitat, habitat availability is less than desirable; substrate is frequently disturbed or removed".
Pool Substrate Characterization	NA	NA	NA	NA	NA	There are no pools present in the East Ditch.
Pool Variability	poor	poor	poor	poor	poor	Overall condition is poor defined as "majority of pools small-shallow or pools absent"
Sediment Deposition	poor	poor	poor	marginal	marginal	Overall condition is poor due to the absence of deposited sediment. Channel substrate is primarily railroad ballast.
Channel Flow Status	poor	poor	poor	marginal	poor	Overall condition is poor defined as "very little water in the channel and mostly present as standing pools".
Channel Alteration	poor	poor	poor	poor	poor	Overall condition is poor defined as "banks covered with gabion or cement; over 80% of the stream reach channelized and disrupted. In stream habitat is greatly altered or removed entirely".
Channel Sinuosity	poor	poor	poor	poor	poor	Overall condition is poor defined as "Channel straight; waterway has been channelized for a long distance."
Bank Stability - East Bank	optimal	optimal	optimal	optimal	optimal	Overall condition is optimal defined as "Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected"
Bank Stability - West Bank	suboptimal	suboptimal	suboptimal	suboptimal	optimal	Overall condition is suboptimal defined as "Moderately stable; infrequent small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion."
Vegetative Protection - East Bank	poor	poor	poor	poor	poor	Overall condition is poor. There is no vegetation on the east bank of the East Ditch.
Vegetative Protection - West Bank	marginal	marginal	poor	marginal	poor	Overall condition is marginal to poor. Width of the riparian zone is less than 6 feet and human activities have impacted the riparian zone a great deal.
Riparian Vegetation Zone Width - East Bank	poor	poor	poor	poor	poor	Overall condition is poor. There is no vegetation on the east bank of the East Ditch.
Riparian Vegetation Zone Width - West Bank	poor	marginal	marginal	suboptimal	poor	Overall condition is marginal to poor. Width of the riparian zone is less than 6 feet and human activities have impacted the riparian zone a great deal.

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Checked by: EYM 7/18/2013

Notes:
ft - feet
NA - Not Applicable

Table 3.7-1
Data Used in the SLERA
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

OU	Media	Exposure Area	Location ID	Field Sample ID	Date Sampled	Sample Depth
OU2	Surface Water	East Ditch	EDSD/SW0	OC-SW-EDSD/SW0-XXX	12/13/2010	
			EDSD/SW0	OC-SW-EDSD/SW0-XXX	6/8/2011	
			EDSD/SW0	OC-SW-SD-EDSD/SW0-XXX	6/8/2011	
			EDSD/SW1 (EDBS5)	OC-SW-EDSD/SW1 (EDBS5)-XXX	12/13/2010	
			EDSD/SW1 (EDBS5)	OC-SW-EDSD/SW1(EDBS5)-XXX	6/8/2011	
			EDSD/SW2 (EDBS6)	OC-SW-EDSD/SW2 (EDBS6)-XXX	12/13/2010	
			EDSD/SW2 (EDBS6)	OC-SW-EDSD/SW2(EDBS6)-XXX	6/8/2011	
			EDSD/SW5 (EDBS11)	OC-SW-EDSD/SW5 (EDBS11)-XXX	12/13/2010	
			EDSD/SW5 (EDBS11)	OC-SW-EDSD/SW5(EDBS11)-XXX	6/8/2011	
			EDSD/SW7	OC-SW-EDSD/SW7-XXX	6/18/2012	
			EDSD/SW7	OC-SW-EDSD/SW7-XXX	11/6/2012	
			ISCO3	OC-SW-ISCO3	3/22/2011	
			ISCO3	OC-SW-ISCO3	5/16/2011	
			ISCO3	OC-SW-ISCO3	8/23/2011	
			ISCO3	OC-SW-ISCO3	11/8/2011	
			ISCO3	OC-ISCO3-SW	2/23/2012	
			ISCO3	OC-SW-ISCO3	6/7/2012	
			ISCO3	OC-SW-ISCO3	8/23/2012	
			ISCO3	OC-SW-ISCO3	11/16/2012	
OU2	Sediment	East Ditch	EDSD/SW2 (EDBS6)	OC-SD-EDSD/SW2 (EDBS6)-XXX	12/13/2010	0 - 0.33 ft
			EDSD/SW7	OC-SD-EDSD/SW7-XXX	6/18/2012	0 - 0.5 ft
			EDSD/SW7	OC-SD-EDSD/SW7-XXX	11/6/2012	
BKG	Surface Water	East Ditch Reference Area	SDBK-001	OC-SW-BK-SW/SD-001-XXX	12/13/2010	
			SDBK-001	OC-SW-SDBK-001-XXX	6/8/2011	
BKG	Sediment	East Ditch Reference Area	SDBK-001	OC-SD-BK-SW/SD-001-XXX	12/13/2010	0 - 0.5 ft

Prepared by: KJC 7/8/2013
Checked by: SFR 7/8/2013

Notes:

BKG - Background
ft - feet
OU - Operable Unit

Table 4.1-1
Ecological Surface Water Screening Benchmarks
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Volatile Organics (mg/L)		
1,1,1-Trichloroethane	0.011	ORNL - SCV
1,1,2-Trichloro-1,2,2-Trifluoroethane	NA	NA
1,1-Dichloroethane	0.047	ORNL - SCV
1,1-Dichloroethene	0.025	ORNL - SCV
2,4,4-Trimethyl-1-pentene	0.015	ECOSAR - CSV
2,4,4-Trimethyl-2-pentene	0.018	ECOSAR - CSV
2-Butanone	14	ORNL - SCV
Acetone	1.5	ORNL - SCV
Chloroethane	NA	NA
Cis-1,2-Dichloroethene	0.59	ORNL - SCV
Methyl Tertbutyl Ether	11.07	USEPA Region 3
Tetrachloroethene	0.098	ORNL - SCV
Toluene	0.0098	ORNL - SCV
Trichloroethene	0.047	ORNL - SCV
Vinyl chloride	0.93	USEPA Region 3
Xylene, o	1.012	ECOSAR - CSV
Xylenes (m&p)	NA	NA
Semivolatile Organics (mg/L)		
Benzo(ghi)perylene	0.0002	ECOSAR - CSV
Benzoic Acid	0.042	ORNL - SCV
Bis(2-Ethylhexyl)phthalate	0.003	ORNL - SCV
Caprolactam	NA	NA
Dibenz(a,h)anthracene	0.0002	ECOSAR - CSV
Indeno(1,2,3-cd)pyrene	0.0002	ECOSAR - CSV
N-Nitrosodimethylamine	0.117	USEPA Region 3
N-Nitrosodi-n-propylamine	NA	NA
Metals (mg/L)		
Aluminum [b]	0.087	AWQC - CCC
Arsenic [c]	0.15	AWQC - CCC
Barium	0.004	ORNL - SCV
Calcium [e]	EN	EN
Chromium [d]	Equation	AWQC - CCC
Chromium, Hexavalent	0.011	AWQC - CCC
Cobalt	0.023	ORNL - SCV
Copper [d]	Equation	AWQC - CCC
Iron	1	AWQC - CCC
Lead [d]	Equation	AWQC - CCC
Magnesium [e]	EN	EN
Manganese	0.12	ORNL - SCV
Nickel [d]	Equation	AWQC - CCC
Potassium [e]	EN	EN
Silver	0.000012	USEPA Region 4 - Chronic
Sodium [e]	EN	EN
Thallium	0.004	USEPA Region 4 - Chronic
Vanadium	0.02	USEPA Region 3
Zinc [d]	Equation	AWQC - CCC
Inorgaincs (mg/L)		
Bromide	NA	NA
Chloride	230	AWQC - CCC
Nitrate as N	166	ECOSAR - CSV
Nitrogen, as Ammonia [f]	3.0	AWQC - CCC
Sulfate	29,479	ECOSAR - CSV
Specialty Compounds (mg/L)		
Kempore (Azodicarbonamide)	NA	NA

Prepared by: SFR 3/13/2013
Checked by: EYM 3/14/2013

Notes:

[a] Screening benchmark sources are in order of preference:

[1] AWQC - CCC - USEPA, Freshwater Ambient Water Quality Criteria (AWQC) Chronic Continuous Concentration (CCC) (USEPA, 2013).

[2] ORNL - SCV - Oak Ridge National Laboratory (ORNL) Tier II Secondary Chronic Values (SCVs) from Suter and Tsao, 1996 as cited in Buchman, 2008, Screening Quick Reference Tables (SQuiRTs from NOAA).

[3] USEPA Region 4 - Chronic - (USEPA, 2001)

[4] USEPA Region 3 - (USEPA, 2006)

Table 4.1-1
Ecological Surface Water Screening Benchmarks
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Notes (continued):

[5] Lacking a value from sources listed in [a][1],[a][2],[a][3],and [a][4] above, benchmarks were estimated using the USEPA, 2009, Ecological Structure Activity Relationships (ECOSAR) Database v.1.11. ChVs (Chronic Toxicity Values; equal to a LC50÷10) were restored to LC50s and factors of 10 for non-persistent chemicals, 20 for persistent but non-bioaccumulating chemicals, and 100 for persistent and bioaccumulating chemicals were applied to convert the LC50s to NOAELs for use as screening benchmarks. Persistent chemicals are defined as those that are either listed as Persistent Organic Pollutants under the Stockholm Convention or have half lives in soil or surface water longer than 2 months as calculated by the USEPA, 2010, Persistent, Bio-accumulating, and Toxic (PBT) Profiler v.1.301. Calculations of persistence exclude net advection and sediment burial. Bio-accumulating organic chemicals are those with LogKow > 3.0. Methodology is derived from the Texas Surface Water Quality Standards TSWQS (30 TAC §307.6(c).(7), as amended TNRCC, 2000b).

[b] AWQC-CCC for aluminum is for waters with pH between 6.5 and 9.0.

[c] AWQC-CCC is for the dissolved fraction of the metal.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

[e] Calcium, magnesium, potassium, and sodium are considered essential nutrients; therefore benchmarks are not applicable.

[f] The AWQC-CCC for ammonia is calculated using the equations presented in USEPA (2013), using a default pH of 7.0 and a default temperature of 25°C and assuming and that sensitive early life stages of fish are absent.

CSV - Calculated Screening Value
EN - Essential Nutrient
Equation - Value is calculated for site-specific conditions using AWQC equations
LC50 - Lethal Concentration affecting 50% of test population
mg/L - milligrams per liter
NA - Not Available
NOAEL - No Observed Adverse Effects Level

References:

Suter, G.W, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects of Aquatic Biota: 1996 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-96/R2. June 1996.

USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

USEPA, 2012. Ecological Sturcture Activity Relationships Database v.1.11.

USEPA. 2006. EPA Region III BTAG Screening Benchmarks for Freshwater Screening Benchmarks. July, 2006.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. November 30, 2001 update.

Table 4.1-2
Ecological Surface Water Screening Benchmarks - AWQC Equations
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Metals	Hardness [a]	Equation Factors [b]				CF [b]		Calculated Values (mg/L) [b]			
								Total Metals		Dissolved Metals	
		mA	bA	mC	bC	CCC	CMC	CCC	CMC	CCC	CMC
Chromium	106	0.819	3.7256	0.819	0.6848	0.86	0.316	0.090	1.89	0.078	0.60
Copper	106	0.9422	-1.7	0.8545	-1.702			0.0098	0.015		
Lead	106	1.273	-1.46	1.273	-4.705			0.0034	0.088		
Nickel	106	0.846	2.255	0.846	0.0584			0.055	0.49		
Zinc	106	0.8473	0.884	0.8473	0.884			0.13	0.13		

Prepared by: SFR 7/10/2013
Checked: EYM 7/15/2013
Revised: SFR 3/26/2014

Notes:

[a] Hardness values are the average (arithmetic mean) concentration measured in the East Ditch expressed as mg/L $CaCO_3$.

[b] Equations used to calculate CCC and CMC values are from USEPA (2013) and are as follows:

Total Metals:
CCC (mg/L) = exp(mC [ln(hardness)]+ bC)/1000
CMC (mg/L) = exp(mA [ln(hardness)]+ bA)/1000
Dissolved Metals:
CCC (mg/L) = (exp(mC [ln(hardness)]+ bC)*CF)/1000
CMC (mg/L) = (exp(mA [ln(hardness)]+ bA)*CF)/1000

AWQC - Ambient Water Quality Criteria
$CaCO_3$ - Calcium Carbonate
CCC - Chronic Continuous Concentration
CF - Freshwater Conversion Factor
CMC - Chronic Maximum Concentration
mg/L - Milligrams per Liter

References:

USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.

Table 4.2-1
Ecological Sediment Screening Benchmarks
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Screening Benchmark	Source [a]
Volatile Organics (mg/kg)		
1,1,2-Trichloro-1,2,2-Trifluoroethane	NA	NA
2,4,4-Trimethyl-2-pentene	NA	NA
2-Butanone	5.4	ORNL - LCV
Acetone	0.0091	ORNL - LCV
Acetaldehyde	NA	NA
Formaldehyde	NA	NA
Trichloroethene	0.0969	USEPA Region 3
Semivolatile Organics (mg/kg)		
2-Methylnaphthalene	0.33	USEPA Region 4
Benzoic Acid	0.65	USEPA Region 3
Bis(2-Ethylhexyl)phthalate	0.182	USEPA Region 4
Carbazole	NA	NA
Dibenzofuran	0.415	USEPA Region 3
Diphenyl ether	NA	NA
N-Nitrosodiphenylamine	2.68	USEPA Region 3
Phenol	0.42	USEPA Region 3
Polyaromatic Hydrocarbons (ug/goc)		
Anthracene	594	USEPA PAH ESBs
Acenaphthene	491	USEPA PAH ESBs
Benzo(a)anthracene	841	USEPA PAH ESBs
Benzo(a)pyrene	965	USEPA PAH ESBs
Benzo(b)fluoranthene	979	USEPA PAH ESBs
Benzo(ghi)perylene	1,095	USEPA PAH ESBs
Benzo(k)fluoranthene	981	USEPA PAH ESBs
Chrysene	844	USEPA PAH ESBs
Dibenz(a,h)anthracene	1,123	USEPA PAH ESBs
Fluoranthene	707	USEPA PAH ESBs
Fluorene	538	USEPA PAH ESBs
Indeno(1,2,3-cd)pyrene	1,115	USEPA PAH ESBs
Naphthalene	385	USEPA PAH ESBs
Phenanthrene	596	USEPA PAH ESBs
Pyrene	697	USEPA PAH ESBs
Metals (mg/kg)		
Aluminum	25,500	ARCs - TEC
Antimony	12	USEPA Region 4
Arsenic	9.79	TEC
Barium	NA	NA
Beryllium	NA	NA
Cadmium	0.99	TEC
Calcium [b]	EN	EN
Chromium	43.4	TEC
Cobalt	50	OMEE - SEL
Copper	31.6	TEC
Iron	20,000	OMEE - LEL
Lead	35.8	TEC
Magnesium [b]	EN	EN
Manganese	460	OMEE - LEL
Mercury	0.18	TEC
Nickel	22.7	TEC
Potassium [b]	EN	EN
Silver	2	USEPA Region 4
Sodium [b]	EN	EN
Tin	NA	NA
Vanadium	NA	NA
Zinc	121	TEC
Inorganics (mg/kg)		
Chloride	NA	NA
Nitrogen, as Ammonia	NA	NA
Sulfate	NA	NA
Specialty Compounds (mg/kg)		
Hydrazine	NA	NA

Table 4.2-1
Ecological Sediment Screening Benchmarks
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared by: EYM 3/13/2013
Checked by: SFR 3/14/2013

Notes:

[a] Sources are in order of preference:

[1] USEPA PAH ESBs - Equilibrium Sediment Partitioning Benchmarks for PAHs ($C_{OC,PAHi,FCVi}$) (USEPA, 2003)

[2] USEPA NIO ESBs - Equilibrium Sediment Partitioning Benchmarks for Nonionic Organics Freshwater Conventional ESBs (USEPA, 2008)

[3] TECs - Threshold Effects Concentrations (TECs) (MacDonald, *et al.*, 2000).

[4] USEPA Region 4 (USEPA, 2001).

[5] OMEE LELs - Ontario Ministry of Energy and Environment (OMEE) Low-Effect Levels (LELs) (Persaud *et al*.,1993).

[6] ARCs TECs - Assessment and Remediation of Contaminated Sediments (ARCS) Program Threshold Effects Concentrations (USEPA, 1996).

[7] USEPA Region 3 (USEPA, 2006).

[8] ORNL - LCVs - Oak Ridge National Laboratory (ORNL) Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).

[9] MassDEP - Sediment Benchmarks for Current MassDEP Petroleum Hydrocarbon Fractions (MassDEP, 2007).

[b] Calcium, magnesium, potassium, and sodium are considered essential nutrients; therefore benchmarks are not applicable.

EN - Essential Nutrient
EPH - Extractable Petroleum Hydrocarbons
mg/kg - milligrams per kilogram
NA - Not available
ug/goc - micrograms per gram organic carbon

References:

Jones, D.S., G.W. Suter II, and R.N. Hull, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision; Oak Ridge National Laboratories (ES/ER/TM-95/R4); November 1997.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39:20-31.

MassDEP, 2007. Sediment Toxicity of Petroleum Hydrocarbon Fractions. Office of Research and Standards. September, 2007.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto. Cited in Jones, Suter and Hull, 1997.

USEPA. 1996. Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella Azteca and the Midge Chironomus Riparius. Great Lakes National Program Office. EPA-905-R96-08. September, 1996.

USEPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: PAH Mixtures. EPA/600/R-02/013. November 2003.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. 2001.

USEPA. 2006. EPA Region III BTAG Screening Benchmarks for Freshwater and Sediment. August, 2006.

Table 4.3-1
Selection of COPECs - East Ditch - Surface Water
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Volatile Organics (mg/L)								
1,1,1-Trichloroethane	2 / 10	0.001 : 0.001	0.001 - 0.0018	EDSD/SW1 (EDBS5)	0.00068	0.011	No	BSL
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 / 10	0.001 : 0.001	0.0011 - 0.0031	EDSD/SW5 (EDBS11)	0.0011	NA	Yes	NSL
1,1-Dichloroethane	1 / 10	0.001 : 0.001	0.00033 - 0.00033	EDSD/SW1 (EDBS5)	0.00048	0.047	No	BSL
1,1-Dichloroethene	1 / 10	0.001 : 0.001	0.00078 - 0.00078	EDSD/SW1 (EDBS5)	0.00053	0.025	No	BSL
2,4,4-Trimethyl-1-pentene	2 / 10	0.001 : 0.001	0.0039 - 0.0044	EDSD/SW2 (EDBS6)	0.0012	0.015	No	BSL
2,4,4-Trimethyl-2-pentene	1 / 10	0.001 : 0.001	0.00057 - 0.00057	EDSD/SW2 (EDBS6)	0.00051	0.018	No	BSL
2-Butanone	2 / 10	0.01 : 0.01	0.0013 - 0.0029	EDSD/SW1 (EDBS5)	0.0044	14	No	BSL
Acetone	1 / 10	0.05 : 0.05	0.0039 - 0.0039	EDSD/SW7	0.023	1.5	No	BSL
Chloroethane	2 / 10	0.002 : 0.002	0.00044 - 0.0026	EDSD/SW1 (EDBS5)	0.0011	NA	Yes	NSL
Cis-1,2-Dichloroethene	4 / 10	0.001 : 0.001	0.0011 - 0.0061	EDSD/SW5 (EDBS11)	0.0015	0.59	No	BSL
Methyl Tertbutyl Ether	1 / 10	0.001 : 0.001	0.00022 - 0.00022	EDSD/SW1 (EDBS5)	0.00047	11.07	No	BSL
Tetrachloroethene	1 / 10	0.001 : 0.001	0.00026 - 0.00026	EDSD/SW5 (EDBS11)	0.00048	0.098	No	BSL
Toluene	5 / 10	0.001 : 0.001	0.00067 - 0.0085	EDSD/SW1 (EDBS5)	0.0016	0.0098	No	BSL
Trichloroethene	4 / 10	0.001 : 0.0021	0.00047 - 0.0034	EDSD/SW5 (EDBS11)	0.0011	0.047	No	BSL
Vinyl chloride	1 / 10	0.0005 : 0.0005	0.00052 - 0.00052	EDSD/SW5 (EDBS11)	0.00028	0.93	No	BSL
Xylene, o	1 / 10	0.001 : 0.001	0.00024 - 0.00024	EDSD/SW1 (EDBS5)	0.00047	1.012	No	BSL
Xylenes (m&p)	1 / 10	0.002 : 0.002	0.00052 - 0.00052	EDSD/SW1 (EDBS5)	0.00095	NA	Yes	NSL
Semivolatile Organics (mg/L)								
Benzo(ghi)perylene	4 / 10	0.00047 : 0.00053	0.000088 - 0.00018	EDSD/SW1 (EDBS5)	0.00020	0.0002	No	BSL
Benzoic Acid	3 / 5	0.0047 : 0.0053	0.0019 - 0.0021	EDSD/SW2 (EDBS6)	0.0022	0.042	No	BSL
Benzoic Acid	3 / 5	0.0047 : 0.0053	0.0019 - 0.0021	EDSD/SW0	0.0022	0.042	No	BSL
Bis(2-Ethylhexyl)phthalate	2 / 10	0.0018 : 0.0021	0.0012 - 0.0015	EDSD/SW2 (EDBS6)	0.001	0.003	No	BSL
Caprolactam	1 / 6	0.0047 : 0.0053	0.00073 - 0.00073	EDSD/SW0	0.0022	NA	Yes	NSL
Dibenz(a,h)anthracene	4 / 10	0.00047 : 0.00053	0.000081 - 0.00018	EDSD/SW1 (EDBS5)	0.0002	0.0002	No	BSL
Indeno(1,2,3-cd)pyrene	4 / 10	0.00047 : 0.00053	0.00009 - 0.00017	EDSD/SW1 (EDBS5)	0.0002	0.0002	No	BSL
N-Nitrosodimethylamine	4 / 10	0.0000019 : 0.00002	0.0000033 - 0.000012	EDSD/SW2 (EDBS6)	0.0000045	0.117	No	BSL
N-Nitrosodi-n-propylamine	1 / 10	0.0000019 : 0.00002	0.0000033 - 0.0000033	EDSD/SW0	0.0000021	NA	Yes	NSL
Metals, Total (mg/L)								
Aluminum	17 / 19	0.1 : 0.2	0.028 - 0.77	EDSD/SW5 (EDBS11)	0.17	0.087	Yes	ASL
Arsenic	2 / 10	0.01 : 0.01	0.005 - 0.0078	EDSD/SW7	0.0053	0.15	No	BSL
Barium	10 / 10		0.013 - 0.1	EDSD/SW0	0.042	0.004	Yes	ASL
Calcium	10 / 10		11 - 46	EDSD/SW0	34	EN	No	EN
Chromium [d]	10 / 19	0.005 : 0.005	0.00068 - 0.065	EDSD/SW5 (EDBS11)	0.006	0.090	No	BSL
Chromium, Hexavalent	2 / 4	0.001 : 0.001	0.00056 - 0.00086	EDSD/SW5 (EDBS11)	0.00061	0.011	No	BSL
Cobalt	5 / 10	0.01 : 0.01	0.0016 - 0.0024	EDSD/SW5 (EDBS11)	0.0036	0.023	No	BSL

Table 4.3-1
Selection of COPECs - East Ditch - Surface Water
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Concentration	Average (arithmetic mean) [a]	Screening Benchmark [b]	Retain for Further Evaluation? [c]	Rationale [c]
Copper [d]	10 / 10		0.00072 - 0.0055	EDSD/SW0	0.0026	0.0098	No	BSL
Iron	10 / 10		0.17 - 11	EDSD/SW0	1.9	1	Yes	ASL
Lead [d]	6 / 10	0.0001 : 0.001	0.00035 - 0.0015	EDSD/SW7	0.00051	0.0034	No	BSL
Magnesium	10 / 10		1.4 - 6.9	EDSD/SW5 (EDBS11)	4.8	EN	No	EN
Manganese	10 / 10		0.016 - 0.91	EDSD/SW7	0.41	0.12	Yes	ASL
Nickel [d]	5 / 10	0.01 : 0.01	0.0017 - 0.0039	EDSD/SW7	0.004	0.055	No	BSL
Potassium	9 / 10	4 : 4	1.6 - 6.1	EDSD/SW7	3.2	EN	No	EN
Silver	1 / 10	0.0001 : 0.001	0.00014 - 0.00014	EDSD/SW7	0.00028	0.000012	Yes	ASL
Sodium	19 / 19		17 - 190	EDSD/SW0	81	EN	No	EN
Thallium	1 / 10	0.01 : 0.01	0.0052 - 0.0052	EDSD/SW1 (EDBS5)	0.005	0.004	Yes	ASL
Vanadium	1 / 10	0.01 : 0.01	0.0025 - 0.0025	EDSD/SW0	0.0048	0.02	No	BSL
Zinc [d]	8 / 10	0.05 : 0.05	0.0088 - 0.053	EDSD/SW0	0.028	0.013	Yes	ASL
Metals, Dissolved (mg/L)								
Aluminum	7 / 9	0.1 : 0.2	0.023 - 0.074	ISCO3	0.047	0.087	No	BSL
Chromium [d]	1 / 8	0.005 : 0.005	0.00068 - 0.00068	ISCO3	0.0023	0.078	No	BSL
Sodium	9 / 9		71 - 120	ISCO3	92	EN	No	EN
Inorganics (mg/L)								
Bromide	2 / 10	0.1 : 0.1	0.11 - 0.18	EDSD/SW7	0.069	NA	Yes	NSL
Chloride	19 / 19		26 - 360	EDSD/SW0	166	230	Yes	ASL
Nitrate as N	19 / 19		0.68 - 2.6	EDSD/SW0	1.1	166	No	BSL
Nitrogen, as Ammonia	16 / 19	0.1 : 0.1	0.11 - 10	EDSD/SW7	3.0	3.1	Yes	ASL
Sulfate	19 / 19		14 - 99	ISCO3	38	29,479	No	BSL
Specialty Compounds (mg/L)								
Kempore (Azodicarbonamide)	2 / 10	1 : 3	1.2 - 4.1	EDSD/SW2 (EDBS6)	1.0	NA	Yes	NSL

Prepared by: KJC 07/9/2013
Checked by: SFR 07/9/2013
Revised: SFR 3/26/2014

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.

[b] Surface water screening benchmark values are presented in Table 4.1-1. Hardness dependent criteria equations are presented in Table 4.1-2.

[c] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

[d] Hardness dependent criteria. AWQC-CCC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NSL - No Screening Level

Table 4.3-2
Selection of COPECs - East Ditch - Sediment
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum PAH Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation ? [d]	Rationale [d]
Volatile Organics (mg/kg)									
1,1,2-Trichloro-1,2,2-Trifluoroethane	1 / 3	0.013 : 0.05	0.0041 - 0.0041	EDSD/SW7	0.012		NA	Yes	NSL
2,4,4-Trimethyl-2-pentene	1 / 3	0.005 : 0.02	0.0016 - 0.0016	EDSD/SW7	0.0047		NA	Yes	NSL
2-Butanone	1 / 3	0.025 : 0.029	0.097 - 0.097	EDSD/SW2 (EDBS6)	0.041		5.4	No	BSL
Acetaldehyde	1 / 2	0.24 : 0.24	0.055 - 0.055	EDSD/SW7	0.09		NA	Yes	NSL
Acetone	1 / 3	0.25 : 0.29	0.43 - 0.43	EDSD/SW2 (EDBS6)	0.23		0.0091	Yes	ASL
Formaldehyde	2 / 2		0.72 - 1.1	EDSD/SW7	0.91		NA	Yes	NSL
Trichloroethene	1 / 3	0.0025 : 0.0099	0.0017 - 0.0017	EDSD/SW7	0.0026		0.0969	No	BSL
Semivolatile Organics (mg/kg)									
Benzoic Acid	2 / 3	3 : 3	0.16 - 0.49	EDSD/SW2 (EDBS6)	0.72		0.65	No	BSL
Bis(2-Ethylhexyl)phthalate	3 / 3		0.96 - 10	EDSD/SW2 (EDBS6)	4.2		0.182	Yes	ASL
Carbazole	2 / 3	0.6 : 0.6	0.063 - 0.24	EDSD/SW2 (EDBS6)	0.20		NA	Yes	NSL
Dibenzofuran	1 / 3	0.042 : 0.6	0.15 - 0.15	EDSD/SW2 (EDBS6)	0.16		0.415	No	BSL
Diphenyl ether	1 / 3	0.042 : 0.6	0.28 - 0.28	EDSD/SW2 (EDBS6)	0.20		NA	Yes	NSL
2-Methylnaphthalene	1 / 3	0.042 : 0.6	0.078 - 0.078	EDSD/SW2 (EDBS6)	0.13		0.33	No	BSL
N-Nitrosodiphenylamine	1 / 3	0.042 : 0.6	0.21 - 0.21	EDSD/SW2 (EDBS6)	0.18		2.68	No	BSL
Phenol	1 / 3	0.2 : 0.6	0.026 - 0.026	EDSD/SW7	0.14		0.42	No	BSL
Polyaromatic Hydrocarbons (mg/kg)									
Acenaphthene	2 / 3	0.6 : 0.6	0.019 - 0.14	EDSD/SW2 (EDBS6)	0.15	4.4	491	No	BSL
Anthracene	2 / 3	0.6 : 0.6	0.04 - 0.27	EDSD/SW2 (EDBS6)	0.20	8.5	594	No	BSL
Benzo(a)anthracene	3 / 3		0.25 - 0.77	EDSD/SW2 (EDBS6)	0.55	24	841	No	BSL
Benzo(a)pyrene	3 / 3		0.24 - 0.94	EDSD/SW2 (EDBS6)	0.62	30	965	No	BSL
Benzo(b)fluoranthene	3 / 3		0.43 - 1.6	EDSD/SW2 (EDBS6)	1.0	51	979	No	BSL
Benzo(ghi)perylene	3 / 3		0.11 - 0.56	EDSD/SW2 (EDBS6)	0.40	17.7	1095	No	BSL
Benzo(k)fluoranthene	3 / 3		0.17 - 0.53	EDSD/SW2 (EDBS6)	0.38	16.8	981	No	BSL
Chrysene	3 / 3		0.38 - 1.3	EDSD/SW2 (EDBS6)	0.89	41	844	No	BSL
Dibenz(a,h)anthracene	1 / 3	0.2 : 0.6	0.037 - 0.037	EDSD/SW7	0.15	1.2	1123	No	BSL
Fluoranthene	3 / 3		0.64 - 2.7	EDSD/SW2 (EDBS6)	1.7	85	707	No	BSL
Fluorene	2 / 3	0.6 : 0.6	0.02 - 0.23	EDSD/SW2 (EDBS6)	0.18	7.3	538	No	BSL
Indeno(1,2,3-cd)pyrene	3 / 3		0.11 - 0.53	EDSD/SW2 (EDBS6)	0.37	16.8	1115	No	BSL
Naphthalene	1 / 2	0.6 : 0.6	0.11 - 0.11	EDSD/SW2 (EDBS6)	0.21	3.5	385	No	BSL
Phenanthrene	3 / 3		0.31 - 1.3	EDSD/SW2 (EDBS6)	0.75	41	596	No	BSL
Pyrene	3 / 3		0.43 - 2.3	EDSD/SW2 (EDBS6)	1.3	73	697	No	BSL
Metals (mg/kg)									
Aluminum	3 / 3		3,800 - 6,400	EDSD/SW2 (EDBS6)	5,367		58,030	No	BSL
Antimony	2 / 3	3.4 : 3.4	0.89 - 4	EDSD/SW7	2.2		12	No	BSL
Arsenic	3 / 3		26 - 450	EDSD/SW2 (EDBS6)	178		9.79	Yes	ASL
Barium	3 / 3		42 - 150	EDSD/SW2 (EDBS6)	111		NA	Yes	NSL
Beryllium	2 / 3	1.4 : 1.4	0.2 - 1.6	EDSD/SW7	0.83		NA	Yes	NSL

Table 4.3-2
Selection of COPECs - East Ditch - Sediment
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Frequency of Detection	Range of Reporting Limits for Non Detects	Range of Detected Concentrations	Location of Maximum Detect	Average (arithmetic mean) [a]	Organic Carbon Normalized Maximum PAH Concentration (ug/goc) [b]	Screening Benchmark [c]	Retain for Further Evaluation ? [d]	Rationale [d]
Cadmium	3 / 3		0.84 - 3.7	EDSD/SW7	2.2		0.99	Yes	ASL
Calcium	3 / 3		1,500 - 7,900	EDSD/SW2 (EDBS6)	3,767		EN	No	EN
Chromium	3 / 3		31 - 78	EDSD/SW7	49		43.4	Yes	ASL
Cobalt	3 / 3		7.2 - 30	EDSD/SW2 (EDBS6)	16.7		50	No	BSL
Copper	3 / 3		110 - 270	EDSD/SW7	170		31.6	Yes	ASL
Iron	3 / 3		21,000 - 210,000	EDSD/SW2 (EDBS6)	90,667		20,000	Yes	ASL
Lead	3 / 3		25 - 340	EDSD/SW7	168		35.8	Yes	ASL
Magnesium	3 / 3		1,400 - 3,300	EDSD/SW7	2,233		EN	No	EN
Manganese	3 / 3		230 - 3,200	EDSD/SW2 (EDBS6)	1,343		460	Yes	ASL
Mercury	2 / 3	0.33 : 0.33	0.026 - 0.04	EDSD/SW7	0.077		0.18	No	BSL
Nickel	3 / 3		19 - 29	EDSD/SW7	23		22.7	Yes	ASL
Potassium	2 / 3	1400 : 1400	290 - 620	EDSD/SW7	537		EN	No	EN
Silver	2 / 3	3.4 : 3.4	0.27 - 2.6	EDSD/SW7	1.5		2	Yes	ASL
Sodium	3 / 3		160 - 340	EDSD/SW2 (EDBS6)	227		EN	No	EN
Tin	1 / 2	12 : 12	8.6 - 8.6	EDSD/SW2 (EDBS6)	7.3		NA	Yes	NSL
Vanadium	3 / 3		15 - 120	EDSD/SW2 (EDBS6)	50		NA	Yes	NSL
Zinc	3 / 3		450 - 1,900	EDSD/SW7	967		121	Yes	ASL
Inorganics (mg/kg)									
Chloride	3 / 3		26 - 690	EDSD/SW2 (EDBS6)	257		NA	Yes	NSL
Nitrogen, as Ammonia	3 / 3		8.5 - 130	EDSD/SW2 (EDBS6)	50		NA	Yes	NSL
Sulfate	1 / 3	48 : 160	71 - 71	EDSD/SW7	58		NA	Yes	NSL
Specialty Compounds (mg/kg)									
Hydrazine	1 / 2	0.0026 : 0.0026	0.0014 - 0.0014	EDSD/SW7	0.0014		NA	Yes	NSL
Total Organic Carbon (mg/kg)									
Total Organic Carbon	3 / 3		28 - 86,000	EDSD/SW2 (EDBS6)	31,609				

Prepared by: KJC 07/9/2013
Checked by: SFR 07/9/2013

Notes:

[a] Average (arithmetic mean) was calculated using one-half the detection limit for non detects.

[b] The maximum detected concentration of PAHs in East Ditch sediment are normalized for organic carbon using the average TOC concentration.

[c] Sediment screening benchmark values are presented in Table 4.2-1. PAH screening benchmarks are shown in units of ug/goc.

[d] Chemical is identified as a COPEC and retained for further evaluation if the maximum detected concentration is greater than the screening benchmark or a screening benchmark is unavailable.

ASL - Above Screening Level
BSL - Below Screening Level
COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/kg - milligrams per kilogram
NA - Not available
NSL - No Screening Level
PAH - Polyaromatic hydrocarbons
TOC - Total Organic Carbon
ug/goc - micrograms per grams organic carbon

Table 5.1-1
Ecological Surface Water Effects Benchmarks
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Effects Benchmark	Source [a]
Volatile Organics (mg/L)		
1,1,2-Trichloro-1,2,2-Trifluoroethane	NA	NA
Chloroethane	NA	NA
Xylenes (m&p)	NA	NA
Semivolatile Organics (mg/L)		
Caprolactam	NA	NA
N-Nitrosodi-n-propylamine	NA	NA
Metals (mg/L)		
Aluminum [b]	0.75	AWQC - CMC
Barium	0.11	ORNL - SAV
Iron	NA	NA
Lead [c]	Equation	AWQC - CMC
Manganese	2.3	ORNL - SAV
Silver	0.00123	USEPA Region 4 - Acute
Thallium	0.14	USEPA Region 4 - Acute
Inorganics (mg/L)		
Bromide	NA	NA
Chloride	860	AWQC - CMC
Nitrogen, as Ammonia [d]	36	AWQC - CMC
Specialty Compounds (mg/L)		
Kempore (Azodicarbonamide)	NA	NA

Prepared by: SFR 3/13/2013
Checked by: EYM 3/14/2013

Notes:

[a] Effects benchmark sources are in order of preference:
[1] AWQC - CMC - USEPA, Freshwater Ambient Water Quality Criteria (AWQC) Chronic Maximum Concentration (CMC) (USEPA, 2013).
[2] ORNL - SAV - Oak Ridge National Laboratory (ORNL) Tier II Secondary Chronic Values (SAVs) from Suter and Tsao, 1996 as cited in Buchman, 2008, Screening Quick Reference Tables (SQuiRTs from NOAA).
[3] USEPA Region 4 - Acute - (USEPA, 2001)
[b] AWQC-CCC for aluminum is for waters with pH between 6.5 and 9.0.
[c] Hardness dependent criteria. AWQC-CMC are calculated for exposure area specific average hardness using the equations presented in USEPA (2013).
[d] AWQC-CCC for ammonia is calculated using the equations in USEPA (2013), using a default pH of 7 and assuming that salmonid fish are absent.

Equation - Value is calculated for site-specific conditions using AWQC equations
mg/L - milligrams per liter
NA - Not Available

References:

Suter, G.W, and C.L. Tsao. 1996. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects of Aquatic Biota: 1996 Revision. Prepared for the U.S. Department of Energy. ES/ER/TM-96/R2. June 1996.
USEPA. 2013. National Recommended Water Quality Criteria. Office of Water and Office of Science Technology. Last Updated 1/8/2013.
USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. November 30, 2001 update.

Table 5.1-2
Ecological Sediment Effects Benchmarks
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Effects Benchmark	Source [a]
Volatile Organics (mg/kg)		
1,1,2-Trichloro-1,2,2-Trifluoroethane	NA	NA
2,4,4-Trimethyl-2-pentene	NA	NA
Acetone	0.0091	ORNL - LCV
Acetaldehyde	NA	NA
Formaldehyde	NA	NA
Semivolatile Organics (mg/kg)		
Bis(2-Ethylhexyl)phthalate	0.182	USEPA Region 4
Carbazole	NA	NA
Diphenyl ether	NA	NA
Metals (mg/kg)		
Arsenic	33	PEC
Barium	NA	NA
Beryllium	NA	NA
Cadmium	4.98	PEC
Chromium	111	PEC
Copper	149	PEC
Iron	40,000	OMEE - SEL
Lead	128	PEC
Manganese	1,100	OMEE - SEL
Nickel	48.6	PEC
Silver	2	Region 4
Tin	NA	NA
Vanadium	NA	NA
Zinc	459	TEC
Inorganics (mg/kg)		
Chloride	NA	NA
Nitrogen, as Ammonia	NA	NA
Sulfate	NA	NA
Specialty Compounds (mg/kg)		
Hydrazine	NA	NA

Prepared by: EYM 3/13/2013
Checked by: SFR 3/14/2013

Notes:

[a] Sources are in order of preference:

[1] PECs - Probable Effects Concentrations (PECs) (MacDonald, *et al.*, 2000).

[2] USEPA Region 4 (USEPA, 2001).

[3] ORNL - LCVs - Oak Ridge National Laboratory (ORNL) Lowest Chronic Values (LCVs) (Jones, Suter, and Hull, 1997).

[4] ARCs PECs - Assessment and Remediation of Contaminated Sediments (ARCS) Program Probable Effects Concentrations (PECs) (USEPA, 1996).

[5] OMEE SELs - Ontario Ministry of Energy and Environment (OMEE) Screening-Effect Levels (SELs) (Persaud *et al*.,1993).

EN - Essential Nutrient

EPH - Extractable Petroleum Hydrocarbon

mg/kg - milligrams per kilogram

NA - Not available

References:

Jones, D.S., G.W. Suter II, and R.N. Hull, 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision; Oak Ridge National Laboratories (ES/ER/TM-95/R4); November 1997.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39:20-31.

Persaud, D., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Water Resources Branch, Ontario Ministry of the Environment. Toronto. Cited in Jones, Suter and Hull, 1997.

USEPA. 1996. Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella Azteca and the Midge Chironomus Riparius. Great Lakes National Program Office. EPA-905-R96-08. September, 1996.

USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. 2001.

Table 5.3-1
Refinement of COPECs - East Ditch - Surface Water
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC [a]	Frequency of Detection	East Ditch Average Concentration [b]	East Ditch Reference Area Average Concentration [b]	Effects Benchmark [c]	East Ditch Average HQ [d]	Incremental Risk Average HQ [e]
Volatile Organics (mg/L)						
1,1,2-Trichloro-1,2,2-Trifluoroethane	5 / 10	0.0011	ND	NA	NC	NC
Chloroethane	2 / 10	0.0011	ND	NA	NC	NC
Xylenes (m&p)	1 / 10	0.00095	ND	NA	NC	NC
Semivolatile Organics (mg/L)						
Caprolactam	1 / 6	0.0022	ND	NA	NC	NC
N-Nitrosodi-n-propylamine	1 / 10	0.0000021	ND	NA	NC	NC
Metals, Total (mg/L)						
Aluminum	17 / 19	0.17	0.57	0.75	0.23	<0
Barium	10 / 10	0.042	0.12	0.11	0.38	<0
Iron	10 / 10	1.9	3.4	NA	NC	NC
Manganese	10 / 10	0.41	1.7	2.3	0.18	<0
Silver	1 / 10	0.00028	ND	0.00123	0.23	NC
Thallium	1 / 10	0.005	ND	0.14	0.036	NC
Inorganics (mg/L)						
Bromide	2 / 10	0.069	0.09	NA	NC	NC
Chloride	19 / 19	166	580	860	0.19	<0
Nitrogen, as Ammonia	16 / 19	3.0	0.23	36	0.08	0.076
Specialty Compounds (mg/L)						
Kempore (Azodicarbonamide)	2 / 10	1.0	NA	NA	NC	NC

Prepared by: SFR 7/9/2013
Checked by: EYM 7/18/2013
Revised: SFR 3/26/2014

Notes:

[a] COPEC selection is shown on Table 4.3-1.

[b] Average (arithmetic mean) values were calculated using one-half the detection limit for non detects.

[c] Surface water effects benchmark values are presented in Table 5.1-1. Hardness dependent criteria equations are presented in Table 4.1-2.

[d] Hazard quotients were calculated by dividing the concentration by the screening benchmark.

[e] Incremental risk hazard quotients were calculated by subtracting the reference area hazard quotient from the East Ditch exposure area hazard quotient.

COPEC - Chemical of Potential Ecological Concern
EN - Essential Nutrient
mg/L - milligrams per liter
NA - Not Available
NC - Not Calculated
ND - Not Detected

Table 5.4-1
Refinement of COPECs - East Ditch - Sediment
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

COPEC [a]	Frequency of Detection	East Ditch Average Concentration [b]	East Ditch Reference Area Concentration [b] [c]	Effects Benchmark [d]	East Ditch Average HQ [e]	Incremental Risk Average HQ [f]
Volatile Organics (mg/kg)						
1,1,2-Trichloro-1,2,2-Trifluoroethane	1 / 3	0.012	ND	NA	NC	NC
2,4,4-Trimethyl-2-pentene	1 / 3	0.0047	ND	NA	NC	NC
Acetaldehyde	1 / 2	0.09	NA	NA	NC	NC
Acetone	1 / 3	0.23	ND	0.0091	**26**	NC
Formaldehyde	2 / 2	0.91	NA	NA	NC	NC
Semivolatile Organics (mg/kg)						
Bis(2-Ethylhexyl)phthalate	3 / 3	4.2	ND	0.182	**23**	NC
Carbazole	2 / 3	0.20	ND	NA	NC	NC
Diphenyl ether	1 / 3	0.20	ND	NA	NC	NC
Metals (mg/kg)						
Arsenic	3 / 3	178	11.0	9.79	**18.1**	**17.0**
Barium	3 / 3	111	27	NA	NC	NC
Beryllium	2 / 3	0.83	0.24	NA	NC	NC
Cadmium	3 / 3	2.2	0.24	0.99	**2.3**	**2.0**
Chromium	3 / 3	49	9.8	43.4	**1.1**	0.91
Copper	3 / 3	170	14.0	31.6	**5.4**	**4.9**
Iron	3 / 3	90,667	13,000	20,000	**4.5**	**3.9**
Lead	3 / 3	168	5.3	35.8	**4.7**	**4.6**
Manganese	3 / 3	1,343	140	460	**2.9**	**2.6**
Nickel	3 / 3	23	7.7	22.7	**1.0**	0.67
Silver	2 / 3	1.5	ND	2	0.8	NC
Tin	1 / 2	7.3	ND	NA	NC	NC
Vanadium	3 / 3	50	12.0	NA	NC	NC
Zinc	3 / 3	967	75	121	**8.0**	**7.4**
Inorganics (mg/kg)						
Chloride	3 / 3	257	150	NA	NC	NC
Nitrogen, as Ammonia	3 / 3	50	26	NA	NC	NC
Sulfate	1 / 3	58	ND	NA	NC	NC
Specialty Compounds (mg/kg)						
Hydrazine	1 / 2	0.0014	NA	NA	NC	NC
Total Organic Carbon (mg/kg)						
Total Organic Carbon	3 / 3	31,609	8,400			

Prepared by: SFR 7/9/2013
Checked by: EYM 7/18/2013

Notes:

[a] COPEC selection is shown on Table 4.3-2.

[b] Average (arithmetic mean) values were calculated using one-half the detection limit for non detects.

[c] The Reference Area concentration is the detected concentration in the one sediment reference sample available.

Table 5.4-1
Refinement of COPECs - East Ditch - Sediment
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Notes (continued):

[d] Sediment effects benchmark values are presented in Table 5.2-1.

[e] Hazard Quotients were calculated by dividing the concentration by the screening benchmark.

[f] Incremental risk hazard quotients were calculated by subtracting the reference area hazard quotient from the East Ditch exposure area hazard quotient.

Bold and Shaded Cells Indicate HQs>1

COPEC - Chemical of Potential Ecological Concern
mg/kg - milligrams per kilogram
NA - Not Available
NC - Not Calculated
ND - Not Detected

ATTACHMENT 1

HABITAT ASSESSMENT AND WETLAND FUNCTIONS AND VALUES ASSESSMENT FIELD SHEETS

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(FRONT)

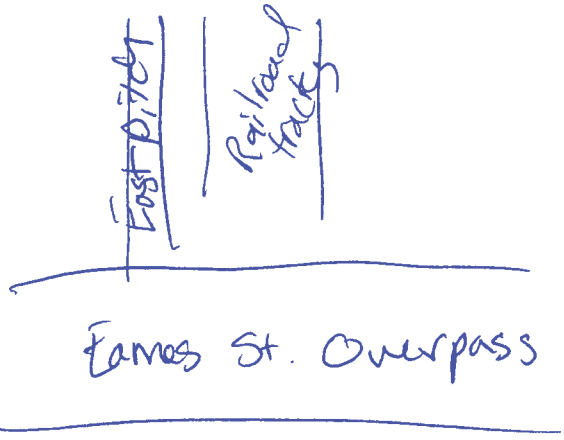
STREAM NAME East Ditch	LOCATION North of Eames St. overpass
STATION #_____ RIVER MILE_____	STREAM CLASS
LAT_____ LONG_____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS SFR, BJR	
FORM COMPLETED BY	DATE 6-20-13 TIME 13:15 AM PM
	REASON FOR SURVEY

WEATHER CONDITIONS

Now	Past 24 hours		Has there been a heavy rain in the last 7 days?
☐	☐	Storm (heavy rain)	☑ Yes ☐ No
☐	☐	Rain (steady rain)	
☐	☐	Showers (intermittent)	Air Temperature ~75 °F
☐	☐	% cloud cover	Other _____
☑	☑	Clear/sunny	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☐ Perennial ☑ Intermittent ☐ Tidal

Stream Origin
☐ Glacial ☐ Spring-fed
☐ Non-glacial montane ☐ Mixture of origins
☐ Swamp and bog ☑ Other Man-made drainage

Stream Type
☐ Coldwater ☑ Warmwater

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surround Land Use
- ☐ Forest
- ☐ Commercial
- ☐ Field/Pasture
- ☒ Industrial
- ☐ Agricultural
- ☐ Other _____
- ☐ Residential

Local Watershed NPS Pollution
- ☐ No evidence ☐ Some potential sources
- ☒ Obvious sources

Local Watershed Erosion
- ☐ None ☐ Moderate ☐ Heavy minimal?

RIPARIAN VEGETATION (18-meter buffer)

Indicate the dominant type and record the dominant species present
- ☒ Trees ☒ Shrubs ☐ Grasses ☐ Herbaceous

Dominant species present _____

IN-STREAM FEATURES

Estimated Stream Width _____m
Estimated Stream Depth _____m
Surface Velocity _____m/sec (at thalweg)
Estimated Reach Length _____m
Canopy Cover
- ☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____m
Proportion of Reach Represented by Stream Morphology Types
- ☐ Riffle _____% ☐ Run _____%
- ☐ Pool _____%

Channelized ☐ Yes ☐ No
Dam Present ☐ Yes ☐ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
- ☐ Floating algae ☐ Attached algae

Dominant species present phragmites, red oak, cattail
Portion of the reach with aquatic vegetation 65 %

WATER QUALITY

Temperature _____°C
Specific Conductance _____
Dissolved Oxygen _____
pH _____
Turbidity _____
WQ Instrument Used _____

Water Odors
- ☐ Normal/None ☐ Sewage
- ☐ Petroleum NM ☐ Chemical
- ☐ Fishy ☐ Other _____

Water Surface Oils
- ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
- ☒ None ☐ Other _____

Turbidity (if not measured)
- ☐ Clear ☒ Slightly turbid ☐ Turbid
- ☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/SUBSTRATE

Odors
- ☐ Normal ☐ Sewage ☐ Petroleum
- ☐ Chemical ☐ Anaerobic ☐ None
- ☐ Other _____

Oils
- ☐ Absent NM ☐ Moderate
- ☐ Slight ☐ Profuse

Deposits
- ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
- ☐ Relict shells ☐ Other None

Looking at stones that are not deeply embedded, are the undersides black?
- ☐ Yes ☐ No No stones

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5-10")	
Gravel	2-64 mm (0.1-2.5")	80%
Sand	0.06-2 mm (gritty)	
Silt	0.004-0.06 mm	20%
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%0)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black,very fine organic (FPOM)	50%
Marl	gray, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME East Ditch		LOCATION North of Barnes St. overpass	
STATION #	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS SFR, BSR			
FORM COMPLETED BY SFR	DATE 6/20/13 TIME 13:15 PM	REASON FOR SURVEY	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization No Pools	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 0 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 (0)

Total Score _____

Form # EL2 - _____

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(FRONT)

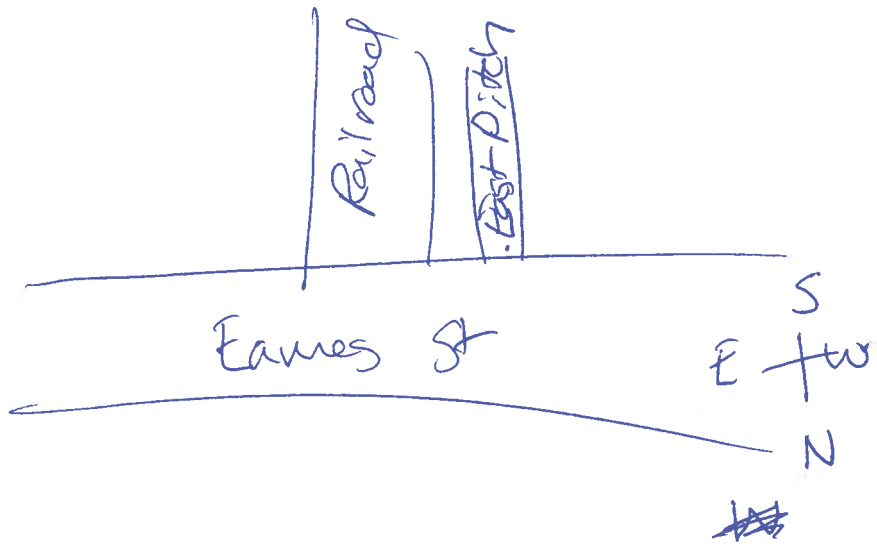
STREAM NAME East Ditch	LOCATION South of Eames St Overpass
STATION #_____ RIVER MILE_____	STREAM CLASS
LAT_____ LONG_____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS SFR, BSR	
FORM COMPLETED BY SFR	DATE 6/20/13 TIME 13:25 AM PM
REASON FOR SURVEY	

WEATHER CONDITIONS

Now	Past 24 hours		Has there been a heavy rain in the last 7 days?
☐	☐	Storm (heavy rain)	☑ Yes ☐ No
☐	☐	Rain (steady rain)	
☐	☐	Showers (intermittent)	Air Temperature ~75 °F ~~°C~~
☐____	☐____	% cloud cover	Other _____
☑	☑	Clear/sunny	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem

☐ Perennial ☑ Intermittent ☐ Tidal

Stream Type

☐ Coldwater ☐ Warmwater

Stream Origin

☐ Glacial ☐ Spring-fed

☐ Non-glacial montane ☐ Mixture of origins

☐ Swamp and bog ☑ Other Man made

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surround Land Use
- ☐ Forest
- ☐ Commercial
- ☐ Field/Pasture
- ☒ Industrial
- ☐ Agricultural
- ☐ Other _____
- ☐ Residential

Local Watershed NPS Pollution
- ☐ No evidence ☐ Some potential sources
- ☒ Obvious sources

Local Watershed Erosion
- ☐ None ☐ Moderate ☐ Heavy Minimal

RIPARIAN VEGETATION (18-meter buffer)

Indicate the dominant type and record the dominant species present
- ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous

Dominant species present Tree of paradise, cattails, phragmites

IN-STREAM FEATURES

Estimated Stream Width 1.5 m
Estimated Stream Depth 0.25 m
Surface Velocity 0.0 m/sec (at thalweg)
Estimated Reach Length _____ m
Canopy Cover
- ☒ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
- ☐ Riffle _____ % ☒ Run 100 %
- ☐ Pool _____ %

Channelized ☑ Yes ☐ No
Dam Present ☐ Yes ☒ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- ☒ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
- ☒ Floating algae ☒ Attached algae

Dominant species present _____

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature _____ °C
Specific Conductance _____
Dissolved Oxygen NM
pH _____
Turbidity _____
WQ Instrument Used _____

Water Odors
- ☐ Normal/None ☐ Sewage
- ☐ Petroleum ☐ Chemical
- ☐ Fishy ☐ Other _____

NM

Water Surface Oils
- ☐ Slick ☒ Sheen ☐ Globs ☐ Flecks
- ☐ None ☐ Other _____

Turbidity (if not measured)
- ☒ Clear ☐ Slightly turbid ☐ Turbid
- ☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/SUBSTRATE

Odors
- ☐ Normal ☐ Sewage ☐ Petroleum
- ☐ Chemical ☐ Anaerobic ☐ None
- ☐ Other _____

N/A

Oils
- ☐ Absent ☐ Moderate
- ☒ Slight ☐ Profuse

Deposits
- ☒ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
- ☐ Relict shells ☐ Other _____

Looking at stones that are not deeply embedded, are the undersides black?
- ☐ Yes ☐ No

NM

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5-10")	
Gravel	2-64 mm (0.1-2.5")	20%
Sand	0.06-2 mm (gritty)	
Silt	0.004-0.06 mm	80%
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%0)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black,very fine organic (FPOM)	85%
Marl	gray, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME East Ditch		LOCATION South of Barnes St Overpass	
STATION #	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS SAR, BSR			
FORM COMPLETED BY SAR	DATE 6/20/13 TIME 13:25 PM	REASON FOR SURVEY	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization No pools	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 (4) 3	2 1 (0)
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 6 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0

Total Score _____

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(FRONT)

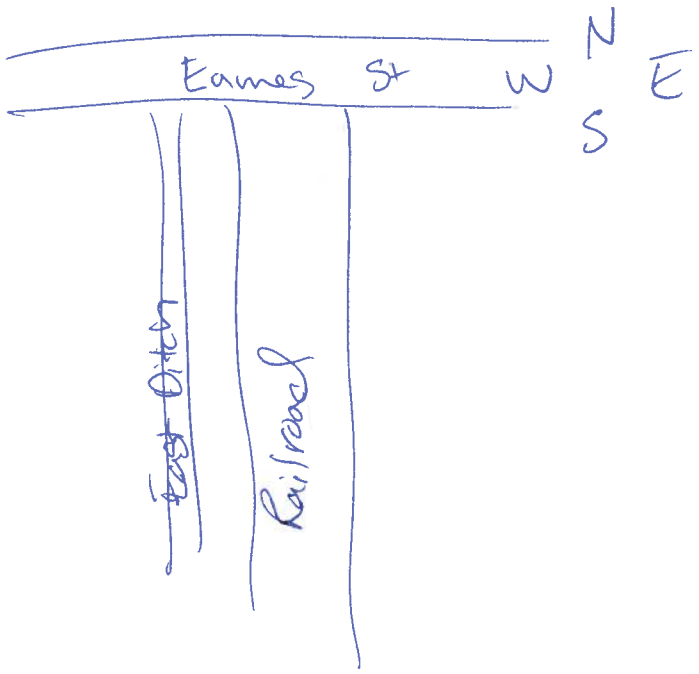
STREAM NAME East Ditch	LOCATION Apx 1,000 ft South of Eames St overpass
STATION #_____ RIVER MILE_____	STREAM CLASS
LAT_____ LONG_____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS SFR, BJR	
FORM COMPLETED BY SFR	DATE 6/20/13 TIME 13:30 AM PM
REASON FOR SURVEY	

WEATHER CONDITIONS

Now	Past 24 hours		Has there been a heavy rain in the last 7 days?
☐	☐	Storm (heavy rain)	☒ Yes ☐ No
☐	☐	Rain (steady rain)	
☐	☐	Showers (intermittent)	Air Temperature ~75 °F
☐____	☐____	% cloud cover	Other _____
☑	☑	Clear/sunny	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem

☐ Perennial ☒ Intermittent ☐ Tidal

Stream Type

☐ Coldwater ☒ Warmwater

Stream Origin

Catchment Area _____ km^2

☐ Glacial ☐ Spring-fed

☐ Non-glacial montane ☐ Mixture of origins

☐ Swamp and bog ☒ Other Man made drainage ditch

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surround Land Use
- ☐ Forest
- ☐ Commercial
- ☐ Field/Pasture
- ☒ Industrial
- ☐ Agricultural
- ☐ Other _____
- ☐ Residential

Local Watershed NPS Pollution
- ☐ No evidence ☐ Some potential sources
- ☒ Obvious sources

Local Watershed Erosion
- ☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18-meter buffer)

Indicate the dominant type and record the dominant species present
- ☐ Trees ☒ Shrubs ☐ Grasses ☒ Herbaceous

Dominant species present Brambles, golden rod, cattails, goldenrod, buckthorn, red oak

IN-STREAM FEATURES

Estimated Stream Width 0.5 m
Estimated Stream Depth 0.15 m
Surface Velocity 0.0 m/sec (at thalweg)
Estimated Reach Length _____ m
Canopy Cover open
- ☐ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m

Proportion of Reach Represented by Stream Morphology Types
- ☐ Riffle _____ % ☒ Run 100 %
- ☐ Pool _____ %

Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- ☒ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
- ☐ Floating algae ☒ Attached algae

Dominant species present cattails

Portion of the reach with aquatic vegetation 40 %

WATER QUALITY

Temperature _____ °C
Specific Conductance _____
Dissolved Oxygen _____
pH _____ NM
Turbidity _____
WQ Instrument Used _____

Water Odors
- ☐ Normal/None ☐ Sewage
- ☐ Petroleum ☐ Chemical
- ☐ Fishy ☐ Other _____

NM

Water Surface Oils
- ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
- ☒ None ☐ Other _____

Turbidity (if not measured)
- ☒ Clear ☐ Slightly turbid ☐ Turbid
- ☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/SUBSTRATE

Odors
- ☐ Normal ☐ Sewage ☐ Petroleum
- ☐ Chemical ☐ Anaerobic ☒ None
- ☐ Other _____

Oils
- ☒ Absent ☐ Moderate
- ☐ Slight ☐ Profuse

Deposits
- ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
- ☐ Relict shells ☐ Other _____

Looking at stones that are not deeply embedded, are the undersides black?
- ☐ Yes ☐ No

NM

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5-10")	
Gravel	2-64 mm (0.1-2.5")	80%
Sand	0.06-2 mm (gritty)	
Silt	0.004-0.06 mm	20%
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%0

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black,very fine organic (FPOM)	20%
Marl	gray, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME East Ditch	LOCATION 1000 ft South of Barnes St ave/pass	
STATION # _____ REACH ID# _____	STREAM CLASS	
UTM N _____ UTM E	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS SFR, BJR		
FORM COMPLETED BY SFR	DATE 6/20/13 TIME 13:50 PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization No pools	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 3	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 (3) 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)

Form # EL - _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 8 (RB)	Right Bank 10 9	(8) 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 3 (RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0

Total Score _____

Form # EL2 - _____

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(FRONT)

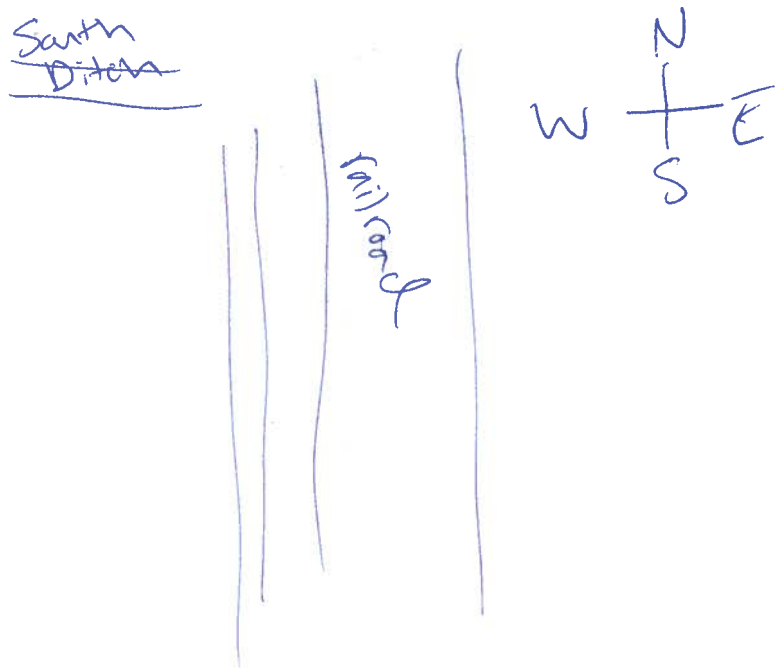
STREAM NAME East Ditch	LOCATION 200 ft South of South Ditch
STATION # _____ RIVER MILE _____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS SFR, BJR	
FORM COMPLETED BY SFR	DATE 6/20/13 TIME 14:15 AM PM
	REASON FOR SURVEY

WEATHER CONDITIONS

Now	Past 24 hours		Has there been a heavy rain in the last 7 days?
☐	☐	Storm (heavy rain)	☑ Yes ☐ No
☐	☐	Rain (steady rain)	
☐	☐	Showers (intermittent)	Air Temperature ~75 °F °C
☐ ____	☐ ____	% cloud cover	Other _____
☑	☑	Clear/sunny	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem

☐ Perennial ☒ Intermittent ☐ Tidal

Stream Type

☐ Coldwater ☒ Warmwater

Stream Origin

☐ Glacial ☐ Spring-fed

☐ Non-glacial montane ☐ Mixture of origins

☐ Swamp and bog ☑ Other Man made

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surround Land Use
- ☐ Forest
- ☐ Commercial
- ☐ Field/Pasture
- ☒ Industrial
- ☐ Agricultural
- ☐ Other _____
- ☐ Residential

Local Watershed NPS Pollution
- ☐ No evidence ☐ Some potential sources
- ☒ Obvious sources

Local Watershed Erosion
- ☐ None ☐ Moderate ☐ Heavy minima

RIPARIAN VEGETATION (18-meter buffer)

Indicate the dominant type and record the dominant species present
- ☒ Trees ☒ Shrubs ☐ Grasses ☒ Herbaceous

Dominant species present birch, high bush blueberry, sugar maple, oak, ferns, glossy buckthorn

IN-STREAM FEATURES

Estimated Stream Width 1.25 m
Estimated Stream Depth 0.15 m
Surface Velocity 0.5 m/sec (at thalweg)
Estimated Reach Length _____ m
Canopy Cover
- ☒ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m
Proportion of Reach Represented by Stream Morphology Types
- ☐ Riffle _____ % ☒ Run 100 %
- ☐ Pool _____ %

Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- ☒ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
- ☐ Floating algae ☐ Attached algae

Dominant species present cattails

Portion of the reach with aquatic vegetation 35 %

WATER QUALITY

Temperature _____ °C
Specific Conductance _____
Dissolved Oxygen _____
pH _____ NM
Turbidity _____
WQ Instrument Used _____

Water Odors
- ☐ Normal/None ☐ Sewage NONE
- ☐ Petroleum ☐ Chemical
- ☐ Fishy ☐ Other _____

Water Surface Oils
- ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
- ☒ None ☐ Other _____

Turbidity (if not measured)
- ☒ Clear ☐ Slightly turbid ☐ Turbid
- ☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/SUBSTRATE

Odors
- ☐ Normal ☐ Sewage ☐ Petroleum
- ☐ Chemical ☐ Anaerobic ☒ None
- ☐ Other _____

Oils
- ☒ Absent ☐ Moderate
- ☐ Slight ☐ Profuse

Deposits
- ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
- ☐ Relict shells ☐ Other None

Looking at stones that are not deeply embedded, are the undersides black?
- ☐ Yes ☐ No

NM

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5-10")	
Gravel	2-64 mm (0.1-2.5")	80%
Sand	0.06-2 mm (gritty)	
Silt	0.004-0.06 mm	20%
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%0)

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	5%
Muck-Mud	black, very fine organic (FPOM)	20%
Marl	gray, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME East Ditch		LOCATION 2000 ft South of South Ditch	
STATION #	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS SRR, BJR			
FORM COMPLETED BY SRR	DATE 6/20/13 TIME 14:15 PM	REASON FOR SURVEY	

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization No Pools	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 9	20 19 18 17 16	15 14 13 12 11	10 (9) 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 2	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 (2) 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 5 (RB)	Right Bank 10 9	8 7 6	(5) 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0

Total Score _____

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(FRONT)

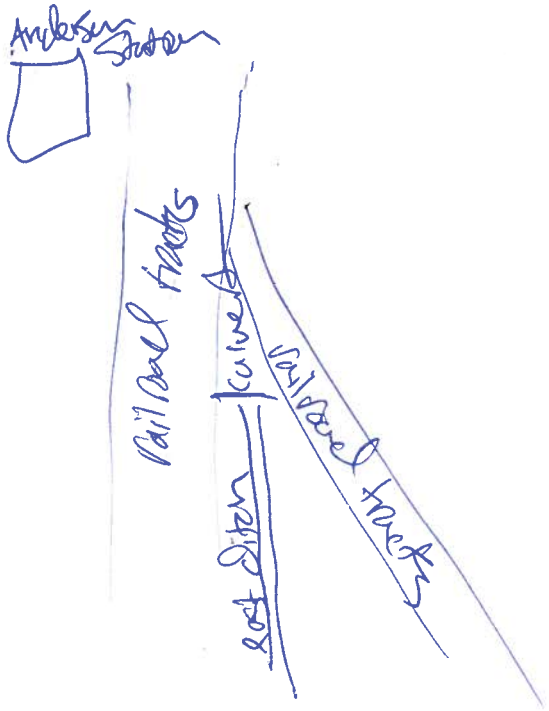
STREAM NAME East Otter	LOCATION @ gravel turnout 500ft north of anderson station	
STATION # _____ RIVER MILE _____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS SPR, BJR		
FORM COMPLETED BY SPR	DATE 6/20/13 TIME 15:25 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS

Now	Past 24 hours		Has there been a heavy rain in the last 7 days?
☐	☐	Storm (heavy rain)	☑ Yes ☐ No
☐	☐	Rain (steady rain)	
☐	☐	Showers (intermittent)	Air Temperature ~75 °F °C
☐ ____	☐ ____	% cloud cover	Other _____
☑	☐	Clear/sunny	

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)



STREAM CHARACTERIZATION

Stream Subsystem
☐ Perennial ☒ Intermittent ☐ Tidal

Stream Type
☐ Coldwater ☒ Warmwater

Stream Origin
☐ Glacial ☐ Spring-fed
☐ Non-glacial montane ☐ Mixture of origins
☐ Swamp and bog ☒ Other man made

Catchment Area _____ km^2

PHYSICAL CHARACTERIZATION / WATER QUALITY FIELD DATA SHEET
(BACK)

WATERSHED FEATURES

Predominant Surround Land Use
- ☐ Forest
- ☐ Commercial
- ☐ Field/Pasture
- ☒ Industrial
- ☐ Agricultural
- ☐ Other _____
- ☐ Residential

Local Watershed NPS Pollution
- ☐ No evidence ☐ Some potential sources
- ☒ Obvious sources

Local Watershed Erosion
- ☐ None ☐ Moderate ☐ Heavy

RIPARIAN VEGETATION (18-meter buffer)

Indicate the dominant type and record the dominant species present
- ☒ Trees ☒ Shrubs ☐ Grasses ☐ Herbaceous

Dominant species present multiflora rose,

IN-STREAM FEATURES

Estimated Stream Width 1.25 m
Estimated Stream Depth 0.25 m
Surface Velocity ~0.25 m/sec (at thalweg)
Estimated Reach Length _____ m
Canopy Cover
- ☒ Partly open ☐ Partly shaded ☐ Shaded

High Water Mark _____ m
Proportion of Reach Represented by Stream Morphology Types
- ☐ Riffle _____ % ☒ Run 100 %
- ☐ Pool _____ %

Channelized ☒ Yes ☐ No
Dam Present ☐ Yes ☒ No

AQUATIC VEGETATION

Indicate the dominant type and record the dominant species present
- ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating
- ☐ Floating algae ☐ Attached algae

Dominant species present None

Portion of the reach with aquatic vegetation _____ %

WATER QUALITY

Temperature _____ °C
Specific Conductance _____
Dissolved Oxygen _____
pH _____ NM
Turbidity _____
WQ Instrument Used _____

Water Odors
- ☐ Normal/None ☐ Sewage
- ☐ Petroleum ☐ Chemical
- ☐ Fishy ☐ Other _____

Water Surface Oils
- ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks
- ☐ None ☐ Other _____

Turbidity (if not measured)
- ☐ Clear ☐ Slightly turbid ☐ Turbid
- ☐ Opaque ☐ Stained ☐ Other _____

SEDIMENT/SUBSTRATE

Odors
- ☐ Normal ☐ Sewage ☐ Petroleum
- ☐ Chemical ☐ Anaerobic ☒ None
- ☐ Other _____

Oils
- ☒ Absent ☐ Moderate
- ☐ Slight ☐ Profuse

Deposits
- ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand
- ☐ Relict shells ☐ Other _____

Looking at stones that are not deeply embedded, are the undersides black?
- ☐ Yes ☐ No NM

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)

Substrate Type	Diameter	% Composition in Sampling Reach
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5-10")	
Gravel	2-64 mm (0.1-2.5")	100%
Sand	0.06-2 mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%0

Substrate Type	Characteristic	% Composition in Sampling Area
Detritus	sticks, wood, coarse plant materials (CPOM)	
Muck-Mud	black,very fine organic (FPOM)	
Marl	gray, shell fragments	

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

STREAM NAME East Ditch		LOCATION 500 ft North of Anderson Station	
STATION #	REACH ID#	STREAM CLASS	
UTM N	UTM E	RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS SFR, BJR			
FORM COMPLETED BY SFR		DATE 6/20/13 TIME 5:25 PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE 1	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 (1) 0
2. Pool Substrate Characterization No pools	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability 0	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
4. Sediment Deposition 8	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
5. Channel Flow Status 5	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	(5) 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE 0	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 (0)
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 9 (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE 9 (RB)	Right Bank 10 (9)	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 2 (RB)	Right Bank 10 9	8 7 6	5 4 3	(2) 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE 0 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 (0)
SCORE 1 (RB)	Right Bank 10 9	8 7 6	5 4 3	2 (1) 0

Total Score _____

Wetland Functions and Values Assessment

Project Name: Ohm - East Ditch PN#: _____ Date: 6/20/13

Wet ID #: East Ditch Time Start: 13:00 Time Stop: 15:45

Weather: clear ~ 75°F

Site investigator(s): SFR, BJR

Recent Precipitation: Below average Average (Above Average) Don't Know TBD

Wildlife investigation method: Cover search Dip netting Auditory Scat Tracks Minnow Traps

Wetland Types(s) Cowardin/Golet Classification

Class	**Subclass**
POW/ Open water	*Vegetated Non-vegetated*
PEM/PSS Deep Marsh	*Dead woody Shrub Sub-shrub Robust Narrow-Leaved Broad-Leaved*
PAB/ Shallow Marsh	*Robust Narrow-leaved Broad-leaved Floating-leaved*
PFL/ Seasonally Flooded Flats	*Emergent Shrub*
PEM/ Wet Meadow	*Ungrazed Grazed*
PSS/ Shrub Swamp	*Sapling Bushy Compact Aquatic*
PFO/ Wooded Swamp	*Deciduous Evergreen*
Bog	*Compact shrub Bushy Shrub Wooded Emergent*

Water Regimes(Cowardin Modifier)

Permanently flooded (H) – *water covers land surface throughout year in all years*

Intermittently Exposed (Z) – *surface water present throughout year except in years of extreme drought*

Semi-permanently flooded (F) – *surface water persists throughout growing season in most years*

Seasonally flooded C – *surface water present for extended periods especially early in growing season, but is absent by end of season in most years*

Seasonally saturated (Y) – *soils saturated to surface, especially early in growing season, but are unsaturated by end of season in most years; surface water absent except for ground water seepage and overland flow*

Temporarily flooded (A) – *surface water present for brief periods during growing season, but water table usually lies well below soil surface for most of the season*

Intermittently flooded (J) – *substrate usually exposed, but surface water is present for variable periods without detectable seasonal periodicity*

Artificially flooded (K) – *amount/duration of flooding controlled by dikes, dams, pumps etc*

Hydrology

Ground water discharges present: Yes (No) If Present, Slope or Depressional

Surface water depth: average - 6 in maximum - 2 ft

Depth to free water: _____

Depth to saturation: _____

Signs of altered hydrology? Yes -

Hydrology indicators: *Inundated* *Saturated in upper 12"* *Water marks* *Drift lines*
Sediment deposits *Drainage patterns within wetland* *Other*

Plant Adaptions to Hydrology: *Pneumatophores* *Polymorphic leaves* *Buttressed trees*
Hypertrophied lenticels *Stooling Inflated leaves, stems or roots* *Adventitious roots*
Rhizospheric Oxidation *Shallow root systems* *floating leaves* *floating stems*

Soils

Drainage classes: Well Moderately Poorly Very Poorly

New England Hydric soil indicators

Slope Nearly level Gentle Moderate Steep

Upland Border

Slope: Nearly level Gentle Moderate Steep 6-8 ft berm on west side

Cover Types: Mature forest (Sapling forest Shrub thicket) Meadow Mowed lawn Farm

Vegetation Density(S/M/D): Trees S Saplings S Shrubs M Herbs D Grass M

Leaf litter: Well developed Moderately well developed Absent Poorly developed

Cover objects: Logs Bark Boulders/Rocks None

Evidence of Erosion: (No) Yes Explain:_____

Water Quality Parameters

Parameter	Station #1	Station #2	Station #3	Station #4
pH (pH units)				
Dissolved Oxygen (mg/L)				
Dissolved Oxygen (%)		NM		
Conductivity (uS/cm)				
Temperature (Deg C)				
Turbidity (NTU)				
ORP (mV)				

Description of Surrounding Area

East Ditch B an approximately 3-3.5 ft wide drainage channel that runs parallel to the MBTA tracks. It is lined w gravel rip/rap. Throughout the channel there are cattails emerging. The western bank is vegetated w/ shrubs + herbs.

Description of Wetland Habitat

Plant Species Observed in Wetland

Species Name	Notes
Cattails	
Phragmites	
Briars	
Golden rod	
Red Maple	
Sugar Maple	
Red Oak	
Glossy Buckthorne	
Ragweed	
Birch	
Cottonwoods	

Wildlife Observed in Wetland

Name	Notes
Frogs	
Dragonflies	
Unidentified Birds	

GWR/GROUNDWATER RECHARGE (Excluding condition: Slope Wetland)

This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area and refers to the fundamental interaction between wetlands and aquifers, regardless of the size or importance of either.

Criteria	+	-	Comments
Soils	Sand/gravel outwash	Hardpan, tight fine-grained soils, shallow ledge	None
Wetland associated w/ perennial or seasonal watercourse	Yes	No	
Slope	Gentle	Moderate or Steep	
Function Present	NO		

Notes:

GWD/GROUNDWATER DISCHARGE

This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area and refers to the fundamental interaction between wetlands and aquifers, regardless of the size or importance of either.

Criteria	+	-	Comments
Soils	Hardpan, shallow ledge	-----	gravel rip/rap
Seeps, springs observed?	Yes	No	
Wetland microrelief	Well developed	Non/poorly developed	
Wetland contains an outlet, no inlet	Yes	No	
Function Present	NO		

Notes:

FFA/FLOODFLOW ALTERATION (Excluding condition: Slope Wetland)

This function considers the effectiveness of the wetland in reducing flood damage by water retention for prolonged periods following precipitation events and the gradual release of floodwaters. It adds to the stability of the wetland ecological system or its buffering characteristics and provides social or economic value relative to erosion and/or flood prone areas.

Criteria	+	-	Comments
Area of wetland is relatively...	Large	Small	
Amount of impervious surface in wetland watershed	Large	Small	
Wetland slope	Gentle	Steep	
Wetland characterized by variable water level?	Yes	No	
Wetland in floodplain of adjacent watercourse?	Yes	No	
Valuable properties, structures or resources located in or near floodplain downstream from wetland?	Yes	No	
Watershed has a history of economic loss due to flooding?	Yes	No	
Wetland outlet restricted?	Yes	No	
Wetland vegetation density	High	Low	
Wetland microrelief	Well developed	None/poorly developed	
Function Present	NO		

Notes:

F&SH/FINFISH HABITAT: POND & LAKE (Excluding condition: Not associated with pond, lake)

For freshwater systems, this function considers the effectiveness of seasonal or permanent watercourses associated with the wetland in question for fish and shellfish habitat.

Criteria	+	-	Comments
Dominant land use adjacent to waterbody	Natural	Developed	
Shallow littoral zone with emergent vegetation present?	Yes	No	
Waterbody at least 10' deep	Yes	No	Not majority west of ditch
% of pond covered by submerged or emergent vegetation	15-40%	Other	
Direct stormwater discharge via culvert?	No	Yes	
Sandbar present at inlet?	No	Yes	
Water transparency	High	Low	
Significant nutrient sources (fertilizers, waterfowl) present in watershed?	No	Yes	
Pond size ≥ 0.5 acre	Yes	No	NA
Pond experiences dense algal blooms, nuisance aquatic vegetation or duckweed?	No	Yes	NA
Signs of fish activity	Yes	No	
Function Present			

Notes:

NO

S&TR/SEDIMENT/TOXICANT/PATHOGEN RETENTION

This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens in runoff water from surrounding uplands or upstream eroding wetland areas.

Criteria	+	-	Comments
Sources of sediment or toxicants upstream	Yes	No	
Duration of water retention in wetland	Long	Short	
Evidence of sediment trapping in wetland	Yes	No	
Vegetation density	High	Low	
Wetland edge broad and intermittently aerobic	Yes	No	
Drainage ditches in wetland	No	Yes	It is a drainage ditch
Water flow through wetland	Diffuse	Channelized	
Ponded water present	Yes	No	
Wetland basin topographic gradient	Low	High	
Fine grained mineral or organic soils present	Yes	No	
Watercourse, if present has visible velocity decreases in the wetland	Yes	No	
Indicators of erosion or high water velocities are present	No	Yes	
Function Present			

Notes:

NO

N&RR/NUTRIENT REMOVAL/RETENTION/TRANSFORMATION

This function considers the effectiveness of the wetland as a trap for nutrients in runoff water from surrounding uplands or contiguous wetlands and the ability of the wetland to process these nutrients into other forms or trophic levels. One aspect of this function is to prevent ill effects of nutrients entering aquifers or TNW such as ponds, lakes, streams, rivers or estuaries.

Criteria	+	-	Comments
Wetland size in relation to the watershed	Large	Small	
Potential sources of excess nutrients upstream	Yes	No	
Wetland is saturated for most of the season	Yes	No	
Emergent vegetation of dense woody stems are dominant	Yes	No	
Water flow through wetland	Diffuse	Channelized	
Vegetation density	High	Low	
Potential for sediment trapping exists	Yes	No	
Deep or open water habitat is present	Yes	No	
Soil type	Organic/high clay content	Sand/gravel	
Wetland basin topographic gradient	Low	High	
Wetland microrelief	Well developed	None, poorly developed	
Function Present			

Notes:

NO

PE/PRODUCTION EXPORT (Excluding Condition: No outlet)

This function evaluates the effectiveness of the wetland to produce food or usable products for humans or other living organisms.

Criteria	+	-	Comments
Wildlife food sources in wetland	Abundant	Few	
Vegetation density	High	Low	
Nutrients and/or organic matter flushed out of wetland into watercourse?	Yes	No	Flushed Through
Wetland has high degree of plant community structure and species diversity	Yes	No	
Detritus development is present within this wetland	Yes	No	
Flowering plants used by nectar gatherers present	Yes	No	on western banks
Evidence of wildlife use in wetland?	Yes	No	Negligible
Fish or shellfish develop/occur in wetland	Yes	No	
Function Present			

Notes:

NO

S&SS/SEDIMENT/SHORELINE STABILIZATION

This function considers the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.

Criteria	+	-	Comments
Topographical gradient in wetland	Yes	No	
Potential sediment sources upstream or upslope	Yes	No	
Wetland border > 10' adjacent to pond or water	Yes	No	
Distinct shoreline or bank evident between wetland and water	No	Yes	
Open water fetch present	Yes	No	
Boating activity present	Yes	No	
Floodplain stabilizing trees and shrubs present	Yes	No	
Indications of erosion or siltation present	Yes	No	
Function Present			

Notes:

NO

REC/RECREATION

This value considers the suitability of the wetland and associated watercourses to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting or other active or passive recreational activities. Consumptive opportunities consume or diminish the plants, animals or other resources that are intrinsic to the wetland. Non-consumptive opportunities do not consume or diminish the resources of the wetland.

Criteria	+	-	Comments
Wetland is part of a recreation area, park, refuge etc	Yes	No	
Fishing is available in or from the wetland	Yes	No	
Hunting is permitted in wetland	Yes	No	
Hiking occurs or has potential to occur in wetland	Yes	No	
Wetland is a valuable wildlife habitat	Yes	No	
Wetland has high visual/aesthetic quality	Yes	No	
Boating or canoeing feasible in wetland	Yes	No	
Off-road public parking near wetland available	Yes	No	
Safety hazards (if present list them)		Railroad	
Function Present			

Notes:

No

WLH/WILDLIFE HABITAT

This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and/or migrating species must be considered.

Criteria	+		Comments
Wetland degradation by human activity	Little or none	Mod to high	
Wetland fragmentation by development	Little or none	Mod to high	Culverted
Buffer Exists (F= forest M= Meadow S=sapling/shrub thicket L=lawn A=agriculture)	Yes	No	
Buffer width	Good to excellent	Fair to poor	
Connectivity with other wetlands	Yes	No	
Size of landscape block in which wetland is located	Large	Small	
Wildlife food sources in wetland	Abundant	Few	
Interspersion of vegetation and open water	High	Low	
Upland islands	Present	Absent	
Wetland class diversity (W=wooded swamp SS=shrub swamp M=marsh WM=wet meadow OW=open water)	High (>=3)	Low OW	
Vegetation density	High	Low	
Vegetation strata (T=tree S-sapling SH=shrub V=vine H=herb LL=leaf litter)		SH, H	
Wetland plant species diversity	High	Low or Mod	
Vernal pool	Yes	No	

Edge diversity (list types)	High	Low	
Water regime	Wetter	Drier	
Habitat features (S=snags L=fallen logs SE= seep/spring)	Abundant	Few None	
Cover objects (L=logs/branches R=rocks B=bark)	Abundant	Few None	
Flat rocks in/near watercourse (stream salamanders)	Present	Absent Rip/Rap	
Sphagnum hummocks next to shallow pools	Present	Absent	
Bare well drained sandy soils near wetland (turtle nest site)	Present	Absent	
Abundance of invasive exotic flora	None or low	high	Buckthorn
Function Present			

Notes: NO

E&SV/EDUCATIONAL/SCIENTIFIC VALUE

This value considers the suitability of the wetland as a site for an "outdoor classroom" or as a location for scientific study or research.

Criteria	+	-	Comments
Wetland contains listed species	Yes	No	
Wetland provides valuable wildlife habitat	Yes	No	
Wetland class diversity	High	Low	
Adjacent upland cover types (F=forest M=meadow S=sapling/shrub thicket A=agriculture)	High	Low	
Off road parking near wetland available	Yes	No	
Proximity to schools	Near	Far	Not relevant
Wetland contains perennial watercourse	Yes	No	
Wetland contains pond/lake	Yes	No	
Safety hazards (if present list them)		Rail road	
Site currently used for educational/scientific purposes	Yes	No	
Function Present			

Notes:

NO

U/H/UNIQUENESS/HERITAGE

This value considers the effectiveness of the wetland or its associated waterbodies to provide certain special values. These may include archaeological sites, critical habitat for endangered species, its overall health and appearance, its role in the ecological system of the area, its relative importance as a typical wetland class for this geographic location. These functions are clearly valuable wetland attributes relative to aspects of public health, recreation and habitat diversity.

Criteria	+	-	Comments
Wetland contains listed species	Yes	No	
Wetland identified as exemplary natural community	Yes	No	
Wetland locally/regionally significant (explain)	Yes	No	
Function Present			

Notes:

No

VQA/VISUAL QUALIT/AESTHETICS

This value considers the visual and aesthetic quality or usefulness of the wetland.

Criteria	+	-	Comments
Visible from primary viewing locations	Yes	No	
Views absent trash, debris, sign of degradation	Yes	No	
Low noise level	Yes	No	
Visual landuse contrast with wetland	Yes	No	
Function Present			

Notes:

No

ESH/ENDANGERED SPECIES HABITAT

This value considers the suitability of the wetland to support threatened or endangered species (either federal or state listed).

Criteria	+	-	Comments
Wetland contains or known to contain federal listed species or habitat	Yes	No	
Wetland contains critical habitat for state or federal listed species	Yes	No	
Area appears in state or national database	Yes	No	
Function Present			

Notes:

No

CONCLUSION: SUMMARY TABLE (X = present, P = Principle Wetland Function)

	GWR/D	FFA	F&SH	S&TR	NR&R	PE	S&SS	REC	WLH	E&S/V	U/H	VQA	ESH
Function Present (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N
Principle Function	None												

ATTACHMENT 2

ENDANGERED, THREATENED OR STATE LISTED SPECIES REVIEW

U.S. Fish and Wildlife Service

Natural Resources of Concern

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

NEW ENGLAND ECOLOGICAL SERVICES FIELD OFFICE
70 COMMERCIAL STREET, SUITE 300
CONCORD, NH 03301
(603) 223-2541
http://www.fws.gov/newengland

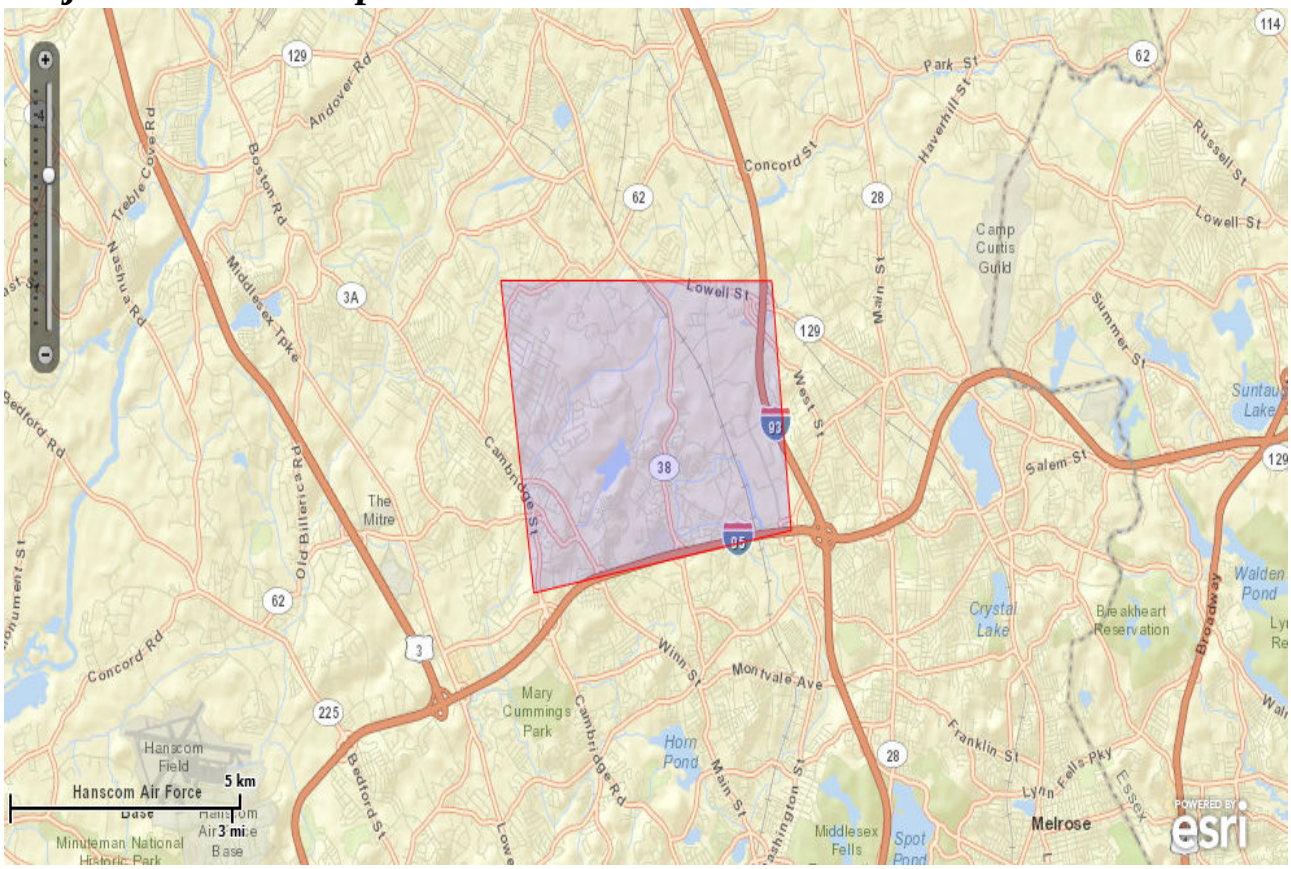
Project Name:

Olin

U.S. Fish and Wildlife Service

Natural Resources of Concern

Project Location Map:



Project Counties:

Middlesex, MA

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-71.2042922 42.5408452, -71.1325377 42.5407188, -71.1273965 42.5028899, -71.1955374 42.4933975, -71.2042922 42.5408452)))

Project Type:

Superfund Site Remediation

U.S. Fish and Wildlife Service

Natural Resources of Concern

Endangered Species Act Species List (USFWS Endangered Species Program).

There are no listed species found within the vicinity of your project.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

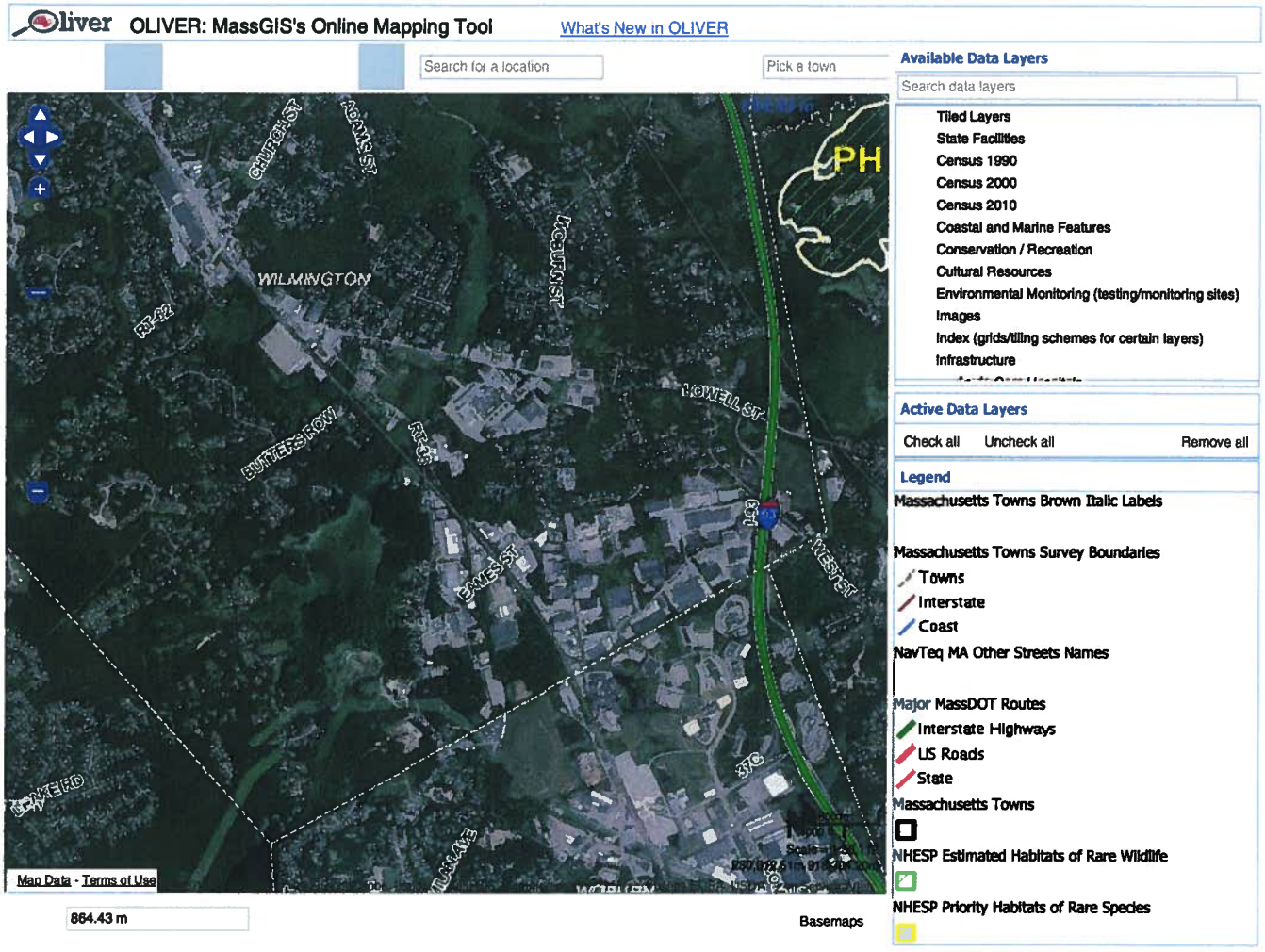
There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

Most species of birds, including eagles and other raptors, are protected under the Migratory Bird Treaty Act (16 U.S.C. 703). Bald eagles and golden eagles receive additional protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668). The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.


OLIVER: MassGIS's Online Mapping Tool
What's New in OLIVER
Search for a location
Pick a town
Available Data Layers
Search data layers
Tiled Layers
State Facilities
Census 1990
Census 2000
Census 2010
Coastal and Marine Features
Conservation / Recreation
Cultural Resources
Environmental Monitoring (testing/monitoring sites)
Images
Index (grids/tiling schemes for certain layers)
Infrastructure
Active Data Layers
Check all
Uncheck all
Remove all
Legend
Massachusetts Towns Brown Italic Labels
Massachusetts Towns Survey Boundaries
Towns
Interstate
Coast
NavTeq MA Other Streets Names
Major MassDOT Routes
Interstate Highways
US Roads
State
Massachusetts Towns
NHESP Estimated Habitats of Rare Wildlife
NHESP Priority Habitats of Rare Species
WILMINGTON
CHURCH ST
ADAMS ST
MCBURN ST
LOWELL ST
BUTTERS ROW
EAMES ST
WEST ST
PH
Map Data - Terms of Use
864.43 m
Basemaps

ATTACHMENT 3

DATA USED IN THE SLERA

Attachment 3-1
East Ditch Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010	OC-SD-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SD-EDSD/SW7-XXX EDSD/SW7 6/18/2012 0-0.5 ft
Volatile Organic Compounds (mg/kg)			
1,1,1,2-Tetrachloroethane	0.0099 UJ	0.0029 U	0.0025 U
1,1,1-Trichloroethane	0.0099 UJ	0.0029 U	0.0025 U
1,1,2,2-Tetrachloroethane	0.0099 UJ	0.0029 U	0.0025 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.05 UJ	0.0041	0.013 U
1,1,2-Trichloroethane	0.0099 UJ	0.0029 U	0.0025 U
1,1-Dichloroethane	0.0099 UJ	0.0029 U	0.0025 U
1,1-Dichloroethene	0.0099 UJ	0.0029 U	0.0025 U
1,1-Dichloropropene	0.0099 UJ	0.0029 U	0.0025 U
1,2,3-Trichlorobenzene	0.0099 UJ	0.0029 U	0.0025 U
1,2,3-Trichloropropane	0.0099 UJ	0.0029 U	0.0025 U
1,2,4-Trichlorobenzene	0.0099 UJ	0.0029 U	0.0025 U
1,2,4-Trimethylbenzene	0.0099 UJ	0.0029 U	0.0025 U
1,2-Dibromo-3-chloropropane	0.099 UJ	0.029 U	0.025 U
1,2-Dibromoethane	0.0099 UJ	0.0029 U	0.0025 U
1,2-Dichlorobenzene	0.0099 UJ	0.0029 U	0.0025 U
1,2-Dichloroethane	0.0099 UJ	0.0029 U	0.0025 U
1,2-Dichloropropane	0.0099 UJ	0.0029 U	0.0025 U
1,3,5-Trimethylbenzene	0.0099 UJ	0.0029 U	0.0025 U
1,3-Dichlorobenzene	0.0099 UJ	0.0029 U	0.0025 U
1,3-Dichloropropane	0.0099 UJ	0.0029 U	0.0025 U
1,4-Dichlorobenzene	0.0099 UJ	0.0029 U	0.0025 U
1,4-Dioxane	0.99 UJ	0.29 UJ	0.25 U
2,2-Dichloropropane	0.0099 UJ	0.0029 U	0.0025 U
2,4,4-Trimethyl-1-pentene	0.02 UJ	0.0058 U	0.005 U
2,4,4-Trimethyl-2-pentene	0.02 UJ	0.0016 J	0.005 U
2-Butanone	0.097 J	0.029 U	0.025 U
2-Chlorotoluene	0.0099 UJ	0.0029 U	0.0025 U
2-Hexanone	0.099 UJ	0.029 U	0.025 U
4-Chlorotoluene	0.0099 UJ	0.0029 U	0.0025 U
4-iso-Propyltoluene	0.0099 UJ	0.0029 U	0.0025 U
4-Methyl-2-pentanone	0.099 UJ	0.029 U	0.025 U
Acetaldehyde		0.055 J	0.24 UJ
Acetic acid, methyl ester	0.2 UJ	0.058 U	0.05 U
Acetone	0.43 J	0.29 U	0.25 UJ
Benzene	0.0099 UJ	0.0029 U	0.0025 U
Bromobenzene	0.0099 UJ	0.0029 U	0.0025 U
Bromochloromethane	0.0099 UJ	0.0029 U	0.0025 U
Bromodichloromethane	0.0099 UJ	0.0029 U	0.0025 U
Bromoform	0.0099 UJ	0.0029 U	0.0025 U
Bromomethane	0.02 UJ	0.0058 U	0.005 U
Butane, 2-methoxy-2-methyl-	0.0099 UJ	0.0029 U	0.0025 U
Carbon disulfide	0.0099 UJ	0.0029 U	0.0025 U
Carbon tetrachloride	0.0099 UJ	0.0029 U	0.0025 U
Chlorobenzene	0.0099 UJ	0.0029 U	0.0025 U
Chlorodibromomethane	0.0099 UJ	0.0029 U	0.0025 U
Chloroethane	0.02 UJ	0.0058 U	0.005 U
Chloroform	0.0099 UJ	0.0029 U	0.0025 U
Chloromethane	0.02 UJ	0.0058 U	0.005 U
Cis-1,2-Dichloroethene	0.0099 UJ	0.0029 U	0.0025 U
cis-1,3-Dichloropropene	0.0099 UJ	0.0029 U	0.0025 U
Cyclohexane	0.099 UJ	0.029 U	0.025 U
Dibromomethane	0.0099 UJ	0.0029 U	0.0025 U
Dichlorodifluoromethane	0.02 UJ	0.0058 U	0.005 U
Diethyl ether	0.0099 UJ	0.0029 U	0.0025 U
Ethyl benzene	0.0099 UJ	0.0029 U	0.0025 U
Ethyl-t-Butyl Ether	0.0099 UJ	0.0029 U	0.0025 U
Formaldehyde		1.1 J	0.72

Attachment 3-1
East Ditch Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010	OC-SD-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SD-EDSD/SW7-XXX EDSD/SW7 6/18/2012 0-0.5 ft
Hexachlorobutadiene	0.0099 UJ	0.0029 U	0.0025 U
Isopropyl ether	0.0099 UJ	0.0029 U	0.0025 U
Isopropylbenzene	0.0099 UJ	0.0029 U	0.0025 U
Methyl cyclohexane	0.0099 UJ	0.0029 U	0.0025 U
Methyl Tertbutyl Ether	0.0099 UJ	0.0029 U	0.0025 U
Methylene chloride	0.04 UJ	0.0029 U	0.01 U
Naphthalene	0.099 UJ	0.029 U	0.025 U
n-Butylbenzene	0.0099 UJ	0.0029 U	0.0025 U
Propylbenzene	0.0099 UJ	0.0029 U	0.0025 U
sec-Butylbenzene	0.0099 UJ	0.0029 U	0.0025 U
Styrene	0.0099 UJ	0.0029 U	0.0025 U
tert-Butylbenzene	0.0099 UJ	0.0029 U	0.0025 U
Tetrachloroethene	0.0099 UJ	0.0029 U	0.0025 U
Tetrahydrofuran	0.099 UJ	0.058 U	0.05 U
Toluene	0.0099 UJ	0.0029 U	0.0025 U
trans-1,2-Dichloroethene	0.0099 UJ	0.0029 U	0.0025 U
trans-1,3-Dichloropropene	0.0099 UJ	0.0029 U	0.0025 U
Trichloroethene	0.0099 UJ	0.0017 J	0.0025 U
Trichlorofluoromethane	0.02 UJ	0.0058 U	0.005 U
Vinyl chloride	0.0099 UJ	0.0029 U	0.0025 U
Xylene, o	0.0099 UJ	0.0029 U	0.0025 U
Xylenes (m&p)	0.02 UJ	0.0058 U	0.005 U
Semivolatile Organic Compounds (mg/kg)			
1,2,4,5-Tetrachlorobenzene	0.2 UJ	0.042 U	0.6 U
1,2,4-Trichlorobenzene	0.2 UJ		0.6 U
1,2-Dichlorobenzene	0.2 UJ		0.6 U
1,3-Dichlorobenzene	0.2 UJ		0.6 U
1,4-Dichlorobenzene	0.2 UJ		0.6 U
1-Methylnaphthalene	0.2 UJ	0.042 U	0.6 U
2,3,4,6-Tetrachlorophenol	0.2 UJ	0.042 U	0.6 U
2,4,5-Trichlorophenol	0.2 UJ	0.042 U	0.6 U
2,4,6-Trichlorophenol	0.2 UJ	0.042 U	0.6 U
2,4-Dichlorophenol	0.2 UJ	0.042 U	0.6 U
2,4-Dimethylphenol	0.2 UJ	0.042 U	0.6 U
2,4-Dinitrophenol	0.2 UJ	R	0.6 U
2,4-Dinitrotoluene	0.2 UJ	0.042 U	0.6 U
2,6-Dinitrotoluene	0.2 UJ	0.042 UJ	0.6 U
2-Chloronaphthalene	0.2 UJ	0.042 U	0.6 U
2-Chlorophenol	0.2 UJ	0.042 U	0.6 U
2-Methylnaphthalene	0.078 J	0.042 U	0.6 U
2-Methylphenol	0.2 UJ	0.042 U	0.6 U
2-Nitroaniline	1 UJ	0.21 U	3 U
2-Nitrophenol	0.2 UJ	0.042 U	0.6 U
3 & 4 Methylphenol	0.2 UJ	0.042 U	0.6 U
3,3'-Dichlorobenzidine	0.4 UJ	0.085 U	1.2 U
3-Nitroaniline	1 UJ	0.21 U	3 U
4,6-Dinitro-2-methylphenol	1 UJ	R	3 U
4-Bromophenyl phenyl ether	0.2 UJ	0.042 U	0.6 U
4-Chloro-3-methylphenol	0.4 UJ	0.085 U	1.2 U
4-Chloroaniline	0.4 UJ	0.085 U	1.2 U
4-Chlorophenyl phenyl ether	0.2 UJ	0.042 U	0.6 U
4-Nitroaniline	1 UJ	0.21 U	3 U
4-Nitrophenol	1 UJ	R	3 U
Acenaphthene	0.14 J	0.019 J	0.6 U
Acenaphthylene	0.2 UJ	0.042 U	0.6 U
Acetophenone	0.2 UJ	0.042 U	0.6 U
Aniline	0.2 UJ	0.042 U	0.6 UJ
Anthracene	0.27 J	0.04 J	0.6 U

Attachment 3-1
East Ditch Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010	OC-SD-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SD-EDSD/SW7-XXX EDSD/SW7 6/18/2012 0-0.5 ft
Atrazine	0.2 UJ	0.042 U	0.6 U
Azobenzene	0.2 UJ	0.042 U	0.6 U
Benzaldehyde	0.2 UJ	0.042 U	0.6 U
Benzo(a)anthracene	0.77 J	0.25	0.63 J
Benzo(a)pyrene	0.94 J	0.24	0.67
Benzo(b)fluoranthene	1.6 J	0.43	1 J
Benzo(ghi)perylene	0.56 J	0.11	0.54 J
Benzo(k)fluoranthene	0.53 J	0.17	0.45 J
Benzoic Acid	0.49 J	0.16 J	3 U
Benzyl alcohol	0.4 UJ	0.085 UJ	1.2 U
Biphenyl	0.2 UJ	0.042 U	0.6 U
Bis(2-Chloroethoxy)methane	0.2 UJ	0.042 U	0.6 U
Bis(2-Chloroethyl)ether	0.2 UJ	0.042 U	0.6 U
Bis(2-Chloroisopropyl)ether	0.2 UJ	0.042 U	0.6 U
Bis(2-Ethylhexyl)phthalate	10 J	0.96 J	1.5
Butylbenzylphthalate	0.2 UJ	0.042 U	0.6 U
Caprolactam	0.2 UJ	0.042 U	0.6 U
Carbazole	0.24 J	0.063	0.6 U
Chrysene	1.3 J	0.38	1
Dibenz(a,h)anthracene	0.2 UJ	0.037 J	0.6 U
Dibenzofuran	0.15 J	0.042 U	0.6 U
Diethylphthalate	0.2 UJ	0.042 U	0.6 U
Dimethylphthalate	0.2 UJ	0.042 U	0.6 U
Di-n-butylphthalate	0.2 UJ	0.21 U	1.2 U
Di-n-octylphthalate	0.2 UJ	0.042 U	0.6 U
Diphenyl ether	0.28 J	0.042 U	0.6 U
Diphenylamine		0.042 U	0.6 U
Diphenylmethanone	0.2 UJ	0.042 U	0.6 U
Fluoranthene	2.7 J	0.64	1.8 J
Fluorene	0.23 J	0.02 J	0.6 U
Hexachlorobenzene	0.2 UJ	0.042 U	0.6 U
Hexachlorobutadiene	0.2 UJ		0.6 U
Hexachlorocyclopentadiene	0.4 UJ	0.085 U	1.2 U
Hexachloroethane	0.2 UJ	0.042 U	0.6 U
Indeno(1,2,3-cd)pyrene	0.53 J	0.11	0.48 J
Isophorone	0.2 UJ	0.042 U	0.6 U
Naphthalene	0.11 J		0.6 U
Nitrobenzene	0.2 UJ	0.042 U	0.6 U
N-Nitrosodimethylamine	0.2 UJ	0.042 UJ	0.12 U
N-Nitrosodi-n-propylamine	0.2 UJ	0.042 U	0.6 U
N-Nitrosodiphenylamine	0.21 J	0.042 UJ	0.6 U
Pentachlorophenol	0.2 UJ	0.042 U	0.6 U
Phenanthrene	1.3 J	0.31	0.64
Phenol	0.2 UJ	0.026 J	0.6 U
Pyrene	2.3 J	0.43	1.1
Metals (mg/kg)			
Aluminum	6400 J	3800 J	5900
Antimony	3.4 UJ	0.89	4
Arsenic	450 J	26	57
Barium	150 J	42 J	140
Beryllium	1.4 UJ	1.6	0.2 J
Cadmium	2.2 J	3.7	0.84
Calcium	7900 J	1900	1500
Chromium	31 J	78 J	39
Cobalt	30 J	13	7.2
Copper	110 J	130 J	270
Iron	210000 J	21000	41000
Lead	25 J	140 J	340

Attachment 3-1
East Ditch Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010	OC-SD-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SD-EDSD/SW7-XXX EDSD/SW7 6/18/2012 0-0.5 ft
Magnesium	1400 J	2000 J	3300
Manganese	3200 J	600	230
Mercury	0.33 UJ	0.026 J	0.04 J
Nickel	21 J	29 J	19
Potassium	1400 UJ	620 J	290 J
Selenium	3.4 UJ	0.66 U	1.2 U
Silver	3.4 UJ	0.27 J	2.6
Sodium	340 J	160	180 J
Thallium	6.9 UJ	1.3 U	2.5 U
Tin	8.6 J		12 U
Vanadium	120 J	15	16
Zinc	550 J	1900	450
Inorganics (mg/kg)			
Bromide			24 U
Chloride	690	26	55
Nitrate as N	20 U	0.99 U	6 U
Nitrite as N	4 U	0.99 U	1.2 U
Nitrogen, as Ammonia	130	8.5	10
Sulfate	160 U	71	48 U
Total Organic Carbon	86000	28	8800
Specialty Compounds (mg/kg)			
Hydrazine		0.0026 U	0.0014 J
Monomethylhydrazine (MMH)		0.0064 U	0.0059 U
UDMH		0.0064 U	0.0059 U
Dimethylformamide		0.23 U	0.21 U
Phthalic Acid/Phthalic anhydride		0.13 UJ	0.12 U

Notes:
mg/kg - milligram per kilogram
ft - feet
U - Not detected, value is reporting limit
J - Value is estimated.
R - Value is rejected

Prepared / Date: KJC 3/28/13
Checked / Date: BJR 3/29/13

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO3-SW ISCO3 2/23/2012	OC-ISCO3 ISCO3 3/21/2013	OC-SW-EDSD/SW0-XXX EDSD/SW0 12/13/2010	OC-SW-EDSD/SW0-XXX EDSD/SW0 6/8/2011	OC-SW-EDSD/SW1 (EDBS5)-XXX EDSD/SW1 (EDBS5) 12/13/2010	OC-SW-EDSD/SW1(EDBS5)-XXX EDSD/SW1 (EDBS5) 6/8/2011	OC-SW-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010
Volatile Organic Compounds (mg/L)							
1,1,1,2-Tetrachloroethane			0.001 U		0.001 U	0.001 U	0.001 U
1,1,1-Trichloroethane			0.001 U		0.001	0.0018	0.001 U
1,1,2,2-Tetrachloroethane			0.0005 U		0.0005 U	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane			0.001 U		0.0013	0.0011	0.001 U
1,1,2-Trichloroethane			0.001 U		0.001 U	0.001 U	0.001 U
1,1-Dichloroethane			0.001 U		0.001 U	0.00033 J	0.001 U
1,1-Dichloroethene			0.001 U		0.001 U	0.00078 J	0.001 U
1,1-Dichloropropene			0.001 U		0.001 U	0.001 U	0.001 U
1,2,3-Trichlorobenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,2,3-Trichloropropane			0.001 U		0.001 U	0.001 U	0.001 U
1,2,4-Trichlorobenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,2,4-Trimethylbenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane			0.005 U		0.005 U	0.005 U	0.005 U
1,2-Dibromoethane			0.001 U		0.001 U	0.001 U	0.001 U
1,2-Dichlorobenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,2-Dichloroethane			0.001 U		0.001 U	0.001 U	0.001 U
1,2-Dichloropropane			0.001 U		0.001 U	0.001 U	0.001 U
1,3,5-Trimethylbenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,3-Dichlorobenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,3-Dichloropropane			0.001 U		0.001 U	0.001 U	0.001 U
1,4-Dichlorobenzene			0.001 U		0.001 U	0.001 U	0.001 U
1,4-Dioxane			R		R	0.05 U	R
2,2-Dichloropropane			0.001 U		0.001 U	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene			0.001 U		0.001 U	0.001 UJ	0.0044
2,4,4-Trimethyl-2-pentene			0.001 U		0.001 U	0.001 U	0.001 U
2-Butanone			0.01 U		0.01 U	0.0029 J	0.01 U
2-Chlorotoluene			0.001 U		0.001 U	0.001 U	0.001 U
2-Hexanone			0.01 U		0.01 U	0.01 U	0.01 U
4-Chlorotoluene			0.001 U		0.001 U	0.001 U	0.001 U
4-iso-Propyltoluene			0.001 U		0.001 U	0.001 U	0.001 U
4-Methyl-2-pentanone			0.01 U		0.01 U	0.01 U	0.01 U
Acetic acid, methyl ester			0.02 U		0.02 U	0.02 U	0.02 U
Acetone			0.05 UJ		0.05 UJ	0.05 U	0.05 UJ
Benzene			0.001 U		0.001 U	0.001 U	0.001 U
Bromobenzene			0.001 U		0.001 U	0.001 U	0.001 U
Bromochloromethane			0.001 U		0.001 U	0.001 U	0.001 U
Bromodichloromethane			0.001 U		0.001 U	0.0005 U	0.001 U
Bromoform			0.001 U		0.001 U	0.001 UJ	0.001 U
Bromomethane			0.002 U		0.002 U	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-			0.005 U		0.005 U	0.005 UJ	0.005 U
Carbon disulfide			0.01 U		0.01 U	0.01 U	0.01 U
Carbon tetrachloride			0.001 UJ		0.001 UJ	0.001 UJ	0.001 UJ
Chlorobenzene			0.001 U		0.001 U	0.001 U	0.001 U
Chlorodibromomethane			0.0005 U		0.0005 U	0.0005 U	0.0005 U
Chloroethane			0.002 U		0.002 U	0.0026	0.002 U
Chloroform			0.001 U		0.001 U	0.001 U	0.001 U
Chloromethane			0.002 U		0.002 U	0.002 U	0.002 U
Cis-1,2-Dichloroethene			0.001 U		0.001 U	0.001 U	0.001 U
cis-1,3-Dichloropropene			0.0004 U		0.0004 U	0.0004 U	0.0004 U
Cyclohexane			0.01 U		0.01 U	0.01 U	0.01 U
Dibromomethane			0.001 U		0.001 U	0.001 U	0.001 U
Dichlorodifluoromethane			0.001 UJ		0.001 UJ	0.001 U	0.001 UJ
Diethyl ether			0.01 U		0.01 U	0.01 U	0.01 U
Ethyl benzene			0.001 U		0.001 U	0.001 U	0.001 U
Ethyl-t-Butyl Ether			0.005 U		0.005 U	0.005 UJ	0.005 U
Hexachlorobutadiene			0.0004 U		0.0004 U	0.0004 U	0.0004 U
Isopropyl ether			0.01 U		0.01 U	0.01 U	0.01 U
Isopropylbenzene			0.001 U		0.001 U	0.001 U	0.001 U
Methyl cyclohexane			0.01 U		0.01 U	0.01 U	0.01 U
Methyl Tertbutyl Ether			0.001 U		0.001 U	0.00022 J	0.001 U
Methylene chloride			0.002 U		0.002 U	0.002 U	0.002 U
Naphthalene			0.005 U		0.005 U	0.005 U	0.005 U
n-Butylbenzene			0.001 U		0.001 U	0.001 U	0.001 U
Propylbenzene			0.001 U		0.001 U	0.001 U	0.001 U
sec-Butylbenzene			0.001 U		0.001 U	0.001 U	0.001 U

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO3-SW ISCO3 2/23/2012	OC-ISCO3 ISCO3 3/21/2013	OC-SW-EDSD/SW0-XXX EDSD/SW0 12/13/2010	OC-SW-EDSD/SW0-XXX EDSD/SW0 6/8/2011	OC-SW-EDSD/SW1 (EDBS5)-XXX EDSD/SW1 (EDBS5) 12/13/2010	OC-SW-EDSD/SW1(EDBS5)-XXX EDSD/SW1 (EDBS5) 6/8/2011	OC-SW-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010
Styrene			0.001 U		0.001 U	0.001 U	0.001 U
tert-Butylbenzene			0.001 U		0.001 U	0.001 U	0.001 U
Tetrachloroethene			0.001 U		0.001 U	0.001 U	0.001 U
Tetrahydrofuran			0.01 U		0.01 U	0.01 U	0.01 U
Toluene			0.001 U		0.0085	0.001	0.0021
trans-1,2-Dichloroethene			0.001 U		0.001 U	0.001 U	0.001 U
trans-1,3-Dichloropropene			0.0004 U		0.0004 U	0.0004 U	0.0004 U
Trichloroethene			0.001 U		0.00047 J	0.00048 J	0.001 U
Trichlorofluoromethane			0.001 U		0.001 U	0.001 U	0.001 U
Vinyl chloride			0.0005 U		0.0005 U	0.0005 U	0.0005 U
Xylene, o			0.001 U		0.001 U	0.00024 J	0.001 U
Xylenes (m&p)			0.002 U		0.002 U	0.00052 J	0.002 U
Semivolatile Organic Compounds (mg/L)							
1,2,4,5-Tetrachlorobenzene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
1-Methylnaphthalene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,3,4,6-Tetrachlorophenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,4,5-Trichlorophenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,4,6-Trichlorophenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,4-Dichlorophenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,4-Dimethylphenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,4-Dinitrophenol			0.0045 UJ		0.0045 UJ	0.0048 U	0.0045 UJ
2,4-Dinitrotoluene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2,6-Dinitrotoluene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2-Chloronaphthalene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2-Chlorophenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2-Methylnaphthalene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
2-Methylphenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2-Nitroaniline			0.0045 U		0.0045 U	0.0048 U	0.0045 U
2-Nitrophenol			0.0045 UJ		0.0045 UJ	0.0048 U	0.0045 UJ
3 & 4 Methylphenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
3,3'-Dichlorobenzidine			0.0045 U		0.0045 U	0.0048 U	0.0045 U
3-Nitroaniline			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4,6-Dinitro-2-methylphenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4-Bromophenyl phenyl ether			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4-Chloro-3-methylphenol			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4-Chloroaniline			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4-Chlorophenyl phenyl ether			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4-Nitroaniline			0.0045 U		0.0045 U	0.0048 U	0.0045 U
4-Nitrophenol			0.0045 UJ		0.0045 UJ	0.0048 U	0.0045 UJ
Acenaphthene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
Acenaphthylene			0.00027 U		0.00027 U	0.00029 U	0.00027 U
Acetophenone			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Aniline			0.0045 UJ		0.0045 UJ	0.0048 U	0.0045 UJ
Anthracene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
Atrazine			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Azobenzene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Benzaldehyde			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Benzo(a)anthracene			0.00027 U		0.00027 U	0.00029 U	0.00027 U
Benzo(a)pyrene			0.00018 U		0.00018 U	0.00019 U	0.00018 U
Benzo(b)fluoranthene			0.00027 U		0.00027 U	0.00029 U	0.00027 U
Benzo(ghi)perylene			0.00012 J		0.00018 J	0.00048 U	0.00015 J
Benzo(k)fluoranthene			0.00027 U		0.00027 U	0.00029 U	0.00027 U
Benzoic Acid			R		R	0.0019 J	R
Benzyl alcohol			0.0091 U		0.0091 U	0.0095 U	0.0091 U
Biphenyl			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Bis(2-Chloroethoxy)methane			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Bis(2-Chloroethyl)ether			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Bis(2-Chloroisopropyl)ether			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Bis(2-Ethylhexyl)phthalate			0.0018 U		0.0018 U	0.0019 U	0.0015 J
Butylbenzylphthalate			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Caprolactam			R		R	0.0048 UJ	R
Carbazole			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Chrysene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
Dibenz(a,h)anthracene			0.00013 J		0.00018 J	0.00048 U	0.00013 J
Dibenzofuran			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Diethylphthalate			0.0045 U		0.0045 U	0.0048 U	0.0062 U

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO3-SW ISCO3 2/23/2012	OC-ISCO3 ISCO3 3/21/2013	OC-SW-EDSD/SW0-XXX EDSD/SW0 12/13/2010	OC-SW-EDSD/SW0-XXX EDSD/SW0 6/8/2011	OC-SW-EDSD/SW1 (EDBS5)-XXX EDSD/SW1 (EDBS5) 12/13/2010	OC-SW-EDSD/SW1(EDBS5)-XXX EDSD/SW1 (EDBS5) 6/8/2011	OC-SW-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010
Dimethylphthalate			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Di-n-butylphthalate			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Di-n-octylphthalate			0.0045 UJ		0.0045 UJ	0.0048 U	0.0045 UJ
Diphenyl ether			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Diphenylmethanone			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Fluoranthene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
Fluorene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
Hexachlorobenzene			0.00091 U		0.00091 U	0.00095 U	0.00091 U
Hexachlorocyclopentadiene			0.0045 UJ		0.0045 UJ	0.0048 U	0.0045 UJ
Hexachloroethane			0.0027 U		0.0027 U	0.0029 U	0.0027 U
Indeno(1,2,3-cd)pyrene			0.00013 J		0.00017 J	0.00048 U	0.00016 J
Isophorone			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Nitrobenzene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
N-Nitrosodimethylamine			0.000002 U		0.0000033	0.0000019 U	0.0000063
N-Nitrosodi-n-propylamine			0.000002 U		0.000002 U	0.0000019 U	0.0000022 U
N-Nitrosodiphenylamine			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Pentachlorophenol			R		R	0.00095 U	R
Phenanthrene			0.00018 U		0.00018 U	0.00019 U	0.00018 U
Phenol			0.0045 UJ		0.0045 UJ	0.0048 UJ	0.0045 UJ
Pyrene			0.0045 U		0.0045 U	0.0048 U	0.0045 U
Total Metals (mg/L)							
Aluminum	0.039 J	0.084 J	0.071 J		0.039 J	0.1 U	0.068 J
Antimony			0.006 U		0.006 U	0.006 U	0.006 U
Arsenic			0.01 U		0.01 U	0.01 U	0.01 U
Barium			0.028		0.032	0.057	0.026
Beryllium			0.001 U		0.001 U	0.001 U	0.001 U
Cadmium			0.001 U		0.001 U	0.001 U	0.001 U
Calcium			18		27	45	22
Chromium	0.00068 J	0.005 U	0.005 U		0.005 U	0.005 U	0.005 U
Chromium, Hexavalent							0.001 UJ
Cobalt			0.01 U		0.01 U	0.01 U	0.01 U
Copper			0.0055 NJ		0.0034 NJ	0.00072	0.0033 NJ
Iron			0.17		0.87	0.89	0.73
Lead			0.00035 J		0.001 U	0.0001 U	0.00067 J
Magnesium			1.8		3.6	6.6	3
Manganese			0.016		0.17	0.27	0.25
Mercury			0.0002 U		0.0002 U	0.0002 U	0.0002 U
Nickel			0.01 U		0.01 U	0.01 U	0.01 U
Potassium			1.6 J		2 J	2.7 J	1.7 J
Selenium			0.01 U		0.01 U	0.01 U	0.01 U
Silver			0.001 U		0.001 U	0.0001 U	0.001 U
Sodium	77 J	85	76		55	78	46
Thallium			0.01 U		0.01 U	0.0052 J	0.01 U
Tin			0.05 U		0.05 U	0.05 U	0.05 U
Vanadium			0.01 UJ		0.01 UJ	0.01 U	0.01 UJ
Zinc			0.053		0.025 J	0.05 U	0.016 J
Dissolved Metals (mg/L)							
Aluminum	0.036 J	0.074 J					
Chromium	0.005 U	0.005 U					
Sodium	88 J	87					
Inorganics (mg/L)							
Bromide			0.1 U		0.1 U	0.1 U	0.1 U
Chloride	140	170	140		100	190	93
Hardness			52		83	140	68
LAB SPECIFIC CONDUCTANCE (mS/cm)	0.67	0.7					
Nitrate as N	0.94	0.87	1.8		1	0.68	0.73
Nitrite as N	0.1 U	0.05 U	0.01 U		0.01 U	0.1 U	0.01 U
Nitrogen, as Ammonia	2.4	1.2	0.1 U		0.11	0.1 U	0.26
Sulfate	36	35	14		17	20	15
Total Organic Carbon			3		2.9	2.1	2.6
Total Suspended Solids			2 U		2 U	5 U	2

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-ISCO3-SW ISCO3 2/23/2012	OC-ISCO3 ISCO3 3/21/2013	OC-SW-EDSD/SW0-XXX EDSD/SW0 12/13/2010	OC-SW-EDSD/SW0-XXX EDSD/SW0 6/8/2011	OC-SW-EDSD/SW1 (EDBS5)-XXX EDSD/SW1 (EDBS5) 12/13/2010	OC-SW-EDSD/SW1(EDBS5)-XXX EDSD/SW1 (EDBS5) 6/8/2011	OC-SW-EDSD/SW2 (EDBS6)-XXX EDSD/SW2 (EDBS6) 12/13/2010
Specialty Compounds (mg/L)							
Kempore (Azodicarbonamide)			1 U	3 U	1 U	1 U	1 U
OPEX			0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ

Notes:
mg/L - milligram per liter
mS/cm - milliSiemens per centimeter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptive evidence of presence of material
R - Value is rejected

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-EDSD/SW2(EDBS6)-XXX EDSD/SW2 (EDBS6) 6/8/2011	OC-SW-EDSD/SW5 (EDBS11)-XXX EDSD/SW5 (EDBS11) 12/13/2010	OC-SW-EDSD/SW5(EDBS11)-XXX EDSD/SW5 (EDBS11) 6/8/2011	OC-SW-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SW-EDSD/SW7-XXX EDSD/SW7 6/18/2012	OC-SW-ISCO3 ISCO3 11/16/2012	OC-SW-ISCO3 ISCO3 11/8/2011
Volatile Organic Compounds (mg/L)							
1,1,1,2-Tetrachloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,1,1-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,1,2,2-Tetrachloroethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U		
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U	0.0015	0.0031	0.0013	0.001 U		
1,1,2-Trichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,1-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,1-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,1-Dichloropropene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2,3-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2,3-Trichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 UJ		
1,2,4-Trichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2,4-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2-Dibromo-3-chloropropane	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		
1,2-Dibromoethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2-Dichloroethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,3,5-Trimethylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,3-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,3-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,4-Dichlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
1,4-Dioxane	0.05 U	R	0.05 U	0.05 UJ	0.05 U		
2,2-Dichloropropane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
2,4,4-Trimethyl-1-pentene	0.0039 J	0.001 U	0.001 UJ	0.001 U	0.001 U		
2,4,4-Trimethyl-2-pentene	0.00057 J	0.001 U	0.001 U	0.001 UJ	0.001 U		
2-Butanone	0.01 U	0.01 U	0.0013 J	0.01 U	0.01 U		
2-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
2-Hexanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
4-Chlorotoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
4-iso-Propyltoluene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
4-Methyl-2-pentanone	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
Acetic acid, methyl ester	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U		
Acetone	0.05 U	0.05 UJ	0.05 U	0.0039 J	0.05 U		
Benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Bromobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Bromochloromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Bromodichloromethane	0.0005 U	0.001 U	0.0005 U	0.0005 U	0.0005 U		
Bromoform	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 U		
Bromomethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		
Butane, 2-methoxy-2-methyl-	0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 U		
Carbon disulfide	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
Carbon tetrachloride	0.001 UJ	0.001 UJ	0.001 UJ	0.001 U	0.001 U		
Chlorobenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Chlorodibromomethane	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U		
Chloroethane	0.00044 J	0.002 U	0.002 U	0.002 U	0.002 U		
Chloroform	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Chloromethane	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		
Cis-1,2-Dichloroethene	0.001 U	0.0019	0.0061	0.0031	0.0011		
cis-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U		
Cyclohexane	0.01 U	0.01 U	0.01 U	0.001 U	0.001 U		
Dibromomethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Dichlorodifluoromethane	0.001 U	0.001 UJ	0.001 U	0.001 U	0.001 U		
Diethyl ether	0.01 U	0.01 U	0.01 U	0.001 U	0.001 U		
Ethyl benzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Ethyl-t-Butyl Ether	0.005 UJ	0.005 U	0.005 UJ	0.005 U	0.005 U		
Hexachlorobutadiene	0.0004 U	0.0004 U	0.0004 U	0.0004 UJ	0.0004 U		
Isopropyl ether	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
Isopropylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Methyl cyclohexane	0.01 U	0.01 U	0.01 U	0.001 U	0.001 U		
Methyl Tertbutyl Ether	0.001 UJ	0.001 U	0.001 UJ	0.001 U	0.001 U		
Methylene chloride	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U		
Naphthalene	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U		
n-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Propylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
sec-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-EDSD/SW2(EDBS6)-XXX EDSD/SW2 (EDBS6) 6/8/2011	OC-SW-EDSD/SW5 (EDBS11)-XXX EDSD/SW5 (EDBS11) 12/13/2010	OC-SW-EDSD/SW5(EDBS11)-XXX EDSD/SW5 (EDBS11) 6/8/2011	OC-SW-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SW-EDSD/SW7-XXX EDSD/SW7 6/18/2012	OC-SW-ISCO3 ISCO3 11/16/2012	OC-SW-ISCO3 ISCO3 11/8/2011
Styrene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
tert-Butylbenzene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Tetrachloroethene	0.001 U	0.001 U	0.00026 J	0.001 U	0.001 U		
Tetrahydrofuran	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
Toluene	0.001 U	0.00067 J	0.00074 J	0.001 U	0.001 U		
trans-1,2-Dichloroethene	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
trans-1,3-Dichloropropene	0.0004 U	0.0004 U	0.0004 U	0.0004 U	0.0004 U		
Trichloroethene	0.001 U	0.0027	0.0034	0.0021 U	0.001 U		
Trichlorofluoromethane	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Vinyl chloride	0.0005 U	0.0005 U	0.00052	0.0005 U	0.0005 U		
Xylene, o	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Xylenes (m&p)	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U		
Semivolatile Organic Compounds (mg/L)							
1,2,4,5-Tetrachlorobenzene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
1-Methylnaphthalene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,3,4,6-Tetrachlorophenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,4,5-Trichlorophenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,4,6-Trichlorophenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,4-Dichlorophenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,4-Dimethylphenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,4-Dinitrophenol	0.005 U	0.0045 UJ	0.0053 U	0.0049 UJ	0.0047 U		
2,4-Dinitrotoluene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2,6-Dinitrotoluene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2-Chloronaphthalene	0.005 U	0.0045 U	0.0053 U	0.0049 UJ	0.0047 U		
2-Chlorophenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2-Methylnaphthalene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
2-Methylphenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2-Nitroaniline	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
2-Nitrophenol	0.005 U	0.0045 UJ	0.0053 U	0.0049 U	0.0047 U		
3 & 4 Methylphenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
3,3'-Dichlorobenzidine	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
3-Nitroaniline	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4,6-Dinitro-2-methylphenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4-Bromophenyl phenyl ether	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4-Chloro-3-methylphenol	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4-Chloroaniline	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4-Chlorophenyl phenyl ether	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4-Nitroaniline	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
4-Nitrophenol	0.005 U	0.0045 UJ	0.0053 U	R	0.0047 U		
Acenaphthene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
Acenaphthylene	0.0003 U	0.00027 U	0.00032 U	0.00029 U	0.00028 U		
Acetophenone	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Aniline	0.005 U	0.0045 UJ	0.0053 U	0.0049 U	0.0047 UJ		
Anthracene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
Atrazine	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Azobenzene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Benzaldehyde	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Benzo(a)anthracene	0.0003 U	0.00027 U	0.00032 U	0.00029 U	0.00028 U		
Benzo(a)pyrene	0.0002 U	0.00018 U	0.00021 U	0.00019 U	0.00019 U		
Benzo(b)fluoranthene	0.0003 U	0.00027 U	0.00032 U	0.00029 U	0.00028 U		
Benzo(ghi)perylene	0.0005 U	0.000088 J	0.00053 U	0.00049 U	0.00047 U		
Benzo(k)fluoranthene	0.0003 U	0.00027 U	0.00032 U	0.00029 U	0.00028 U		
Benzoic Acid	0.0021 J	R	0.0053 U	R	0.0047 U		
Benzyl alcohol	0.01 U	0.0091 U	0.011 U	0.0097 U	0.0094 U		
Biphenyl	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Bis(2-Chloroethoxy)methane	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Bis(2-Chloroethyl)ether	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Bis(2-Chloroisopropyl)ether	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Bis(2-Ethylhexyl)phthalate	0.002 U	0.0012 J	0.0021 U	0.0019 U	0.0019 U		
Butylbenzylphthalate	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Caprolactam	0.005 UJ	R	0.0053 UJ	0.0049 UJ	0.0047 UJ		
Carbazole	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Chrysene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
Dibenz(a,h)anthracene	0.0005 U	0.000081 J	0.00053 U	0.00049 U	0.00047 U		
Dibenzofuran	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Diethylphthalate	0.005 U	0.006 U	0.0053 U	0.0049 U	0.0047 U		

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-EDSD/SW2(EDBS6)-XXX EDSD/SW2 (EDBS6) 6/8/2011	OC-SW-EDSD/SW5 (EDBS11)-XXX EDSD/SW5 (EDBS11) 12/13/2010	OC-SW-EDSD/SW5(EDBS11)-XXX EDSD/SW5 (EDBS11) 6/8/2011	OC-SW-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SW-EDSD/SW7-XXX EDSD/SW7 6/18/2012	OC-SW-ISCO3 ISCO3 11/16/2012	OC-SW-ISCO3 ISCO3 11/8/2011
Dimethylphthalate	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Di-n-butylphthalate	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Di-n-octylphthalate	0.005 U	0.0045 UJ	0.0053 U	0.0049 U	0.0047 U		
Diphenyl ether	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Diphenylmethanone	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Fluoranthene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
Fluorene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
Hexachlorobenzene	0.001 U	0.00091 U	0.0011 U	0.00097 U	0.00094 U		
Hexachlorocyclopentadiene	0.005 U	0.0045 UJ	0.0053 U	0.0049 UJ	0.0047 U		
Hexachloroethane	0.003 U	0.0027 U	0.0032 U	0.0049 U	0.0028 U		
Indeno(1,2,3-cd)pyrene	0.0005 U	0.00009 J	0.00053 U	0.00049 U	0.00047 U		
Isophorone	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Nitrobenzene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
N-Nitrosodimethylamine	0.000012	0.000002 U	0.00002 U	0.0000019 UJ	0.0000086		
N-Nitrosodi-n-propylamine	0.000002 U	0.000002 U	0.00002 U	0.0000019 U	0.000002 U		
N-Nitrosodiphenylamine	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Pentachlorophenol	0.001 U	R	0.0011 U	0.00097 U	0.00094 U		
Phenanthrene	0.0002 U	0.00018 U	0.00021 U	0.00039 U	0.00019 U		
Phenol	0.005 UJ	0.0045 UJ	0.0053 UJ	0.0049 U	0.0047 U		
Pyrene	0.005 U	0.0045 U	0.0053 U	0.0049 U	0.0047 U		
Total Metals (mg/L)							
Aluminum	0.028 J	0.77	0.13	0.2 U	0.12	0.14 J	0.2
Antimony	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U		
Arsenic	0.01 U	0.01 U	0.01 U	0.01 U	0.0078 J		
Barium	0.057	0.013	0.033	0.036	0.04		
Beryllium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Cadmium	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		
Calcium	43	11	46	42	38		
Chromium	0.005 U	0.065	0.004 J	0.0041 J	0.0087	0.005 U	0.002 J
Chromium, Hexavalent	0.00056 J	0.00086 J	0.001 UJ				
Cobalt	0.0016 J	0.002 J	0.0024 J	0.0024 J	0.0022 J		
Copper	0.0014	0.003 NJ	0.00084	0.0029	0.0019		
Iron	1	0.7	0.91	0.79	1.7		
Lead	0.00013 U	0.00086 J	0.0001 U	0.0005 J	0.0015		
Magnesium	6.5	1.4	6.9	6.5	6.1		
Manganese	0.77	0.22	0.71	0.66	0.91		
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U		
Nickel	0.0017 J	0.0029 J	0.0025 J	0.0039 J	0.0037 J		
Potassium	2.8 J	4 U	3.6 J	6.1	5.4		
Selenium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
Silver	0.0001 U	0.001 U	0.0001 U	0.001 U	0.00014		
Sodium	88	17	81	78	82	78	93
Thallium	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U		
Tin	0.05 U	0.05 U	0.05 U	0.01 UJ	0.05 U		
Vanadium	0.01 U	0.01 UJ	0.01 U	0.01 U	0.01 U		
Zinc	0.0088 J	0.026 J	0.05 U	0.023 J	0.021 J		
Dissolved Metals (mg/L)							
Aluminum						0.2 U	0.028 J
Chromium						0.005 U	0.005 U
Sodium						78	100
Inorganics (mg/L)							
Bromide	0.1 U	0.1 U	0.1 U	0.18 J	0.11		
Chloride	220	26	180	130	140	150	170
Hardness	140	34	140	140	120		
LAB SPECIFIC CONDUCTANCE (mS/cm)						0.68	0.74
Nitrate as N	0.81	0.87	0.93	1.6	1.1	1 J	1
Nitrite as N	0.1 U	0.01 U	0.1 U	0.05 U	0.1 U	R	0.1 U
Nitrogen, as Ammonia	0.92	2.2	8.7	9	10	1.1	1.7
Sulfate	19	36	69	81	70	29	33
Total Organic Carbon	1.2	5.1	1.5	4.4	4.3		
Total Suspended Solids	5	5.5	5 U	4 U	12		

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-EDSD/SW2(EDBS6)-XXX EDSD/SW2 (EDBS6) 6/8/2011	OC-SW-EDSD/SW5 (EDBS11)-XXX EDSD/SW5 (EDBS11) 12/13/2010	OC-SW-EDSD/SW5(EDBS11)-XXX EDSD/SW5 (EDBS11) 6/8/2011	OC-SW-EDSD/SW7-XXX EDSD/SW7 11/6/2012	OC-SW-EDSD/SW7-XXX EDSD/SW7 6/18/2012	OC-SW-ISCO3 ISCO3 11/16/2012	OC-SW-ISCO3 ISCO3 11/8/2011
Specialty Compounds (mg/L)							
Kempore (Azodicarbonamide)	4.1 N	1 U	1.2 N	1 UJ	1 U		
OPEX	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ	0.1 UJ		

Notes:
mg/L - milligram per liter
mS/cm - milliSiemens per centimeter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptive evidence of presence of material
R - Value is rejected

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO3 ISCO3 3/22/2011	OC-SW-ISCO3 ISCO3 5/16/2011	OC-SW-ISCO3 ISCO3 6/7/2012	OC-SW-ISCO3 ISCO3 8/23/2011	OC-SW-ISCO3 ISCO3 8/23/2012	OC-SW-SD-EDSD/SW0-XXX EDSD/SW0 6/8/2011
Volatile Organic Compounds (mg/L)						
1,1,1,2-Tetrachloroethane						0.001 U
1,1,1-Trichloroethane						0.001 U
1,1,2,2-Tetrachloroethane						0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane						0.001 U
1,1,2-Trichloroethane						0.001 U
1,1-Dichloroethane						0.001 U
1,1-Dichloroethene						0.001 U
1,1-Dichloropropene						0.001 U
1,2,3-Trichlorobenzene						0.001 U
1,2,3-Trichloropropane						0.001 U
1,2,4-Trichlorobenzene						0.001 U
1,2,4-Trimethylbenzene						0.001 U
1,2-Dibromo-3-chloropropane						0.005 U
1,2-Dibromoethane						0.001 U
1,2-Dichlorobenzene						0.001 U
1,2-Dichloroethane						0.001 U
1,2-Dichloropropane						0.001 U
1,3,5-Trimethylbenzene						0.001 U
1,3-Dichlorobenzene						0.001 U
1,3-Dichloropropane						0.001 U
1,4-Dichlorobenzene						0.001 U
1,4-Dioxane						0.05 U
2,2-Dichloropropane						0.001 U
2,4,4-Trimethyl-1-pentene						0.001 UJ
2,4,4-Trimethyl-2-pentene						0.001 U
2-Butanone						0.01 U
2-Chlorotoluene						0.001 U
2-Hexanone						0.01 U
4-Chlorotoluene						0.001 U
4-iso-Propyltoluene						0.001 U
4-Methyl-2-pentanone						0.01 U
Acetic acid, methyl ester						0.02 U
Acetone						0.05 U
Benzene						0.001 U
Bromobenzene						0.001 U
Bromochloromethane						0.001 U
Bromodichloromethane						0.0005 U
Bromoform						0.001 UJ
Bromomethane						0.002 U
Butane, 2-methoxy-2-methyl-						0.005 UJ
Carbon disulfide						0.01 U
Carbon tetrachloride						0.001 UJ
Chlorobenzene						0.001 U
Chlorodibromomethane						0.0005 U
Chloroethane						0.002 U
Chloroform						0.001 U
Chloromethane						0.002 U
Cis-1,2-Dichloroethene						0.001 U
cis-1,3-Dichloropropene						0.0004 U
Cyclohexane						0.01 U
Dibromomethane						0.001 U
Dichlorodifluoromethane						0.001 U
Diethyl ether						0.01 U
Ethyl benzene						0.001 U
Ethyl-t-Butyl Ether						0.005 UJ
Hexachlorobutadiene						0.0004 U
Isopropyl ether						0.01 U
Isopropylbenzene						0.001 U
Methyl cyclohexane						0.01 U
Methyl Tertbutyl Ether						0.001 UJ
Methylene chloride						0.002 U
Naphthalene						0.005 U
n-Butylbenzene						0.001 U
Propylbenzene						0.001 U
sec-Butylbenzene						0.001 U

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO3 ISCO3 3/22/2011	OC-SW-ISCO3 ISCO3 5/16/2011	OC-SW-ISCO3 ISCO3 6/7/2012	OC-SW-ISCO3 ISCO3 8/23/2011	OC-SW-ISCO3 ISCO3 8/23/2012	OC-SW-SD-EDSD/SW0-XXX EDSD/SW0 6/8/2011
Styrene						0.001 U
tert-Butylbenzene						0.001 U
Tetrachloroethene						0.001 U
Tetrahydrofuran						0.01 U
Toluene						0.001 U
trans-1,2-Dichloroethene						0.001 U
trans-1,3-Dichloropropene						0.0004 U
Trichloroethene						0.001 U
Trichlorofluoromethane						0.001 U
Vinyl chloride						0.0005 U
Xylene, o						0.001 U
Xylenes (m&p)						0.002 U
Semivolatile Organic Compounds (mg/L)						
1,2,4,5-Tetrachlorobenzene						0.005 U
1-Methylnaphthalene						0.005 U
2,3,4,6-Tetrachlorophenol						0.005 U
2,4,5-Trichlorophenol						0.005 U
2,4,6-Trichlorophenol						0.005 U
2,4-Dichlorophenol						0.005 U
2,4-Dimethylphenol						0.005 U
2,4-Dinitrophenol						0.005 U
2,4-Dinitrotoluene						0.005 U
2,6-Dinitrotoluene						0.005 U
2-Chloronaphthalene						0.005 U
2-Chlorophenol						0.005 U
2-Methylnaphthalene						0.001 U
2-Methylphenol						0.005 U
2-Nitroaniline						0.005 U
2-Nitrophenol						0.005 U
3 & 4 Methylphenol						0.005 U
3,3'-Dichlorobenzidine						0.005 U
3-Nitroaniline						0.005 U
4,6-Dinitro-2-methylphenol						0.005 U
4-Bromophenyl phenyl ether						0.005 U
4-Chloro-3-methylphenol						0.005 U
4-Chloroaniline						0.005 U
4-Chlorophenyl phenyl ether						0.005 U
4-Nitroaniline						0.005 U
4-Nitrophenol						0.005 U
Acenaphthene						0.001 U
Acenaphthylene						0.0003 U
Acetophenone						0.005 U
Aniline						0.005 U
Anthracene						0.001 U
Atrazine						0.005 U
Azobenzene						0.005 U
Benzaldehyde						0.005 U
Benzo(a)anthracene						0.0003 U
Benzo(a)pyrene						0.0002 U
Benzo(b)fluoranthene						0.0003 U
Benzo(ghi)perylene						0.0005 U
Benzo(k)fluoranthene						0.0003 U
Benzoic Acid						0.0021 J
Benzyl alcohol						0.01 U
Biphenyl						0.005 U
Bis(2-Chloroethoxy)methane						0.005 U
Bis(2-Chloroethyl)ether						0.005 U
Bis(2-Chloroisopropyl)ether						0.005 U
Bis(2-Ethylhexyl)phthalate						0.002 U
Butylbenzylphthalate						0.005 U
Caprolactam						0.00073 J
Carbazole						0.005 U
Chrysene						0.001 U
Dibenz(a,h)anthracene						0.0005 U
Dibenzofuran						0.005 U
Diethylphthalate						0.005 U

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO3 ISCO3 3/22/2011	OC-SW-ISCO3 ISCO3 5/16/2011	OC-SW-ISCO3 ISCO3 6/7/2012	OC-SW-ISCO3 ISCO3 8/23/2011	OC-SW-ISCO3 ISCO3 8/23/2012	OC-SW-SD-EDSD/SW0-XXX EDSD/SW0 6/8/2011
Dimethylphthalate						0.005 U
Di-n-butylphthalate						0.005 U
Di-n-octylphthalate						0.005 U
Diphenyl ether						0.005 U
Diphenylmethanone						0.005 U
Fluoranthene						0.001 U
Fluorene						0.001 U
Hexachlorobenzene						0.001 U
Hexachlorocyclopentadiene						0.005 U
Hexachloroethane						0.003 U
Indeno(1,2,3-cd)pyrene						0.0005 U
Isophorone						0.005 U
Nitrobenzene						0.005 U
N-Nitrosodimethylamine						0.000002 U
N-Nitrosodi-n-propylamine						0.0000033
N-Nitrosodiphenylamine						0.005 U
Pentachlorophenol						0.001 U
Phenanthrene						0.0002 U
Phenol						0.005 UJ
Pyrene						0.005 U
Total Metals (mg/L)						
Aluminum	0.23	0.18	0.028 J	0.053 J	0.54	0.39
Antimony						0.006 U
Arsenic						0.005 J
Barium						0.1
Beryllium						0.001 U
Cadmium						0.001 U
Calcium						46
Chromium	0.0013 J	0.005 U	0.005 U	0.0012 J	0.0035 J	0.0014 J
Chromium, Hexavalent						
Cobalt						0.01 U
Copper						0.0032
Iron						11
Lead						0.00051 J
Magnesium						5.2
Manganese						0.09
Mercury						0.0002 U
Nickel						0.01 U
Potassium						3.7 J
Selenium						0.01 U
Silver						0.0001 U
Sodium	100 J	87	71 J	82 J	74 J	190
Thallium						0.01 U
Tin						0.05 U
Vanadium						0.0025 J
Zinc						0.053
Dissolved Metals (mg/L)						
Aluminum	0.045 J	0.039 J	0.025 J	0.1 U	0.023 J	
Chromium	0.005 U	0.005 U	0.005 U	0.005 U	0.00068 J	
Sodium	120 J	100	71	99 J	89 J	
Inorganics (mg/L)						
Bromide						0.1 U
Chloride	210	190 J	160	200	180	360
Hardness						140
LAB SPECIFIC CONDUCTANCE (mS/cm)	0.91	0.92	0.68	0.8	0.72	
Nitrate as N	0.93	1.1 J	0.71	0.7	0.72	2.6 J
Nitrite as N	0.1 U	0.01 UJ	0.1 U	0.1 U	0.1 U	0.1 U
Nitrogen, as Ammonia	5.3	8.2 J	1.8	1.7	1.7	0.1 U
Sulfate	53	99 J	34	22	26	19
Total Organic Carbon						2.3
Total Suspended Solids						14

Attachment 3-2
East Ditch Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-ISCO3 ISCO3 3/22/2011	OC-SW-ISCO3 ISCO3 5/16/2011	OC-SW-ISCO3 ISCO3 6/7/2012	OC-SW-ISCO3 ISCO3 8/23/2011	OC-SW-ISCO3 ISCO3 8/23/2012	OC-SW-SD-EDSD/SW0-XXX EDSD/SW0 6/8/2011
Specialty Compounds (mg/L)						
Kempore (Azodicarbonamide)						
OPEX						

Notes:
mg/L - milligram per liter
mS/cm - milliSiemens per centimeter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptive evidence of presence of material
R - Value is rejected

Prepared / Date: KJC 7/24/13
Checked / Date:

Attachment 3-3
East Ditch Reference Area Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-BK-SW/SD-001-XXX SDBK-001 12/13/2010 0-0.5 ft
Volatile Organics (mg/Kg)	
1,1,1,2-Tetrachloroethane	0.0028 U
1,1,1-Trichloroethane	0.0028 U
1,1,2,2-Tetrachloroethane	0.0028 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.014 U
1,1,2-Trichloroethane	0.0028 U
1,1-Dichloroethane	0.0028 U
1,1-Dichloroethene	0.0028 U
1,1-Dichloropropene	0.0028 U
1,2,3-Trichlorobenzene	0.0028 U
1,2,3-Trichloropropane	0.0028 U
1,2,4-Trichlorobenzene	0.0028 U
1,2,4-Trimethylbenzene	0.0028 U
1,2-Dibromo-3-chloropropane	0.028 U
1,2-Dibromoethane	0.0028 U
1,2-Dichlorobenzene	0.0028 U
1,2-Dichloroethane	0.0028 U
1,2-Dichloropropane	0.0028 U
1,3,5-Trimethylbenzene	0.0028 U
1,3-Dichlorobenzene	0.0028 U
1,3-Dichloropropane	0.0028 U
1,4-Dichlorobenzene	0.0028 U
1,4-Dioxane	0.28 UJ
2,2-Dichloropropane	0.0028 U
2,4,4-Trimethyl-1-pentene	0.0057 U
2,4,4-Trimethyl-2-pentene	0.0057 U
2-Butanone	R
2-Chlorotoluene	0.0028 U
2-Hexanone	0.028 U
4-Chlorotoluene	0.0028 U
4-iso-Propyltoluene	0.0028 U
4-Methyl-2-pentanone	0.028 U
Acetic acid, methyl ester	0.057 U
Acetone	R
Benzene	0.0028 U
Bromobenzene	0.0028 U
Bromochloromethane	0.0028 U
Bromodichloromethane	0.0028 U
Bromoform	0.0028 U
Bromomethane	0.0057 U
Butane, 2-methoxy-2-methyl-	0.0028 U
Carbon disulfide	0.0028 U
Carbon tetrachloride	0.0028 U
Chlorobenzene	0.0028 U
Chlorodibromomethane	0.0028 U
Chloroethane	0.0057 UJ
Chloroform	0.0028 U
Chloromethane	0.0057 UJ
Cis-1,2-Dichloroethene	0.0028 U
cis-1,3-Dichloropropene	0.0028 U
Cyclohexane	0.028 U
Dibromomethane	0.0028 U
Dichlorodifluoromethane	0.0057 UJ
Diethyl ether	0.0028 U
Ethyl benzene	0.0028 U

Attachment 3-3
East Ditch Reference Area Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-BK-SW/SD-001-XXX SDBK-001 12/13/2010 0-0.5 ft
Ethyl-t-Butyl Ether	0.0028 U
Hexachlorobutadiene	0.0028 U
Isopropyl ether	0.0028 U
Isopropylbenzene	0.0028 U
Methyl cyclohexane	0.0028 U
Methyl Tertbutyl Ether	0.0028 U
Methylene chloride	0.011 U
Naphthalene	0.028 U
n-Butylbenzene	0.0028 U
Propylbenzene	0.0028 U
sec-Butylbenzene	0.0028 U
Styrene	0.0028 U
tert-Butylbenzene	0.0028 U
Tetrachloroethene	0.0028 U
Tetrahydrofuran	0.028 U
Toluene	0.0028 U
trans-1,2-Dichloroethene	0.0028 U
trans-1,3-Dichloropropene	0.0028 U
Trichloroethene	0.0028 U
Trichlorofluoromethane	0.0057 U
Vinyl chloride	0.0028 U
Xylene, o	0.0028 U
Xylenes (m&p)	0.0057 U
Semivolatile Organics (mg/Kg)	
1,2,4,5-Tetrachlorobenzene	0.046 U
1,2,4-Trichlorobenzene	0.046 U
1,2-Dichlorobenzene	0.046 U
1,3-Dichlorobenzene	0.046 U
1,4-Dichlorobenzene	0.046 U
1-Methylnaphthalene	0.046 U
2,3,4,6-Tetrachlorophenol	0.046 U
2,4,5-Trichlorophenol	0.046 U
2,4,6-Trichlorophenol	0.046 U
2,4-Dichlorophenol	0.046 U
2,4-Dimethylphenol	0.046 U
2,4-Dinitrophenol	0.046 U
2,4-Dinitrotoluene	0.046 U
2,6-Dinitrotoluene	0.046 U
2-Chloronaphthalene	0.046 U
2-Chlorophenol	0.046 U
2-Methylnaphthalene	0.046 U
2-Methylphenol	0.046 U
2-Nitroaniline	0.23 U
2-Nitrophenol	0.046 U
3 & 4 Methylphenol	0.046 U
3,3'-Dichlorobenzidine	0.092 U
3-Nitroaniline	0.23 U
4,6-Dinitro-2-methylphenol	0.23 U
4-Bromophenyl phenyl ether	0.046 U
4-Chloro-3-methylphenol	0.092 U
4-Chloroaniline	0.092 UJ
4-Chlorophenyl phenyl ether	0.046 U
4-Nitroaniline	0.23 U
4-Nitrophenol	0.23 U
Acenaphthene	0.046 U

Attachment 3-3
East Ditch Reference Area Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-BK-SW/SD-001-XXX SDBK-001 12/13/2010 0-0.5 ft
Acenaphthylene	0.046 U
Acetophenone	0.046 U
Aniline	0.046 UJ
Anthracene	0.046 U
Atrazine	0.046 U
Azobenzene	0.046 U
Benzaldehyde	0.046 U
Benzo(a)anthracene	0.032 J
Benzo(a)pyrene	0.035 J
Benzo(b)fluoranthene	0.063
Benzo(ghi)perylene	0.032 J
Benzo(k)fluoranthene	0.069
Benzoic Acid	0.12 J
Benzyl alcohol	0.092 U
Biphenyl	0.046 U
Bis(2-Chloroethoxy)methane	0.046 U
Bis(2-Chloroethyl)ether	0.046 U
Bis(2-Chloroisopropyl)ether	0.046 U
Bis(2-Ethylhexyl)phthalate	0.046 U
Butylbenzylphthalate	0.046 U
Caprolactam	0.046 U
Carbazole	0.046 U
Chrysene	0.06
Dibenz(a,h)anthracene	0.022 J
Dibenzofuran	0.046 U
Diethylphthalate	0.046 U
Dimethylphthalate	0.046 U
Di-n-butylphthalate	0.046 U
Di-n-octylphthalate	0.046 U
Diphenyl ether	0.046 U
Diphenylmethanone	0.046 U
Fluoranthene	0.096
Fluorene	0.046 U
Hexachlorobenzene	0.046 U
Hexachlorobutadiene	0.046 U
Hexachlorocyclopentadiene	0.092 U
Hexachloroethane	0.046 U
Indeno(1,2,3-cd)pyrene	0.038 J
Isophorone	0.046 UJ
Naphthalene	0.11 U
Nitrobenzene	0.046 U
N-Nitrosodimethylamine	0.046 U
N-Nitrosodi-n-propylamine	0.046 U
N-Nitrosodiphenylamine	0.046 U
Pentachlorophenol	0.046 U
Phenanthrene	0.036 J
Phenol	0.046 U
Pyrene	0.077
Inorganics (mg/Kg)	
Aluminum	6800
Antimony	0.72 UJ
Arsenic	11
Barium	27
Beryllium	0.24 J
Cadmium	0.24 J

Attachment 3-3
East Ditch Reference Area Sediment Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SD-BK-SW/SD-001-XXX SDBK-001 12/13/2010 0-0.5 ft
Calcium	860
Chromium	9.8
Cobalt	3.3
Copper	14
Iron	13000
Lead	5.3
Magnesium	2000
Manganese	140 J
Mercury	0.08 U
Nickel	7.7
Potassium	980
Selenium	0.72 U
Silver	0.72 U
Sodium	170
Thallium	1.4 U
Tin	7.2 U
Vanadium	12
Zinc	75
Chloride	150
Nitrate as N	7 U
Nitrite as N	1.4 U
Nitrogen, as Ammonia	26
Percent Moisture **(%)**	29
Percent Solids **(%)**	71
Sulfate	56 U
Total Organic Carbon	8400

Prepared / Date: KJC 7/24/13
Checked / Date:

Notes:
mg/L - milligram per liter

mS/cm - milliSiemens per centimeter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptive evidence of presence of material
R - Value is rejected

Attachment 3-4
East Ditch Reference Area Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-BK-SW/SD-001-XXX SDBK-001 12/13/2010	OC-SW-SDBK-001-XXX SDBK-001 6/8/2011
Volatile Organics (mg/L)		
1,1,1,2-Tetrachloroethane	0.001 U	0.001 U
1,1,1-Trichloroethane	0.001 U	0.001 U
1,1,2,2-Tetrachloroethane	0.0005 U	0.0005 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.001 U	0.001 U
1,1,2-Trichloroethane	0.001 U	0.001 U
1,1-Dichloroethane	0.001 U	0.001 U
1,1-Dichloroethene	0.001 U	0.001 U
1,1-Dichloropropene	0.001 U	0.001 U
1,2,3-Trichlorobenzene	0.001 U	0.001 U
1,2,3-Trichloropropane	0.001 U	0.001 U
1,2,4-Trichlorobenzene	0.001 U	0.001 U
1,2,4-Trimethylbenzene	0.001 U	0.001 U
1,2-Dibromo-3-chloropropane	0.005 U	0.005 U
1,2-Dibromoethane	0.001 U	0.001 U
1,2-Dichlorobenzene	0.001 U	0.001 U
1,2-Dichloroethane	0.001 U	0.001 U
1,2-Dichloropropane	0.001 U	0.001 U
1,3,5-Trimethylbenzene	0.001 U	0.001 U
1,3-Dichlorobenzene	0.001 U	0.001 U
1,3-Dichloropropane	0.001 U	0.001 U
1,4-Dichlorobenzene	0.001 U	0.001 U
1,4-Dioxane	R	0.05 U
2,2-Dichloropropane	0.001 U	0.001 U
2,4,4-Trimethyl-1-pentene	0.001 U	0.001 UJ
2,4,4-Trimethyl-2-pentene	0.001 U	0.001 U
2-Butanone	0.01 U	0.01 U
2-Chlorotoluene	0.001 U	0.001 U
2-Hexanone	0.01 U	0.01 U
4-Chlorotoluene	0.001 U	0.001 U
4-iso-Propyltoluene	0.001 U	0.001 U
4-Methyl-2-pentanone	0.01 U	0.01 U
Acetic acid, methyl ester	0.02 U	0.02 U
Acetone	0.05 UJ	0.05 U
Benzene	0.001 U	0.001 U
Bromobenzene	0.001 U	0.001 U
Bromochloromethane	0.001 U	0.001 U
Bromodichloromethane	0.001 U	0.0005 U
Bromoform	0.001 U	0.001 UJ
Bromomethane	0.002 U	0.002 U
Butane, 2-methoxy-2-methyl-	0.005 U	0.005 UJ
Carbon disulfide	0.01 U	0.0004 J
Carbon tetrachloride	0.001 UJ	0.001 UJ
Chlorobenzene	0.001 U	0.001 U
Chlorodibromomethane	0.0005 U	0.0005 U
Chloroethane	0.002 U	0.002 U
Chloroform	0.001 U	0.001 U
Chloromethane	0.002 U	0.002 U
Cis-1,2-Dichloroethene	0.001 U	0.001 U
cis-1,3-Dichloropropene	0.0004 U	0.0004 U
Cyclohexane	0.01 U	0.01 U
Dibromomethane	0.001 U	0.001 U
Dichlorodifluoromethane	0.001 UJ	0.001 U
Diethyl ether	0.01 U	0.01 U
Ethyl benzene	0.001 U	0.001 U
Ethyl-t-Butyl Ether	0.005 U	0.005 UJ
Hexachlorobutadiene	0.0004 U	0.0004 U
Isopropyl ether	0.01 U	0.01 U
Isopropylbenzene	0.001 U	0.001 U

Attachment 3-4
East Ditch Reference Area Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-BK-SW/SD-001-XXX SDBK-001 12/13/2010	OC-SW-SDBK-001-XXX SDBK-001 6/8/2011
Methyl cyclohexane	0.01 U	0.01 U
Methyl Tertbutyl Ether	0.001 U	0.001 UJ
Methylene chloride	0.002 U	0.002 U
Naphthalene	0.005 U	0.005 U
n-Butylbenzene	0.001 U	0.001 U
Propylbenzene	0.001 U	0.001 U
sec-Butylbenzene	0.001 U	0.001 U
Styrene	0.001 U	0.001 U
tert-Butylbenzene	0.001 U	0.001 U
Tetrachloroethene	0.001 U	0.001 U
Tetrahydrofuran	0.01 U	0.01 U
Toluene	0.001 U	0.0013
trans-1,2-Dichloroethene	0.001 U	0.001 U
trans-1,3-Dichloropropene	0.0004 U	0.0004 U
Trichloroethene	0.001 U	0.001 U
Trichlorofluoromethane	0.001 U	0.001 U
Vinyl chloride	0.0005 U	0.0005 U
Xylene, o	0.001 U	0.001 U
Xylenes (m&p)	0.002 U	0.002 U
Semivolatile Organics (mg/L)		
1,2,4,5-Tetrachlorobenzene	0.0045 U	0.005 U
1-Methylnaphthalene	0.0045 U	0.005 U
2,3,4,6-Tetrachlorophenol	0.0045 U	0.005 U
2,4,5-Trichlorophenol	0.0045 U	0.005 U
2,4,6-Trichlorophenol	0.0045 U	0.005 U
2,4-Dichlorophenol	0.0045 U	0.005 U
2,4-Dimethylphenol	0.0045 U	0.005 U
2,4-Dinitrophenol	0.0045 UJ	0.005 U
2,4-Dinitrotoluene	0.0045 U	0.005 U
2,6-Dinitrotoluene	0.0045 U	0.005 U
2-Chloronaphthalene	0.0045 U	0.005 U
2-Chlorophenol	0.0045 U	0.005 U
2-Methylnaphthalene	0.00091 U	0.001 U
2-Methylphenol	0.0045 U	0.005 U
2-Nitroaniline	0.0045 U	0.005 U
2-Nitrophenol	0.0045 UJ	0.005 U
3 & 4 Methylphenol	0.0045 U	0.005 U
3,3'-Dichlorobenzidine	0.0045 U	0.005 U
3-Nitroaniline	0.0045 U	0.005 U
4,6-Dinitro-2-methylphenol	0.0045 U	0.005 U
4-Bromophenyl phenyl ether	0.0045 U	0.005 U
4-Chloro-3-methylphenol	0.0045 U	0.005 U
4-Chloroaniline	0.0045 U	0.005 U
4-Chlorophenyl phenyl ether	0.0045 U	0.005 U
4-Nitroaniline	0.0045 U	0.005 U
4-Nitrophenol	0.0045 UJ	0.005 U
Acenaphthene	0.00011 J	0.001 U
Acenaphthylene	0.00027 U	0.0003 U
Acetophenone	0.0045 U	0.005 U
Aniline	0.0045 UJ	0.005 U
Anthracene	0.00091 U	0.001 U
Atrazine	0.0045 U	0.005 U
Azobenzene	0.0045 U	0.005 U
Benzaldehyde	0.0045 U	0.005 U
Benzo(a)anthracene	0.00027 U	0.0003 U
Benzo(a)pyrene	0.000094 J	0.0002 U
Benzo(b)fluoranthene	0.00027 U	0.0003 U
Benzo(ghi)perylene	0.00014 J	0.0005 U
Benzo(k)fluoranthene	0.00027 U	0.0003 U

Attachment 3-4
East Ditch Reference Area Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-BK-SW/SD-001-XXX SDBK-001 12/13/2010	OC-SW-SDBK-001-XXX SDBK-001 6/8/2011
Benzoic Acid	R	0.0021 J
Benzyl alcohol	0.0091 U	0.01 U
Biphenyl	0.0045 U	0.005 U
Bis(2-Chloroethoxy)methane	0.0045 U	0.005 U
Bis(2-Chloroethyl)ether	0.0045 U	0.005 U
Bis(2-Chloroisopropyl)ether	0.0045 U	0.005 U
Bis(2-Ethylhexyl)phthalate	0.00046 J	0.002 U
Butylbenzylphthalate	0.0045 U	0.005 U
Caprolactam	R	0.005 UJ
Carbazole	0.0045 U	0.005 U
Chrysene	0.00091 U	0.001 U
Dibenz(a,h)anthracene	0.00014 J	0.0005 U
Dibenzofuran	0.0045 U	0.005 U
Diethylphthalate	0.0047 U	0.005 U
Dimethylphthalate	0.0045 U	0.005 U
Di-n-butylphthalate	0.0045 U	0.005 U
Di-n-octylphthalate	0.0045 UJ	0.005 U
Diphenyl ether	0.0045 U	0.005 U
Diphenylmethanone	0.0045 U	0.005 U
Fluoranthene	0.00091 U	0.001 U
Fluorene	0.00091 U	0.001 U
Hexachlorobenzene	0.00091 U	0.001 U
Hexachlorocyclopentadiene	0.0045 UJ	0.005 U
Hexachloroethane	0.0027 U	0.003 U
Indeno(1,2,3-cd)pyrene	0.00016 J	0.0005 U
Isophorone	0.0045 U	0.005 U
Nitrobenzene	0.0045 U	0.005 U
N-Nitrosodi-n-propylamine	0.0045 U	0.005 U
N-Nitrosodiphenylamine	0.0045 U	0.005 U
Pentachlorophenol	R	0.001 U
Phenanthrene	0.00018 U	0.0002 U
Phenol	0.0045 UJ	0.005 UJ
Pyrene	0.0045 U	0.005 U
Metals, Total (mg/L)		
Aluminum	0.042 J	1.1
Antimony	0.006 U	0.006 U
Arsenic	0.01 U	0.0036 J
Barium	0.044	0.2
Beryllium	0.001 U	0.001 U
Cadmium	0.001 U	0.0011 J
Calcium	28	79
Chromium	0.005 U	0.0022 J
Cobalt	0.01 U	0.003 J
Copper	0.0067 NJ	0.027
Iron	0.12	6.7
Lead	0.001 U	0.014
Magnesium	2.5	7.7
Manganese	0.042	3.4
Mercury	0.0002 U	0.0002 U
Nickel	0.01 U	0.0037 J
Potassium	2.5 J	9.6
Selenium	0.01 U	0.01 U
Silver	0.001 U	0.00023 U
Sodium	120	450
Thallium	0.01 U	0.01 U
Tin	0.05 U	0.05 U
Vanadium	0.01 UJ	0.0022 J
Zinc	0.022 J	0.023 J
Inorganics (mg/L)		

Attachment 3-4
East Ditch Reference Area Surface Water Data
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	OC-SW-BK-SW/SD-001-XXX SDBK-001 12/13/2010	OC-SW-SDBK-001-XXX SDBK-001 6/8/2011
Bromide	0.1 U	0.13
Chloride	230	930
Hardness	74	230
Nitrate as N	1.9	0.47 J
Nitrite as N	0.1 U	0.1 U
Nitrogen, as Ammonia	0.1 U	0.4
Sulfate	16	12
Total Organic Carbon	3.35	12
Total Suspended Solids	3.3 U	82

Prepared / Date: KJC 7/24/13
Checked / Date:

Notes:
mg/L - milligram per liter
mS/cm - milliSiemens per centimeter
U - Not detected, value is reporting limit
J - Value is estimated
N - Presumptive evidence of presence of material
R - Value is rejected

ATTACHMENT 4
ECOSAR SCREENING BENCHMARK CALCULATIONS

Attachment 4
ECOSAR Surface Water Screening Benchmark Calculations
Screening Level Ecological Risk Assessment - East Ditch
Olin Chemical Superfund Site
Wilmington, Massachusetts

Parameter	Persistent [a]	LogKow [b]	Bioaccumulating [c]	Screening Factor	ECOSAR Estimate mg/L	Type	Organism	Durration	Calculated Screening Benchmark mg/L [d] [e]	Calculated Effects Benchmark mg/L [d] [f]
2,4,4-Trimethyl-1-pentene	Yes	4.55	Yes	0.01	0.153	CHV	Fish	30 Day	0.015	0.15
2,4,4-Trimethyl-2-Pentene	Yes	4	Yes	0.01	0.179	CHV	Fish	30 Day	0.018	0.18
2-Methylnaphthalene	No	3.86	Yes	0.1	0.396	CHV	Fish	30 Day	0.40	4.0
4-Chlorophenyl phenyl ether	Yes	4.7	Yes	0.01	0.084	CHV	Fish	30 Day	0.0084	0.084
Acenaphthylene	Yes	3.94	Yes	0.01	0.275	CHV	Fish	30 Day	0.028	0.28
Acetic acid, methyl ester	No	0.18	No	0.1	11.392	CHV	Fish	32/33 Day	11.4	114
Acetophenone	No	1.58	No	0.1	18.287	CHV	Fish	30 Day	18.3	183
Alpha-Chlordane	Yes	6.1	Yes	0.01	0.00177	CHV	Fish	30/60 Day	0.00018	0.0018
Benzo(b)fluoranthene	Yes	5.78	Yes	0.01	0.006	CHV	Fish	30 Day	0.00060	0.0060
Benzo(ghi)perylene	Yes	6.63	Yes	0.01	0.002	CHV	Fish	30 Day	0.00020	0.0020
Benzo(k)fluoranthene	Yes	6.11	Yes	0.01	0.006	CHV	Fish	30 Day	0.00060	0.0060
Bromodichloromethane	Yes	2	No	0.05	28.215	CHV	Fish	30 Day	14.1	141
Carbazole	No	3.72	Yes	0.1	1.204	CHV	Fish	30 Day	1.2	12.0
Chlordane (technical)	Yes	6.1	Yes	0.01	0.00177	CHV	Fish	30/60 Day	0.00018	0.0018
Chlorodibromomethane	Yes	2.16	No	0.05	30.101	CHV	Fish	30 Day	15.1	151
Chrysene	Yes	5.81	Yes	0.01	0.019	CHV	Fish	30 Day	0.0019	0.019
Dibenz(a,h)anthracene	Yes	6.75	Yes	0.01	0.002	CHV	Fish	30 Day	0.00020	0.0020
Dibromomethane	No	1.7	No	0.1	0.148	CHV	Fish	30 Day	0.15	1.5
Diphenyl ether	No	4.2	Yes	0.1	0.247	CHV	Fish	30 Day	0.25	2.5
Diphenylamine	Yes	3.5	Yes	0.01	1.083	CHV	Fish	30 Day	0.11	1.1
Diphenylmethanone	No	3.2	Yes	0.1	1.547	CHV	Fish	30 Day	1.5	15.5
Endrin ketone	Yes	4.99	Yes	0.01	0.088	CHV	Fish	30 Day	0.0088	0.088
Formaldehyde	No	0.35	No	0.1	3.871	CHV	Fish	30 Day	3.9	39
Indeno(1,2,3-cd)pyrene	Yes	6.7	Yes	0.01	0.002	CHV	Fish	30 Day	0.00020	0.0020
Nitrate as N	No	0.21	No	0.1	166.306	CHV	Fish	30 Day	166	1663
sec-Butylbenzene	No	4.57	Yes	0.1	0.241	CHV	Fish	30 Day	0.24	2.4
Sulfate	No	-2.2	No	0.1	29479.303	CHV	Fish	30 Day	29479	294793
Tetrahydrofuran	No	0.46	No	0.1	46.479	CHV	Fish	30 Day	46	465
Trichlorofluoromethane	Yes	2.53	No	0.05	8.57	CHV	Fish	30 Day	4.3	43
Xylene, o	No	3.12	Yes	0.1	1.012	CHV	Fish	30 Day	1.0	10.1

Prepared by: SFR 6/28/2013
Checked by: RRD 7/18/2013

Notes:
[a] Persistent chemicals are those that are either listed by chemical or chemical class as Persistent Organic Pollutants under the Stockholm Convention or have half lives longer than 2-months in surface water and soil as calculated by the USEPA's PBT (Persistent, Bio-accumulating, and Toxic) Profiler (http://www.pbtprofiler.net/entry.asp). Calculations of persistence exclude net advection and sediment burial.
[b] Log Kow values are presented in the Master Chemical List.
[c] Assumed that organic compounds with LogK_{ow} < 3.0 do not significantly accumulate in biological tissue.
[d] Aquatic screening and effects values are calculated from CHVs for 30, 32/33, or 30/60 day fish exposures as estimated by the ECOSAR database - ECOSAR, 2012. v.1.11.
[e] Aquatic screening benchmarks are calculated by converting CHVs for 30, 32/33, or 30/60 day fish exposures to LC50s by multiplying by 10 and by applying a multiple of 0.10 to LC50 values for non-persistent chemicals; applying a multiple of 0.05 to LC50 values for persistent non-bioaccumulating chemicals; and a multiple of 0.01 to LC50 values for persistent bioaccumulating chemicals. Methodology is derived from the Texas Surface Water Quality Standards TSWQS (30 TAC §307.6(c).(7), as ammended TNRCC, 2000b).
[f] Aquatic effects benchmarks are calculated by applying a multiple of 10 to calculated screening benchmarks.

LC50 - Median Lethal Concentration
CHV - Chronic Toxicity Value = LC50 * 0.10
mg/: - mill

ATTACHMENT 8

CHROMIUM BIOACCUMULATION MEMORANDUM DATED MARCH 26, 2015

(Provided on CD ROM)

Discussion Points for Review
Amec Foster Wheeler Environment and Infrastructure

Part 1: Soil to Earthworm Bioaccumulation Information

- The data presented in Sample 1998 for soil indicate there is not a correlation between soil chromium concentrations and earthworm tissue concentrations. Therefore, attempting to identify a reliable Uptake Factor across a wide range of soil concentrations is not advised. That would be attempting to force a model on a system when the system data do not support the model.

- Two different soil to earthworm bioaccumulation studies were conducted for the Site in March 1997 and August 2005. In 1997 nine soil samples were collected from the undeveloped portion of the property. The samples were analyzed for metals, pesticides, and SVOCs. Splits of four samples were used in laboratory earthworm bioaccumulation tests in the 1997 study. For the 2005 study three sample splits were used for bioaccumulation tests. Depurated tissue samples were analyzed at the end of the bioaccumulation period. Data are presented below with respect locations in EA2, EA4 and EA5.

Location	Year	EA	Total Cr in Soil (mg/kg)	Total Cr in Tissue (mg/kg)
BS-013	1997	EA2	480/402	4.4
BS-015	1997	EA4	200	4
BS-018	1997	EA4	5.2	29.6
BS-043	2005	EA4	240	0.67
BS-045	2005	EA4	1500	9.3
BS-040	2005	EA5	5000	77.1
BS-021 REF	1997	MMB	11/27/34	<0.2

- These data are consistent with the Sample et al. 1998 data set with respect to the range of detected tissue concentrations and reinforce the conclusion no correlation exists between soil concentrations and tissue concentrations for chromium.

- For EA2 and EA4, the range in Cr soil concentrations was 5.2 to 1,500 mg/kg and the Cr tissue samples ranged from 4.0 to 29.6 mg/kg (dry weight). This is consistent with the data in Sample et al. 1998. The range of actual tissue concentrations is a more realistic representation for EA2 and EA4 than estimated concentrations from poorly correlated data and the associated 90% percentile uptake factors from Sample et.al. 1998.

- One soil sample from EA5 had a Cr concentration of 5,000 and a Cr tissue concentration of 77.1 mg/kg (dry weight). This Cr tissue concentration is within the range reported by Sample et al. 1998 for soil concentrations up to approximately 820 mg/kg.

- The Draft Final BERA used a wet weight tissue concentration of 4 mg/kg which corresponds to a dry weight of 20 mg/kg as the earthworm tissue concentration. The value of 20 mg/kg is an estimate of the median chromium concentration in earthworms from Sample et al.1998.

- **Use of Site Specific Chromium Earthworm Tissue Data from EA2 and EA4 would result in the same risk conclusions that were presented in the Draft Final BERA.**

Part 2: Sediment to Invertebrate Tissue Bioaccumulation Information

- The data presented in Bechtel Jacobs 1998 for sediment indicate there is not a correlation between sediment chromium concentrations and invertebrate tissue concentrations. Bechtel Jacobs 1998 could not validate their model with an independent data set. Therefore, attempting to identify a reliable Uptake Factor across a wide range of sediment concentrations is not advised. That would be attempting to force a model on a system when the system data do not support the model.

- Invertebrate tissue samples were collected in 1996 from on-Property West Ditch (on-PWD) and South Ditch (SD) prior to remediation (2000/2001). These invertebrates are mobile and subject to the range of exposure concentrations across the entire exposure area. The Smith Phase II report indicates the maximum chromium concentrations in sediment detected at that time were 8,900 mg/kg in on-PWD and 2,900 mg/kg in SD. Chromium concentrations from invertebrate tissue collected in on-PWD and SD sediments prior to remediation of sediments ranged from 7.5 mg/kg (dry weight) to 30.1 mg/kg (dry weight). These data are presented below.

Sample ID	Location	Total Cr in Tissue (mg/kg)
CF001WDXXX	on-PWD	23.9
CF002WDXXX	on-PWD	30.1
CF003WDXXX	on-PWD	11.5
CF004WDXXX	on-PWD	7.5
CF005STDXX	SD	8
CF006STDXX	SD	10.6
CF007STDXX	SD	16.6
CF008STDXX	SD	9.9

- These tissue concentrations are consistent with the Bechtel Jacobs 1998 data set, even though the pre-remediation sediment concentrations from the Site were higher.

- The Draft Final BERA used a wet weight tissue concentration of 4 mg/kg which corresponds to a dry weight of 20 mg/kg as the invertebrate tissue concentration. This is the tissue concentration from the sediment sample with the highest sediment chromium concentration in the Bechtel Jacobs 1998 data set

- **Use of Site Specific Chromium Invertebrate Tissue Data from portion of SD would result in the same risk conclusions that were presented in the Draft Final BERA.**

Tables

Summary - Chromium in Surface Soil and Earthworm Tissue
Olin Chemical Superfund Site

SURFACE SOIL

Exposure Area	Maximum Cr Soil	95% UCL Cr Soil	EPC RME (2014 BERA)	EPC CTE (2014 BERA) (mean)	Assumed Earthworm Cr Conc BERA (2014)	Earthworm Cr Concs Lab Bioaccumulation Test	Cr Conc Corresponding to Earthworm Max Conc	Earthworm Cr Conc Using EPA Proposed Uptake factor of 2.71 (RME)	Earthworm Cr Conc Using EPA Proposed Uptake factor of 2.71 (CTE)
EA2	275	116	116	39	20	29.6 (a)	5.2	314	106
EA4	5,000	583	583	272	20	0.67, 4, 4.4, 9.3	1,500	1,580	737
EA5	62,000	26,344	26,344	6,648	20	77.1	5000 (b)	71,392	18,016

all concentrations in mg/kg dry weight
(a) For EA2 and EA4 bioaccumulation test samples, this maximum detected tissue concentration was associated with the lowest chromium soil concentration.
(b) = concentration reported for location SWMU-33. Five samples surrounding that location had 10, 11, 6.4, 1.5, and 6.1 mg/kg chromium.

20 mg/kg dry weight tissue corresponds with approximately 4 mg/kg wet weight tissue.

Figures

Maple Meadow Brook Wetland
EA2
On-PWD
EA3
EA2
EA1
On-PWD
East Ditch
Off-PWD
Containment Area
EA4
Detention Basin
Central Pond
Upper South Ditch
Lower South Ditch
EA5
Soil Background
Calcium Sulfate Landfill
North Pond
Landfill Brook

Legend

- Exposure Area
- Culvert
- 51 Eames St. Property Boundary
- Water
- Railroad
- Paved Road
- Unpaved Road
- Wetland Boundary

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Chelmsford, MA 01824

N

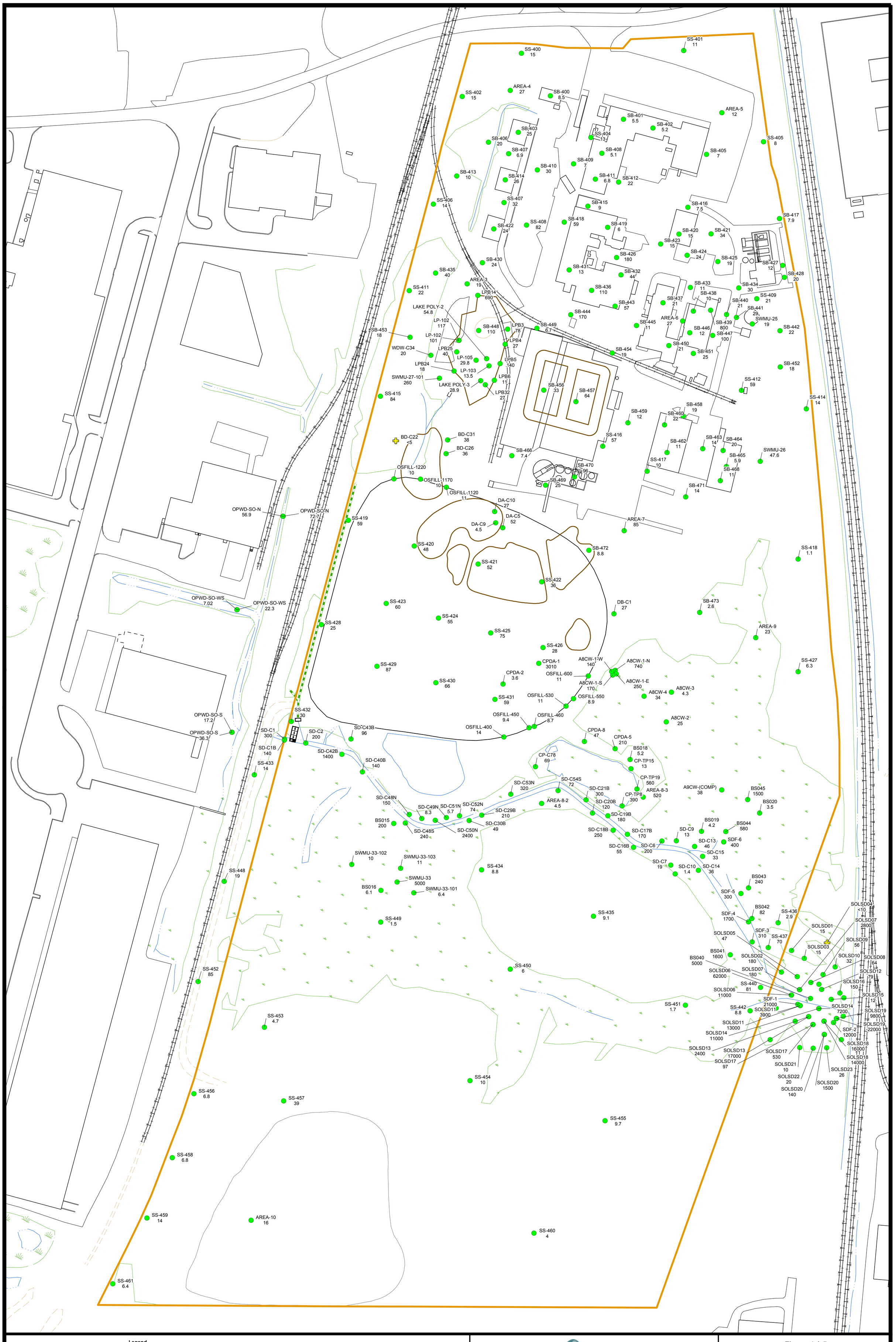
0 250 500 Feet

Figure ES-5
BERA Exposure Areas

Remedial Investigation Report - OU1 and OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 04/02/14 | Checked/Date: SFR 04/02/14

Document: P:\old_Wakefield_Data\projects\OLIN\Wilmington\GIS\MapDocuments\BERA OU1 OU2\BERA_22X34_P_rotated.mxd PDF: P:\old_Wakefield_Data\projects\OLIN\Wilmington\2013 Remedial Investigation Report\Revised_OU1_OU2_RI\Figures\Figure ES-5 - BERA Exposure Areas.pdf 4/2/2014 3:58 PM brian.roden



Legend

- Chemical Detected Below Industrial RSL
- Chemical Detected Above Industrial RSL
- Analyte not detected - Reporting Limit Below Industrial RSL
- Analyte not detected - Reporting Limit Above Industrial RSL
- 2.5 Detected Analyte Concentration (mg/kg)
- 51 Eames St. Property Boundary
- Water
- Railroad
- Paved Road
- Unpaved Road
- Wetland Boundary
- Historic Disposal Feature (see Figure 1.3-1)

Notes:
1. Industrial RSL (USEPA) for Chromium = 1,500,000 mg/kg.
2. < - Not Detected, value shown is reporting limit
3. Samples collected as part of the RI have IDs SS-4XX, SB-4XX, SS-5XX, or SB-5XXX. All other samples were collected previous to the RI.
4. Historic Disposal Features are shown in Figure 1.3-1.

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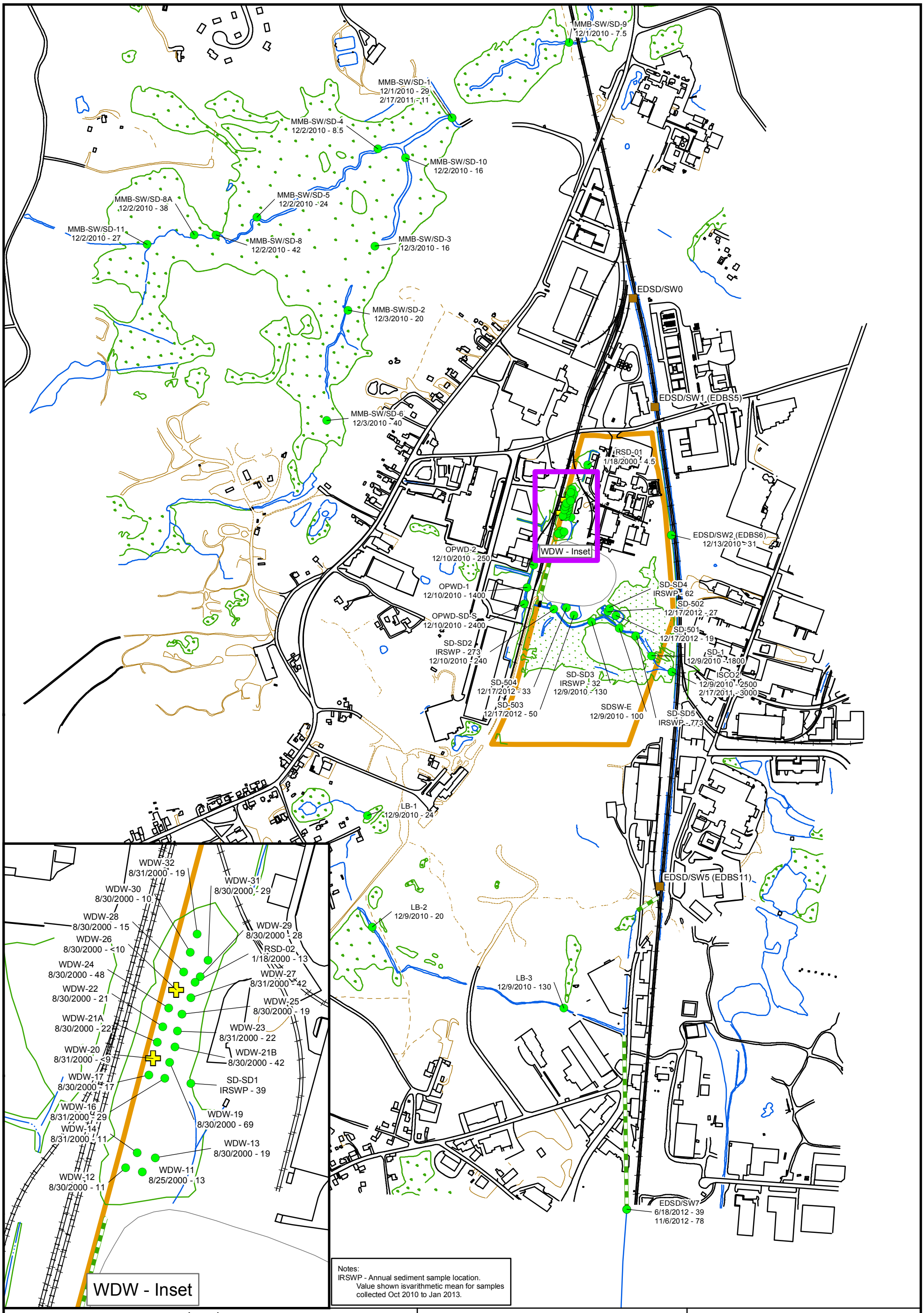
Chelmsford, MA 01824

0 80 160 Feet

Figure 4.1-5
Distribution of Surface Soil Concentrations for Chromium
Remedial Investigation Report - OU1 and OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 03/06/14 | Checked/Date: CTM 03/06/14

Document: P:\old_Wakefield_Data\projects\OLIN\Wilmington\GIS\MapDocuments\RI OU1 OU2\PrelimRI_SoilDistributions_22X34_P_rotated.mxd PDF: P:\old_Wakefield_Data\projects\OLIN\Wilmington\2013 Remedial Investigation Report\Revised_OU1_OU2_RI\Figures\Figure 4.1-5 - Distribution of Surface Soil Concentrations for Chromium.pdf 3/6/2014 2:19 PM brian.roden



Notes:
IRSWP - Annual sediment sample location.
Value shown isvarithmetic mean for samples collected Oct 2010 to Jan 2013.

Legend

- *SDC1* Location ID
- *10* Analyte Concentration (mg/kg)
- Analyte Not Detected (ND)
- Paved Road
- Unpaved Road
- Railroad
- Sidewalks
- Structures
- Surface Water
- Trails
- Wetland Boundary
- Culvert
- 51 Eames St. Property Boundary

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0 340 680 1,360 Feet

Figure 4.1-42
Distribution of Sediment Concentrations for Chromium
Remedial Investigation Report - OU1 and OU2
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 03/11/14 | Checked/Date: CTM 03/11/14

Document: P:\old_Wakefield_Data\projects\OLIN\Wilmington\GIS\MapDocuments\RI OU1 OU2\OU!OU2SedimentDistributions_with_Inset.mxd PDF: P:\old_Wakefield_Data\projects\OLIN\Wilmington\2013 Remedial Investigation Report\Revised_OU1_OU2_RI\Figures\Figure 4.1-42 - SD Chromium.pdf

Reference Documents

Sample et al 1998
Development and Validation of Bioaccumulation Models
for Earthworms

Bechtel Jacobs 1998
Biota Sediment Accumulation Factors for Invertebrates: Review and
Recommendations for the Oak Ridge Reservation

LOCKHEED MARTIN

ENVIRONMENTAL RESTORATION PROGRAM

ES/ER/TM-220

Development and Validation of Bioaccumulation Models for Earthworms

B. E. Sample
J. J. Beauchamp
R. A. Efroymson
G. W. Suter, II
T. L. Ashwood

This document has been approved
by the East Tennessee Technology Park
Technical Information Office
for release to the public. Date: *2/10/98*

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FOR THE UNITED STATES
DEPARTMENT OF ENERGY

UCN-17560 (8 8-95)

ES/ER/TM-220

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managing the
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PREFACE

While considerable research has been conducted on contaminant transfer from soil to earthworms, most studies focus on only a single location, and external validation of transfer models has not been performed. The purpose of this document, then, was to develop a database of soil and tissue concentrations for 9 inorganic and 2 organic chemicals based on data from 31 studies from 11 countries and 5 states. This information will form a critical component in many ecological risk assessments performed on the Oak Ridge Reservation. Related plant and small mammal data are presented in companion reports ES/ER/TM-218 and ES/ER/TM-219, respectively.

This work was performed under Work Breakdown Structure 1.4.12.2.3.04.05.02, Activity Data Sheet 8300 (CCADS-8323).

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ABBREVIATIONS

CEC	cation exchange capacity
DTPA	diethylenetriaminepentaacetic acid
GI	gastrointestinal
OM	organic matter
PCBs	polychlorinated biphenyls
PD	proportional deviation
TCDD	tetrachlorodibenzo-p-dioxin
UFs	uptake factors
UPL	upper prediction limit

EXECUTIVE SUMMARY

Estimation of contaminant concentrations in earthworms is a critical component in many ecological risk assessments. Without site-specific data, literature-derived uptake factors (UFs) or models are frequently used. While considerable research has been conducted on contaminant transfer from soil to earthworms, most studies focus on only a single location. External validation of transfer models has not been performed.

We developed a database of soil and tissue concentrations for 9 inorganic (As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, and Zn) and 2 organic [polychlorinated biphenyls (PCBs) and tetrachlorodibenzo-p-dioxin (TCDD)] chemicals based on data from 32 studies from 11 countries and 5 states. Only studies that presented "total" concentrations in depurated earthworms were included. UFs— earthworm concentration/soil concentration— and regression models of natural-log-transformed concentrations of each analyte in soil and earthworms were developed. Multiple regression models incorporating soil pH and log-transformed soil Ca were also developed. Models were developed using data from 26 studies and then were applied to the data from the remaining 6 studies. Estimated and observed earthworm concentrations were compared using nonparametric Wilcoxon signed-rank tests. Relative accuracy and quality of different estimation methods were evaluated by calculating the proportional deviation ([measured - estimate]/measured) of the estimate from the measured value and the percentage of estimates that exceeded measured values.

With the exception of Cr, significant, single-variable (e.g., soil concentration) regression models were fit for each analyte. Inclusion of soil Ca improved model fits for Cd and Pb. Soil pH only marginally improved model fits. The best general estimates of chemical concentrations in earthworms were generated by simple ln-ln regression models for As, Cd, Cu, Hg, Mn, Pb, Zn, and PCBs. No method accurately estimated Cr or Ni in earthworms. The best conservative estimates of chemical concentrations in earthworms were generated by the upper 95% prediction limit for the simple ln-ln regression models for Cd, Cu, Hg, Zn, and PCBs. The 90th percentile UFs generated the best conservative estimates for As, Cr, and Pb. While multivariate regression models including pH generated better estimates for a few analytes, in general, the predictive utility gained by incorporating environmental variables was marginal.

Because the available data indicate that bioaccumulation by earthworms is non-linear, decreasing as soil concentration increases, and UFs implicitly assume that accumulation is linear and constant across all soil concentrations, the use of log-linear regression models to estimate earthworm bioaccumulation is recommended. For applications where conservative estimates are desired, the upper 95% prediction limit on the simple regression is recommended.

1. INTRODUCTION

Estimation of the risks that soil contamination presents to vermivorous (e.g., earthworm-eating) wildlife requires measuring the contaminant concentration in earthworms. These data may be acquired either by direct measurement or estimation. Direct measurement consists of collecting and analyzing contaminant concentrations in earthworms from contaminated sites. Because this approach provides information on the actual contaminant loading in on-site earthworms, direct measurement contributes the least uncertainty to exposure estimates and is therefore the preferred approach. However, for various reasons (incompatible sampling schedule; insufficient time, personnel, or finances to support field sampling; etc.), direct measurement may not be feasible. When direct measurement of contaminants is not possible, estimation is the only alternative.

Contaminant loads in earthworms may be estimated using uptake factors (UFs) or empirically derived regression models. UFs, the ratios of contaminant concentrations in earthworms to those in soil, are the simplest method for estimating contaminant loads in earthworms. In practice, if the contaminant concentration in soil is known (likely in almost all retrospective ecological risk assessments), the concentration in earthworms may be estimated by multiplying the soil concentration by the UF. The use of UFs depends on the assumption that the concentration of chemicals in organisms is a linear, no-threshold function of concentrations in soil. This is expected to be the case for xenobiotic chemicals like polychlorinated biphenyls (PCBs) that are passively accumulated and not metabolized to any significant extent. It will not be the case if the chemical in question is well-regulated by the organism, either because it is an essential nutrient or because it is a toxicant with effective inducible mechanisms for metabolism or excretion. Such regulated chemicals will, within the effective concentration range for the mechanism, have nearly constant concentrations in earthworms regardless of soil concentrations, except at deficient concentrations.

Various complex patterns are also possible due to lack of induction at low concentrations, saturation kinetics at high concentrations, toxicity at high concentrations, or other processes. Despite these situations that lead to violation of the assumptions, UFs are commonly used in risk assessments. Published sources of earthworm UFs are summarized in Table 1.

Regression models are another approach to estimating contaminant concentrations in earthworms. These models are generally simple linear or log-linear regressions of the soil contaminant concentration on the earthworm concentration. Soil pH, soil Ca concentration, percent organic matter in soil, etc., may also be included in the models as predictive parameters (e.g., Beyer et al. 1987, Corp and Morgan 1991). Published sources of earthworm uptake models are summarized in Table 1.

While there has been considerable research concerning the uptake of soil contaminants by earthworms, most studies use data from a limited number of locations and focus on a limited number of analytes. In addition, no studies have attempted to validate the accuracy of UFs or models in predicting contaminant concentrations in earthworms at other locations. The purpose of this report was to assemble a database of soil and earthworm contaminant concentration data from published literature for a wide range of contaminants, develop UFs and other bioaccumulation models from these data, and then evaluate the accuracy of the estimates using independent data that was not included in the model development. The validation step allows the reliability of the models to be determined.

Table 1. Summary of sources of soil-earthworm UFs and uptake models

Study Location	Analytes with UFs	Analytes with Models	Reference
Pennsylvania, USA	Cd, Cu, Pb, Ni, and Zn	Cd	Beyer et al. 1982
Maryland, USA		Pb, Cu, Cd, and Se	Beyer et al. 1987
Finland	Al, Cd, Cu, Fe, Hg, Mn, V, and Zn		Braunschweiler 1996
Wales, Great Britain	Pb	Ca, Cd, Cu, Pb, and Zn	Corp and Morgan 1991
Warsaw, Poland	Cd, Cu, Pb, Zn		Czarnowska and Jopkiewicz 1978
Germany	Cd, Pb, and Zn		Emmerling et al. 1997
Denmark		Se	Nielsen and Gissel-Nielsen 1975
Netherlands	Cd, Cu, Mn, Ni, Pb, and Zn		Hendriks et al. 1995
Netherlands	Cd, Cr, Cu, Fe, Mn, Ni, Pb, and Zn	Pb and Zn	Ma 1982
Netherlands		Cd, Cu, Pb, and Zn	Ma et al. 1983
Seveso, Italy	TCDD		Martinucci et al. 1983
Models fit to data from multiple locations.		Cd, Cu, Ni, Pb, and Zn	Neuhauser et al. 1995
Montana, USA	As, Cd, Cu, and Zn		Pascoe et al. 1996
Illinois, USA	Cd, Cr, Cu, Ni, and Pb		Pietz et al. 1984
Reading, Great Britain	Cd, Cu, Pb, and Zn	Cd, Cu, Pb, and Zn	Spurgeon and Hopkins 1996
Tennessee, USA	Cd, Pb, Zn		Van Hook 1974

TCDD = tetrachlorodibenzo-p-dioxin

In this report, both UFs and regression models were developed and tested, because, while regression models are most likely to consistently provide the best estimate of earthworm body burdens, UFs are required by some regulatory agencies. In addition, when no regression model fits the uptake data well, a conservative UF may be employed in screening assessments to determine whether site-specific studies are needed. The models presented in this report will facilitate the more accurate estimation of contaminant exposure experienced by earthworm-consuming wildlife on the Oak Ridge Reservation (ORR) and at other contaminated sites. Additional models for estimating contaminant bioaccumulation by sediment biota, plants, and small mammals are presented in Jones et al. (1998), Efroymson et al. (1998), and Sample et al. (1998).

2. MATERIALS AND METHODS

2.1 DATABASE DEVELOPMENT

A literature search was performed for studies that reported chemical concentrations in co-located earthworm and soil samples. To ensure relevancy to field situations, only field studies in which resident earthworms were collected were considered. All earthworm tissue burdens were therefore assumed to be at equilibrium with soil concentrations. Because soil residues in the earthworm gastrointestinal (GI) tract may be highly variable and therefore may significantly bias body burden measurements, only depurated earthworms were included. Samples in which the GI tract had been dissected or manually flushed were also considered suitable.

To ensure comparability of data, only "total" chemical analyses of both soil and earthworms (e.g., resulting from extractions of metals using concentrated acids) were included. Data resulting from diethylenetriaminepentaacetic acid (DTPA), acetic acid, and other mild extraction methods were excluded. The mean (or composite) chemical concentration in soil and earthworms reported for each sampling location evaluated in each study was considered an observation. If data for multiple earthworm species were reported at a site, each was considered a separate observation. Soil and earthworm data in the database were reported as mg/kg dry weight. If studies reported earthworms in terms of wet weight concentrations, dry weight concentrations were estimated assuming a 84% water content (EPA 1993). Data concerning earthworm species, soil pH, % organic matter (OM), cation exchange capacity (CEC), soil texture, and soil Ca concentration (mg/kg dry wt) were included in the database whenever reported. Summaries of the analytical methods and data presented for each study included in the database are presented in Appendix A. The earthworm bioaccumulation database is presented in Appendix B.

2.2. MODEL DEVELOPMENT AND VALIDATION

The earthworm bioaccumulation database was segregated into two groups. Twenty-six studies were assigned to the "model" dataset and were used for model development. The remaining six studies were designated the 'validation' dataset and were employed to test the accuracy and predictive utility of the UFs and bioaccumulation models. Segregation of studies into model and validation datasets was arbitrary and based on the sequence of when copies of the studies were acquired (i.e., the final six studies obtained were used for the validation dataset). Because sampling and analytical variability and environmental characteristics are likely to be correlated among data from the same study, it was assumed that data from wholly independent studies (e.g., studies from which no data were included in the model development) would be unbiased and would provide a better test of the UFs and models than would randomly selected observations extracted from the total dataset.

UFs, (contaminant concentration in earthworms/contaminant concentration in soil), were calculated for each observation and analyte in the model dataset. Summary statistics were generated for each analyte. The Shapiro-Wilk test (PROC UNIVARIATE; SAS Inst. Inc. 1988a) was applied to the untransformed and natural-log transformed UFs for each analyte to determine whether the distribution of the UFs was normal or log-normal, respectively.

To evaluate if there was a linear relationship between the contaminant concentration in soil and that in earthworms, simple and multiple regressions were performed using SAS PROC REG (SAS Inst. Inc. 1988b). Contaminant concentrations in both soil and earthworms were natural-log (ln)

transformed prior to regression analyses. Because data concerning the number of individuals included in composites or means were not available for all observations, no weighting of observations was applied. Simple linear regression models of ln-earthworm concentration on ln-soil concentration were developed for each analyte. Multiple regression models incorporating soil pH and ln soil Ca concentration, singly and combined, were developed for each analyte for which adequate data were available.

UFs and regression models developed from the "model" dataset were applied to the soil concentration data in the "validation" dataset, and estimated contaminant concentrations in earthworms were generated. To evaluate the appropriateness and accuracy of various methods for generating estimates for general application, estimated concentrations in earthworms were generated using the median UF, simple and multiple regression models developed in the current study, and selected published bioaccumulation models (Table 2). Because conservative estimates are needed for some purposes (e.g., screening assessments), estimates were also generated using the 90th percentile UF and the upper 95% prediction limit (95% UPL) for the simple regression model from this study. The 95% UPL was calculated according to Dowdy and Wearden (1983).

Table 2. Selected earthworm bioaccumulation models from the literature

Analyte	Model	Reference
Cd	log (worm)[a] = 0.66 log (soil)[a] + 1.21	Neuhauser et al. 1995
Cu	log (worm) = 0.57 log (soil) + 0.39	Neuhauser et al. 1995
Pb	log (worm) = 0.74 log (soil) + 0.05	Neuhauser et al. 1995
Ni	log (worm) = 0.98 log (soil) + 0.67	Neuhauser et al. 1995
Zn	log (worm) = 0.27 log (soil) + 2.09	Neuhauser et al. 1995
Se	log (worm) = 1.07 + (soil Ca)[b]	Beyer et al. 1987
Se	worm = 8.7 (soil) + 6.4	Nielsen and Gissel-Nielsen 1975

[a] All concentrations expressed as mg/kg dry weight, unless otherwise noted.
[b] Soil Ca expressed as meq/100 g.

For each analyte and estimation method (e.g., UF, models from this study, published models, etc.), differences between estimated and measured concentrations in validation earthworms were evaluated using Wilcoxon signed-rank tests (PROC UNIVARIATE; SAS Inst. Inc. 1988a). Differences were considered significant if $p(H_0=0) \leq 0.05$. Relative accuracy and quality of different estimation methods were evaluated by calculating the proportional deviation of the estimate from the measured value:

$$PD = (M_i - E_i) / M_i$$

where

PD = proportional deviation
M_i = measured concentration for chemical in earthworm at soil concentration (I)
E_i = estimated concentration for chemical in earthworm at soil concentration (I)

Negative values for PD indicate overestimation while positive PD values indicate underestimation. The percentage of estimated values that exceeded their corresponding measured value was also

tabulated for each chemical and estimation method. Relative quality of general estimation methods was evaluated by the following criteria:

1. median PD closest to 0 (indicates estimates center around measured values),
2. PD with narrowest range (indicates relative accuracy of method),
3. percentage overestimation closest to 50% (indicates estimates center around measured values), and
4. difference between estimated and measured values not significantly different as determined by Wilcoxon signed-rank tests.

Relative quality of conservative estimation methods was evaluated by

1. smallest, negative median PD value (indicates method overestimates while minimizing the degree of overestimation) and
2. PD with narrowest range (to minimize the degree of overestimation);

In addition to the use of PD values, a graphical evaluation of measured versus estimated concentrations in earthworms was performed by plotting the earthworm concentrations against the corresponding measured soil concentration.

Linear regressions of the natural-log transformed earthworm and soil "validation" data were performed and compared to simple models (i.e., soil concentration only) developed from the "model" dataset using the F-test procedure for comparing regression lines outlined in Draper and Smith (1981). Differences were considered significant if $p \leq 0.05$.

Following validation analyses, the "model" and "validation" datasets were pooled, and UFs and simple and multiple regression models were recalculated. These results were reported as the final UF or model.

Data for additional analytes were present in the "validation" dataset that were unrepresented in the "model" dataset. UFs were generated and summary statistics and distributions were determined for these analytes. Because these data represent only a single study, the remedial investigation for the Bear Creek Valley on the ORR, regression models were not fit to these data. These data are presented in Appendix C.

3. RESULTS

3.1 MODELING RESULTS

A total of 32 studies were identified that contained data suitable for inclusion in the earthworm bioaccumulation database (Appendix A). The "model" portion of the database consisted of 26 studies, representing 11 countries and 5 states. Data from the remaining 6 studies, representing Spain, Great Britain and the United States (Tennessee), were retained for validation purposes. Scatterplots of the observations from the "model" and "validation" datasets are presented in Figs. 1 through 6.

UFs and simple regression models were developed for nine inorganic and two organic chemicals (Tables 3 and 4). The number of studies available for each analyte ranged from a minimum of two studies for Mn, PCBs, and tetrachlorodibenzo-p-dioxin (TCDD) to a maximum of 17 studies for Cd (Table 3). With the exception of As and Ni, the distribution of all UFs was best described by the lognormal distribution (Table 3); As and Ni were best fit by a normal distribution. Median UFs for 6 chemicals (As, Cr, Cu, Mn, Ni, and Pb) were <1, indicating no biomagnification (Table 3). Median UFs>1 were observed for the remaining 5 chemicals (Cd, Hg, Zn, PCB, and TCDD; Table 3). [**Note:** the mean and standard deviation of the natural-log-transformed UFs are presented as parameters for describing the UF distributions for those analytes best fit by a lognormal distribution. While the untransformed UFs are best fit by a lognormal distribution, the natural-log-transformed UFs are normally distributed. These parameters may be used in two ways. They may be applied to normal distribution functions in Monte Carlo simulation software, however the output from the Monte Carlo sampling from this distribution must be back-transformed (e.g., e^y, where y=sampling result). Alternatively, they may be incorporated into the LOGNORM2 function in the @RISK Monte Carlo simulation software (Palisades Corp. 1994) or equivalent functions in other software. Use of the LOGNORM2 function requires no back-transformation. Comparable results are obtained using either approach.]

Regression of ln (earthworm) on ln (soil) produced significant model fits for all chemicals except Cr (Table 4). With the exception of Ni, slopes of all significant regression models were positive (Table 4; Figs. 1 through 6). Intercepts differed significantly from 0 for all chemicals except Hg, Mn, and Pb (Table 4). r^2 values for the significant models ranged from 0.22 (Cu) to 0.93 (PCB and TCDD).

Additional descriptive variables (e.g., pH, soil Ca concentration) were not available for all observations included in the "model" dataset; addition of these variables resulted in decreases in sample sizes. Consequently, the simple and multiple regression models are not directly comparable. While inclusion of soil pH in the regression model resulted in significant model fits for six chemicals (Table 5), only for Ni, Pb, and Zn did pH contribute significantly to the model fit. In the case of Ni, pH contributed significantly to the model fit while soil Ni did not (Table 5). Correlation analysis indicated no correlation between that soil Ni and soil pH ($r=0.31$, $p=0.3$).

Inclusion of ln soil Ca resulted in significant model fits for five chemicals (Table 6), however, only for Cd and Pb did soil Ca contribute significantly to model fit. When both soil Ca and soil pH were included in the model, significant fits were obtained for Cd, Cu, Pb, and Zn, albeit with dramatically reduced sample sizes (Table 7). For each chemical only two of the three dependent variables included contributed significantly; soil and pH for Cu, Pb, and Zn and soil and soil Ca for Cd (Table 7).

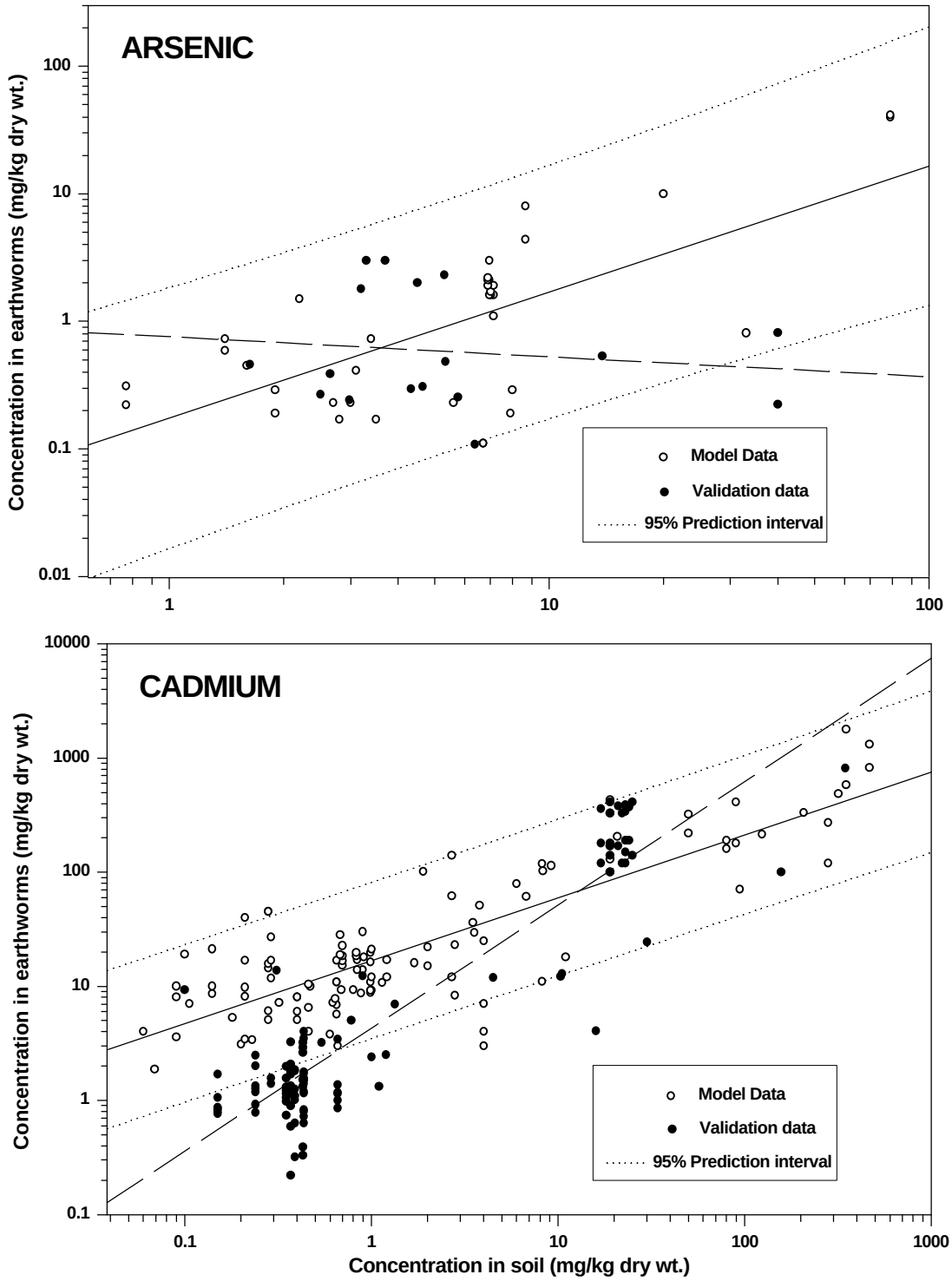

Fig. 1. Scatterplot of model and validation As and Cd data. Lines represent simple linear regression models of natural-log-transformed data for both model (solid) and validation (dashed) datasets. Dotted lines represent 95% prediction interval for model data. Regression models for model and validation datasets differed significantly ($p<0.0001$) for both As and Cd.

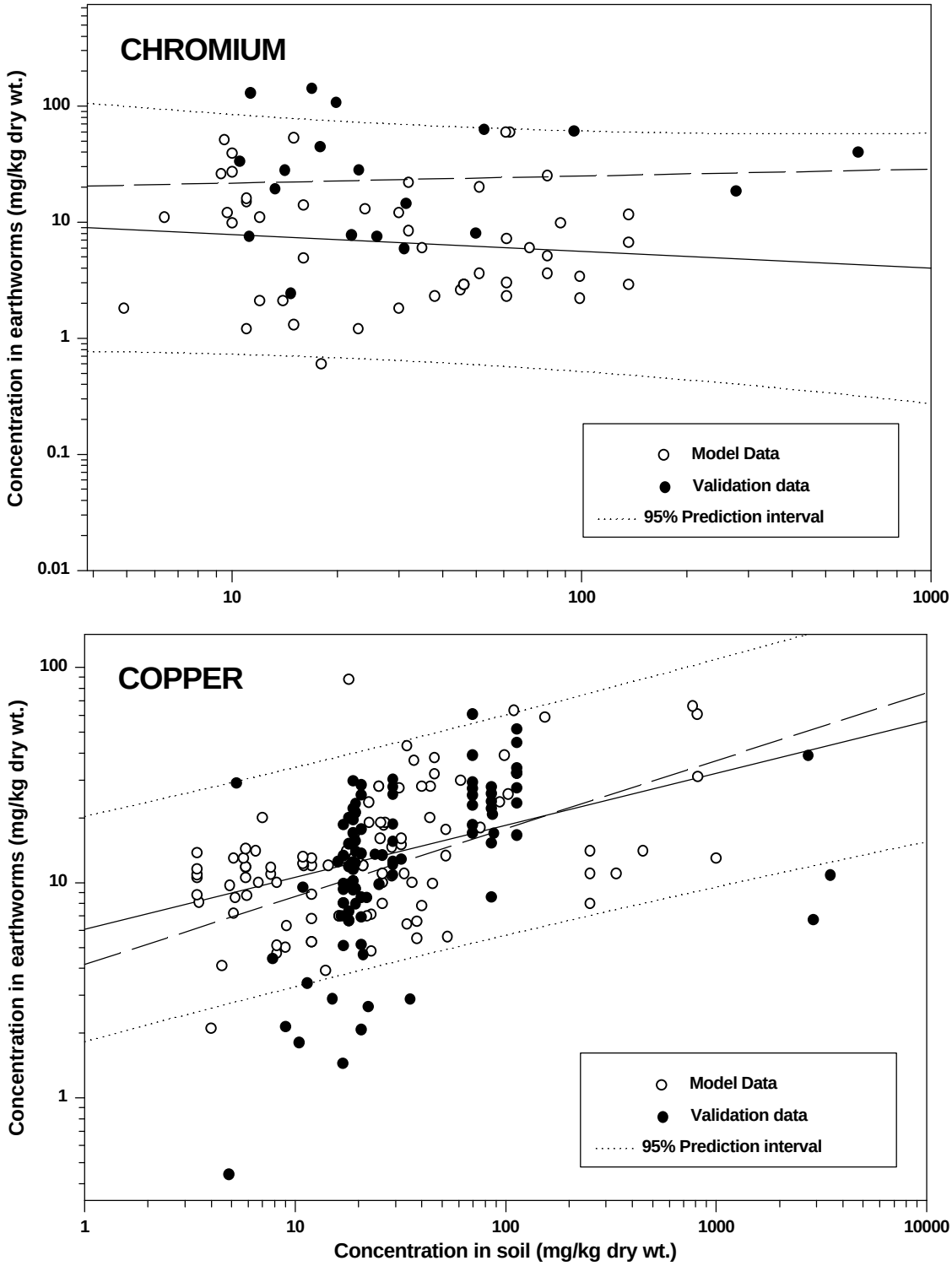

Fig. 2. Scatterplot of model and validation Cr and Cu data. Lines represent simple linear regression models of natural-log-transformed data for both model (solid) and validation (dashed) datasets. Dotted lines represent 95% prediction interval for model data. Regression models for model and validation datasets differed significantly ($p<0.001$) for Cr; models did not differ ($p=0.28$) for Cu.

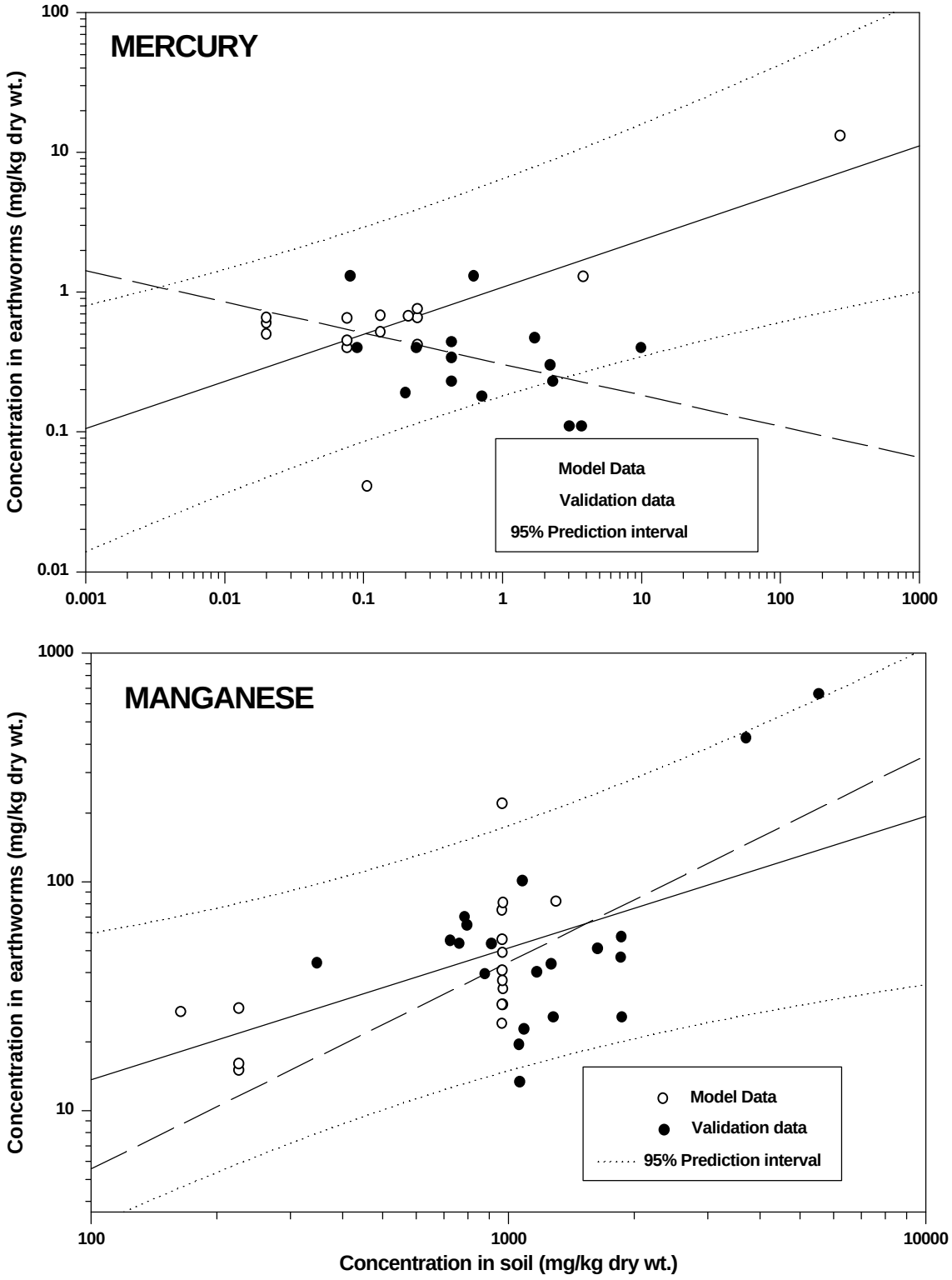

Fig. 3. Scatterplot of model and validation Hg and Mn data. Lines represent simple linear regression models of natural-log-transformed data for both model (solid) and validation (dashed) datasets. Dotted lines represent 95% prediction interval for model data. Regression models for model and validation datasets differed significantly ($p<0.001$) for Hg; models did not differ ($p=0.54$) for Mn.

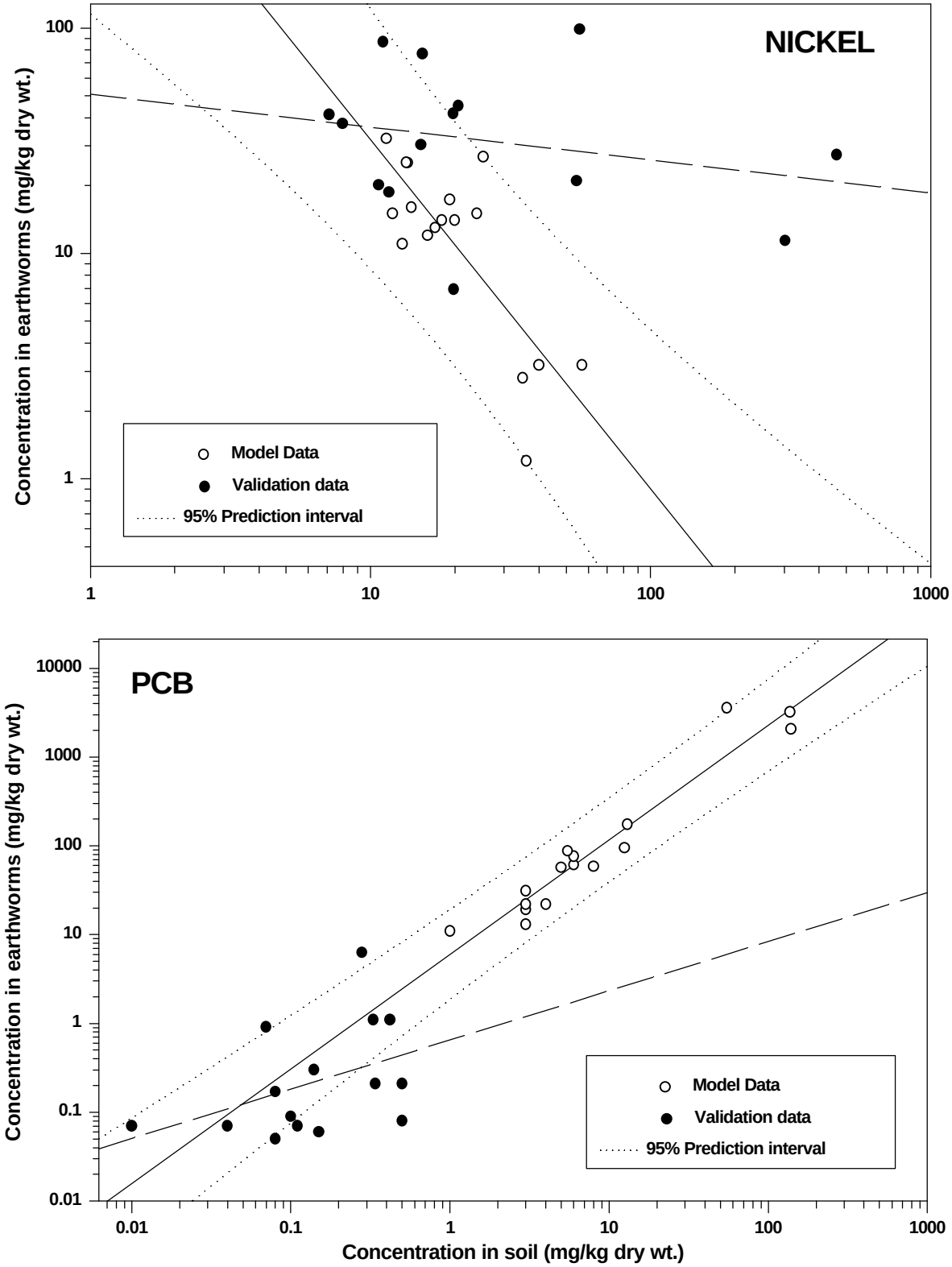

Fig. 4. Scatterplot of model and validation Ni and PCB data. Lines represent simple linear regression models of natural-log-transformed data for both model (solid) and validation (dashed) datasets. Dotted lines represent 95% prediction interval for model data. Regression models for model and validation datasets differed significantly ($p<0.01$) for both Ni and PCB.

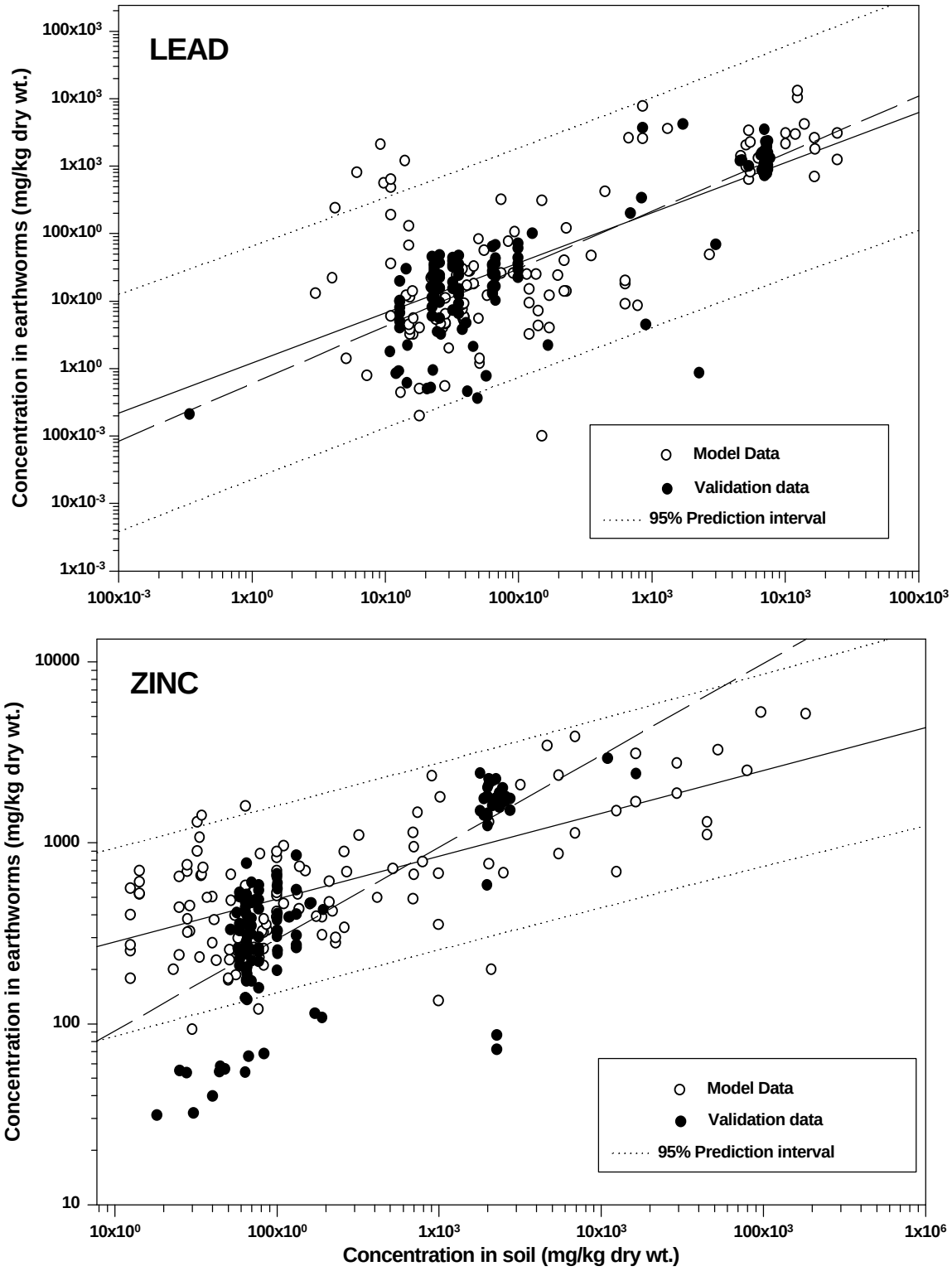

Fig. 5. Scatterplot of model and validation Pb and Zn data. Lines represent simple linear regression models of natural-log-transformed data for both model (solid) and validation (dashed) datasets. Dotted lines represent 95% prediction interval for model data. Regression models for model and validation datasets differed significantly ($p<0.0001$) for Zn; models did not differ ($p=0.49$) for Pb.

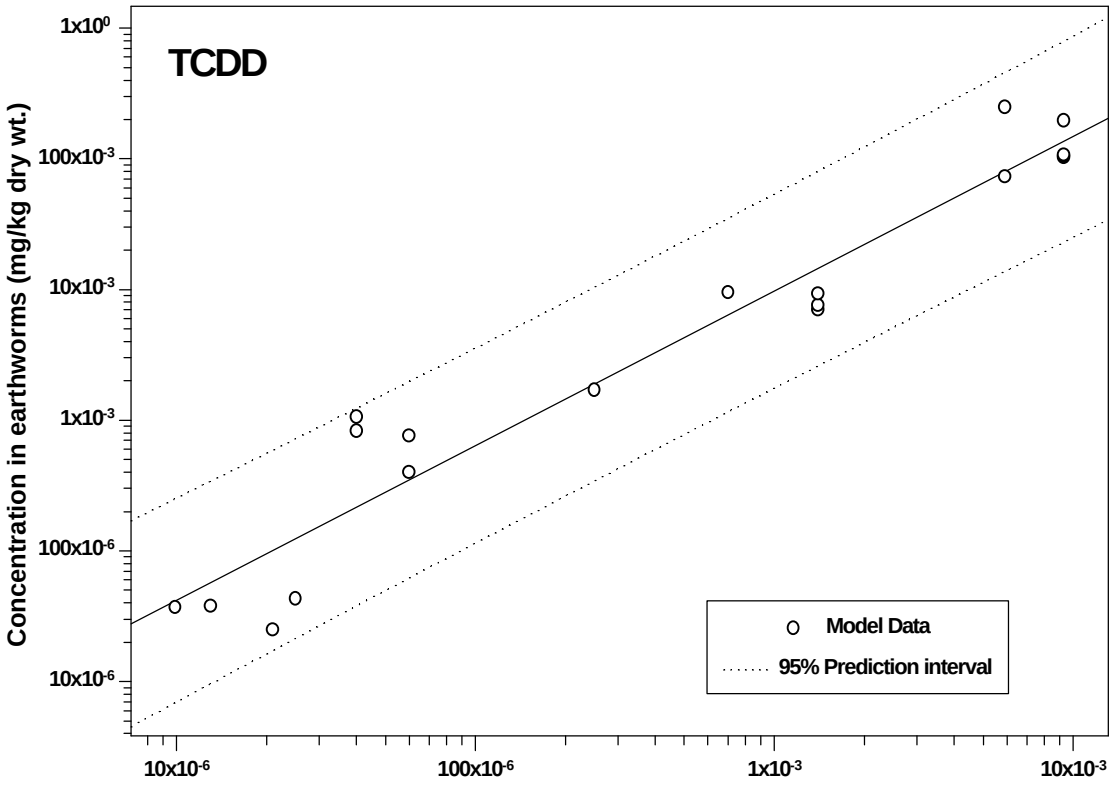

Fig. 6. Scatterplot of model data for TCDD. Line represents simple linear regression model of natural-log-transformed data. Validation data were unavailable for this chemical.

Table 3. Summary statistics for literature-derived soil-to-earthworm UFs

Analyte	N (Studies)	N (Observations)	Mean	Standard Deviation	Minimum	Median	90th Percentile	Maximum	Mean of Natural Log-transformed values	Standard Deviation of Natural Log-transformed values	Distribution
As	3	36	0.2656	0.2116	0.0164	0.2361	0.5214	0.9250			normal
Cd	17	114	27.1682	37.5895	0.4286	14.2603	66.0377	190.0000	2.58768	1.28036	lognormal
Cr	5	48	0.7080	1.1496	0.0212	0.1607	2.7000	5.3680	-1.48636	1.5555	lognormal
Cu	13	103	0.9283	0.9135	0.0130	0.6364	2.2807	4.8890	-0.57464	1.14691	lognormal
Hg	4	15	8.5537	11.0986	0.0488	3.9334	30.0000	33.0000	1.16596	1.77202	lognormal
Mn	2	16	0.0742	0.0551	0.0249	0.0605	0.1646	0.2280	-2.80288	0.62809	lognormal
Ni	3	17	0.9200	0.7418	0.0333	0.7778	1.8881	2.8330			normal
Pb	15	119	6.3297	26.7336	0.0007	0.2250	4.3243	228.2610	-1.10093	2.05196	lognormal
Zn	15	123	8.2364	11.0731	0.0247	3.7816	25.0000	49.5100	1.03218	1.83458	lognormal
PCB	2	16	14.1790	14.4186	4.3333	10.6667	23.4945	65.2270	2.40307	0.64066	lognormal
TCDD	2	19	11.7404	9.8083	1.1905	11.0108	22.2290	42.0680	2.1132	0.8918	lognormal

Table 4. Results of regression of ln (earthworm) on ln (soil)

	N	B0±SE	B1±SE	r^2	P model fit
As	36	-1.747±0.3542^{c}	0.9884±0.1804^{c}	0.47	0.0001
Cd	114	2.8216±0.0766^{c}	0.5512±0.03343^{c}	0.71	0.0001
Cr	48	2.3957±0.653^{c}	-0.146±0.1863^{NS}	0.01	0.44
Cu	103	1.8059±0.1528^{c}	0.2414±0.04503^{c}	0.22	0.0001
Hg	15	0.0781±0.2594^{NS}	0.3369±0.0915^{b}	0.51	0.0028
Mn	16	-0.043±1.3719^{NS}	0.5759±0.2096^{a}	0.35	0.016
Ni	17	7.033±0.9409^{c}	-1.548±0.3097^{c}	0.62	0.0002
Pb	119	0.0752±0.4153^{NS}	0.7612±0.07586^{c}	0.46	0.0001
Zn	123	5.0981±0.1384^{c}	0.2373±0.0239^{c}	0.45	0.0001
PCB	16	1.7903±0.2358^{c}	1.2909±0.09404^{c}	0.93	0.0001
TCDD	19	3.533±0.810^{c}	1.182±0.074^{c}	0.94	0.0001

model: ln(earthworm)=B0+B1(ln[soil])
^{NS} not significant: p>0.05.
^{a} p<0.05.
^{b} p<0.01.
^{c} p<0.001.

Table 5. Results of regression of ln (earthworm) on ln (soil) and pH

Analyte	N	B0±SE	B1±SE	B2±SE	r^2	P model fit
As	36	0.341±1.245^{NS}	1.0908±0.1847^{c}	-0.41611±0.2384^{NS}	0.51	0.0001
Cd	75	3.84±0.5653^{c}	0.5482±0.04668^{c}	-0.15294±0.09318^{NS}	0.67	0.0001
Cu	83	2.087±0.384^{c}	0.2894±0.0517^{c}	-0.07384±0.069^{NS}	0.29	0.0001
Ni	13	2.862±0.6393^{b}	-0.4625±0.2333^{NS}	0.2074±0.0418^{c}	0.72	0.0018
Pb	80	5.233±1.2657^{c}	0.7253±0.1122^{c}	-0.82195±0.2299^{c}	0.36	0.0001
Zn	86	4.453±0.3485^{c}	0.234±0.02958^{c}	0.12845±0.05867^{a}	0.49	0.0001

model: ln(earthworm)=B0+B1(ln[soil])+B2(pH)
^{NS} not significant: p>0.05.
^{a} p<0.05.
^{b} p<0.01.
^{c} p<0.001.

Table 6. Results of regression of ln (earthworm) on ln (soil) and ln (soil Ca)

Analyte	N	B0±SE	B1±SE	B2±SE	r^2	P model fit
Cd	56	5.8213±0.5896^{c}	0.8232±0.07248^{c}	-0.39236±0.0814^{c}	0.81	0.0001
Cu	32	1.8809±0.3383^{c}	0.1054±0.1002^{NS}	0.07289±0.0758^{NS}	0.36	0.0016
Mn	16	3.5354±3.7592^{NS}	0.3611±0.2966^{NS}	-0.24575±0.2404^{NS}	0.4	0.04
Pb	39	0.5998±0.9629^{NS}	1.2419±0.1174^{c}	-0.42872±0.1034^{c}	0.76	0.0001
Zn	54	5.8957±0.3803^{c}	0.2797±0.0648^{c}	-0.10903±0.0836^{NS}	0.5	0.0001

model: ln(earthworm)=B0+B1(ln[soil])+B2(ln[soil Ca])
^{NS} not significant: p>0.05.
^{a} p<0.05.
^{b} p<0.01.
^{c} p<0.001.

Table 7. Results of regression of ln (earthworm) on ln (soil), ln (soil Ca), and pH

Analyte	N	B0±SE	B1±SE	B2±SE	B3±SE	r^2	P model fit
Cd	29	5.29±1.0326[c]	0.89±0.1196[c]	-0.5095±0.1462[b]	0.22896±0.1411[NS]	0.88	0.0001
Cu	27	2.4±0.3263[c]	0.29±0.05869[c]	0.0512±0.04412[NS]	-0.12232±0.0581[a]	0.86	0.0001
Pb	12	3.61±1.0152[b]	0.9±0.1402[c]	0.1191±0.2115[NS]	-0.82338±0.3315[a]	0.88	0.0005
Zn	29	4.16±0.74[c]	0.41±0.1289[b]	-0.2986±0.2083[NS]	0.42723±0.2067[a]	0.75	0.0001

model: ln(earthworm)=B0+B1(ln[soil])+B2(ln[soil Ca])+B3(pH)
[NS] not significant: $p>0.05$.
[a] $p<0.05$.
[b] $p<0.01$.
[c] $p<0.001$.

3.2 VALIDATION RESULTS

Data for model validation were available for all nine organic chemicals and for PCBs. No validation data were available for TCDD. While UFs and models for Se were not developed as part of the current study, data were available to validate two published Se uptake models.

Comparison of simple regression models for the "model" and "validation" data indicated that the models differed significantly ($p<0.01$) for 7 of 10 chemicals: As and Cd (Fig. 1), Cr (Fig. 2), Hg (Fig. 3), Ni and PCB (Fig. 4), and Zn (Fig. 5). No significant differences ($p \geq 0.28$) between "model" and "validation" regressions were observed for Cu (Fig. 2), Mn (Fig. 3), and Pb (Fig. 5).

Based on the full validation dataset, significant differences between measured and estimated concentrations were observed for 7 of 10 chemicals for the median UF, 4 of 9 chemicals for the simple regression model, and 4 of 5 chemicals for the models from Neuhauser et al. (1995; Table 8). The median UF and simple regression models overestimated concentrations for more than 50% of observations for 7 of 10 and 7 of 9 chemicals, respectively (Table 8). In contrast, models from Neuhauser et al. (1995) underestimated concentrations for >50% of observations for 5 of 5 chemicals (Table 8). For all three estimation methods, median proportion deviations of estimated values from measured values ranged from a minimum of -0.005 for the simple regression model for Cu to a maximum of -6.35 for the median UF for Hg (Table 8). Using the selection criteria outlined previously, the best estimates for As, Cu, Hg, Mn, PCB, Pb, and Zn were produced using the simple regression model, for Cd using the model from Neuhauser et al. (1995), and for Cr using the median UF (Table 8). Graphical presentations of measured an estimated concentrations of analytes in earthworm for given soil concentrations are presented in Figs. 7 through 17.

Because soil pH and soil Ca were reported for few observations in the "validation" dataset, fewer data were available for validation of the multiple regression models that include these variables. Using this reduced dataset, significant differences between measured and estimated concentrations were observed for 4 of 6, 1 of 6, 2 of 6, 4 of 4, and 4 of 4 chemicals for the median UF, simple regression, multiple regression w/pH, multiple regression with Ca, and the multiple regression with both pH and Ca, respectively (Table 9). Of the five estimation methods, the multiple regression model that included pH generated estimates with the smallest median and range PD values for As, Cd, and Cu, while the simple regression model generated estimates with the smallest median and range PD values for Pb and Zn (Table 9). Comparison of estimates using the Wilcoxon signed-rank test indicated that while

estimates from the simple regression and the regression with pH differed significantly for As ($p=0.002$), estimates did not differ significantly for Cd, Cu, Pb, or Zn ($p>0.05$).

Ni concentrations in earthworms were not estimated well by any method (Fig. 13). Using the whole validation dataset, Ni estimates generated by the median UF and by the model from Neuhauser et al. (1995) model did not differ significantly from measured values, while those based on the simple regression model did (Table 8). Using the restricted validation dataset, significant differences between estimated and measured values were observed for the median UF and the multiple regression including pH; in contrast, no differences were observed for estimates from the simple regression model (Table 9). When viewed graphically, it is clear that estimates from the median UF, simple regression and the Neuhauser et al. (1995) regression models do not reflect the measured data (Fig. 13). In contrast, while the multiple regression model that included pH underestimated most observations, the estimates generated by this model more closely reflect measured values than those from any other method.

Table 8. Comparison of quality of general estimation methods as determined by the proportional deviation (PD) of the estimated values from measured values. PD = (measured - estimate)/measured. Negative PD values indicate overestimates while positive PD values indicate underestimates

		Median UF		Simple regression model		Regression model from Neuhauser et al. 1995	
Analyte	N	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated
As	17	-1.62^{NS} (-41.35 to 0.74)	65	-0.89^{NS} (-28.96 to 0.81)	65		
Cd	112	-1.98^{c} (-55.34 to 0.85)	88	-4.73^{NS} (-43.15 to 0.79)	74	-0.06^{a} (-6.91 to 0.94)	40
Cr	19	0.76^{b} (-1.49 to 0.99)	16				
Cu	94	-0.51^{c} (-273.62 to 0.88)	71	-0.005^{NS} (-19.25 to 0.72)	51	0.22^{c} (-19.68 to 0.87)	29
Hg	15	-6.35^{c} (-131.31 to 0.76)	87	-2.31^{b} (-14.28 to 0.64)	87		
Mn	20	-0.55^{NS} (-3.85 to 0.52)	60	-0.24^{NS} (-2.99 to 0.79)	55		
Ni	14	0.60^{NS} (-19.60 to 0.90)	29	0.71^{a} (-0.60 to 1.00)	36	0.75^{NS} (-11.09 to 0.94)	29
PCB	16	-5.10^{b} (-65.67 to 0.53)	88	-0.78^{a} (-29.61 to 0.82)	81		
Pb	126	0.29^{a} (-590.28 to 0.95)	37	0.19^{c} (-446.97 to 0.95)	40	0.28^{c} (-369.90 to 0.96)	33
Zn	121	-0.32^{c} (-118.39 to 0.68)	65	-0.28^{NS} (-13.25 to 0.60)	60	0.93^{c} (0.09 to 0.97)	0

^{NS} Estimate not significantly different from measured as determined by Wilcoxon signed-rank test.
^{a} Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p<0.05$.
^{b} Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p<0.01$.
^{c} Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p<0.001$.

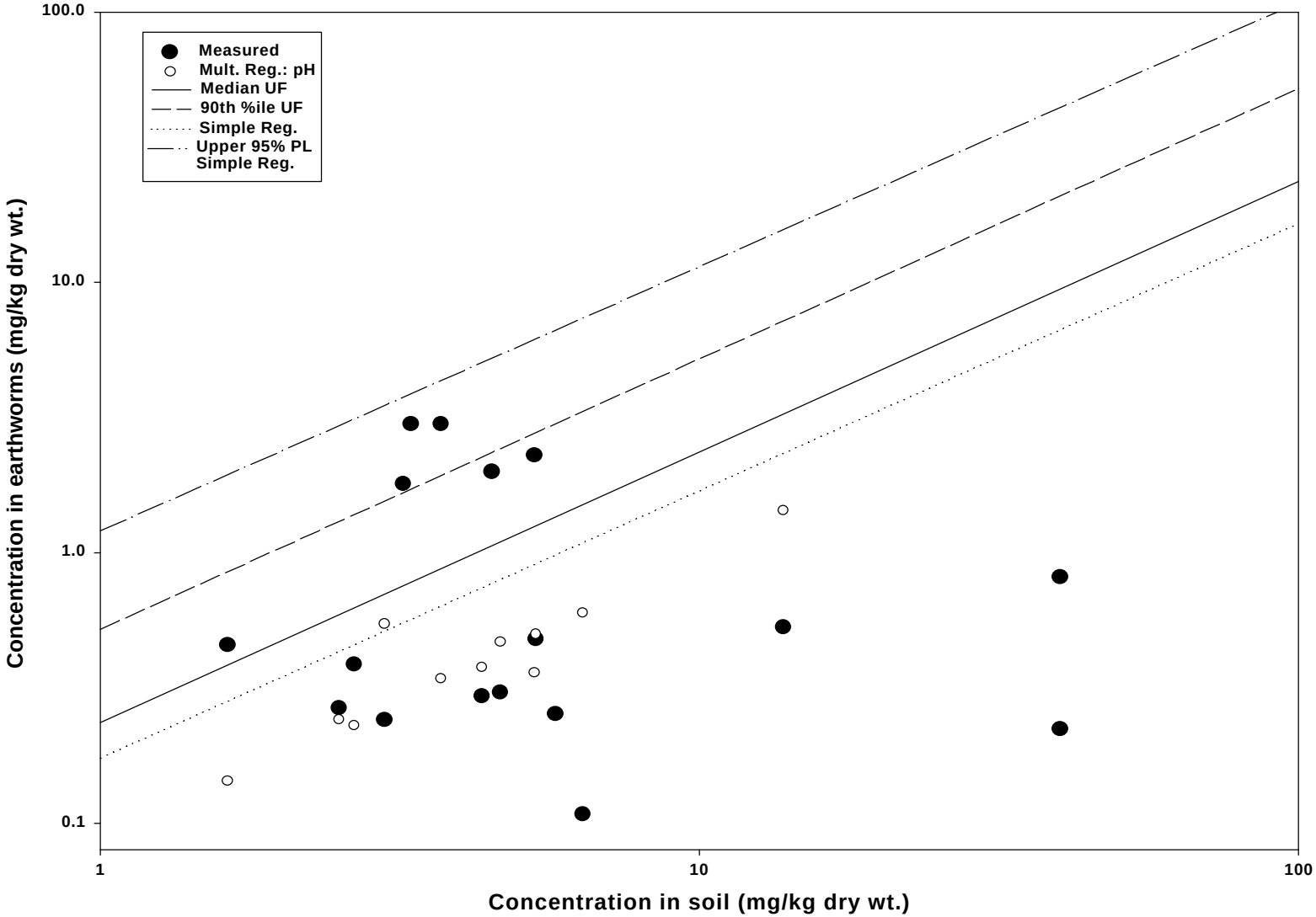

Fig. 7. Comparison of measured As concentrations in earthworms from the validation dataset to estimated As concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured As concentrations in earthworms and estimates generated by the multiple regression model that included soil pH are represented as point values. Estimates of As concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression model from this study are represented as lines.

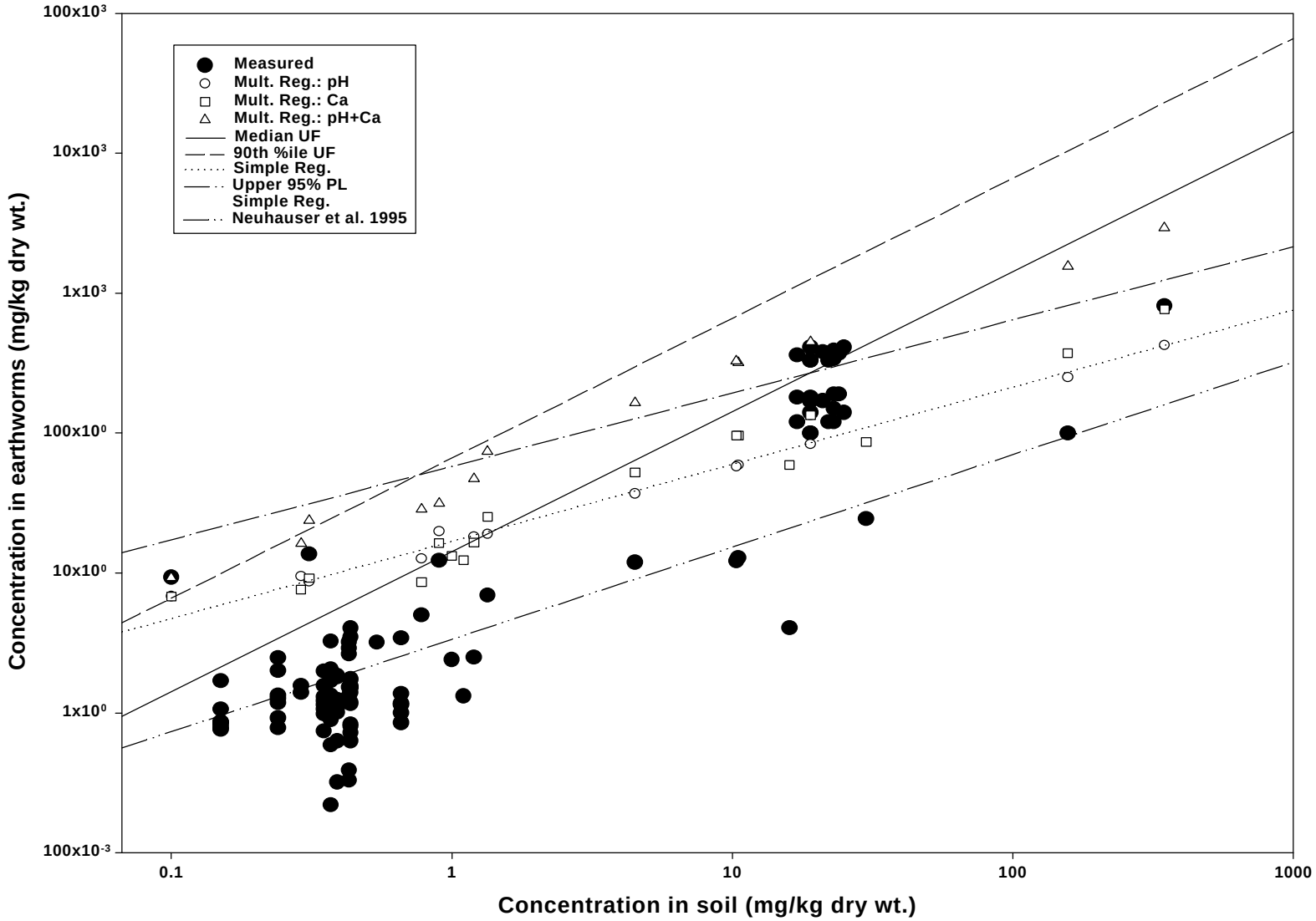

Fig. 8. Comparison of measured Cd concentrations in earthworms from the validation dataset to estimated Cd concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Cd concentrations in earthworms and estimates generated by the multiple regression models that included soil pH, soil Ca, and both pH and Ca, and the regression model from Beyer et al. (1987) are represented as point values. Estimates of Cd concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression models from this study and from Neuhauser et al. (1995) are represented as lines.

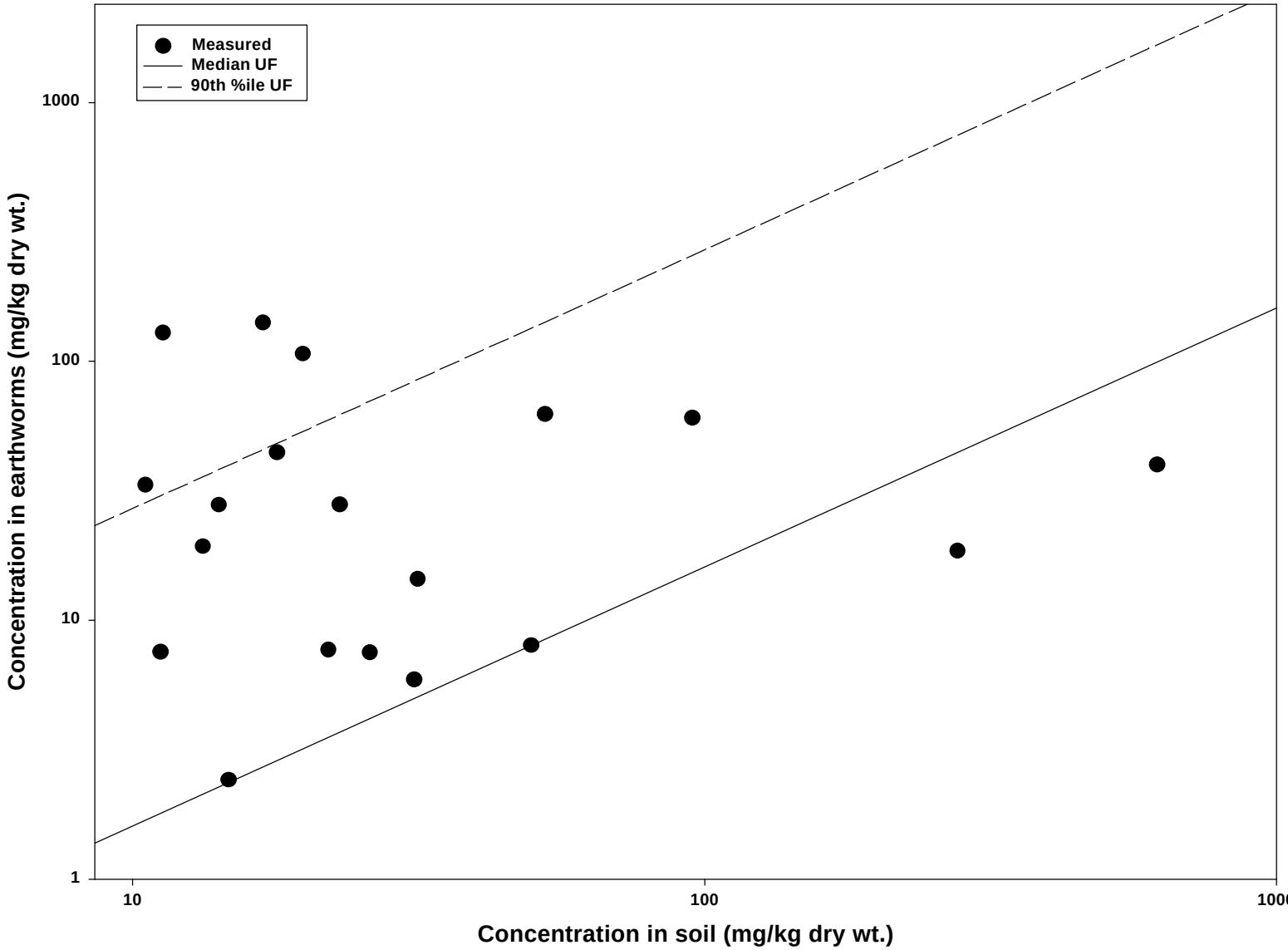

Fig. 9. Comparison of measured Cr concentrations in earthworms from the validation dataset to estimated Cr concentrations in earthworms. Estimates were generated by applying UFs to the measured soil concentration from the validation dataset. Measured Cr concentrations in earthworms are represented as point values. Estimates of Cr concentrations in earthworms generated by the median and 90th percentile UFs are represented as lines.

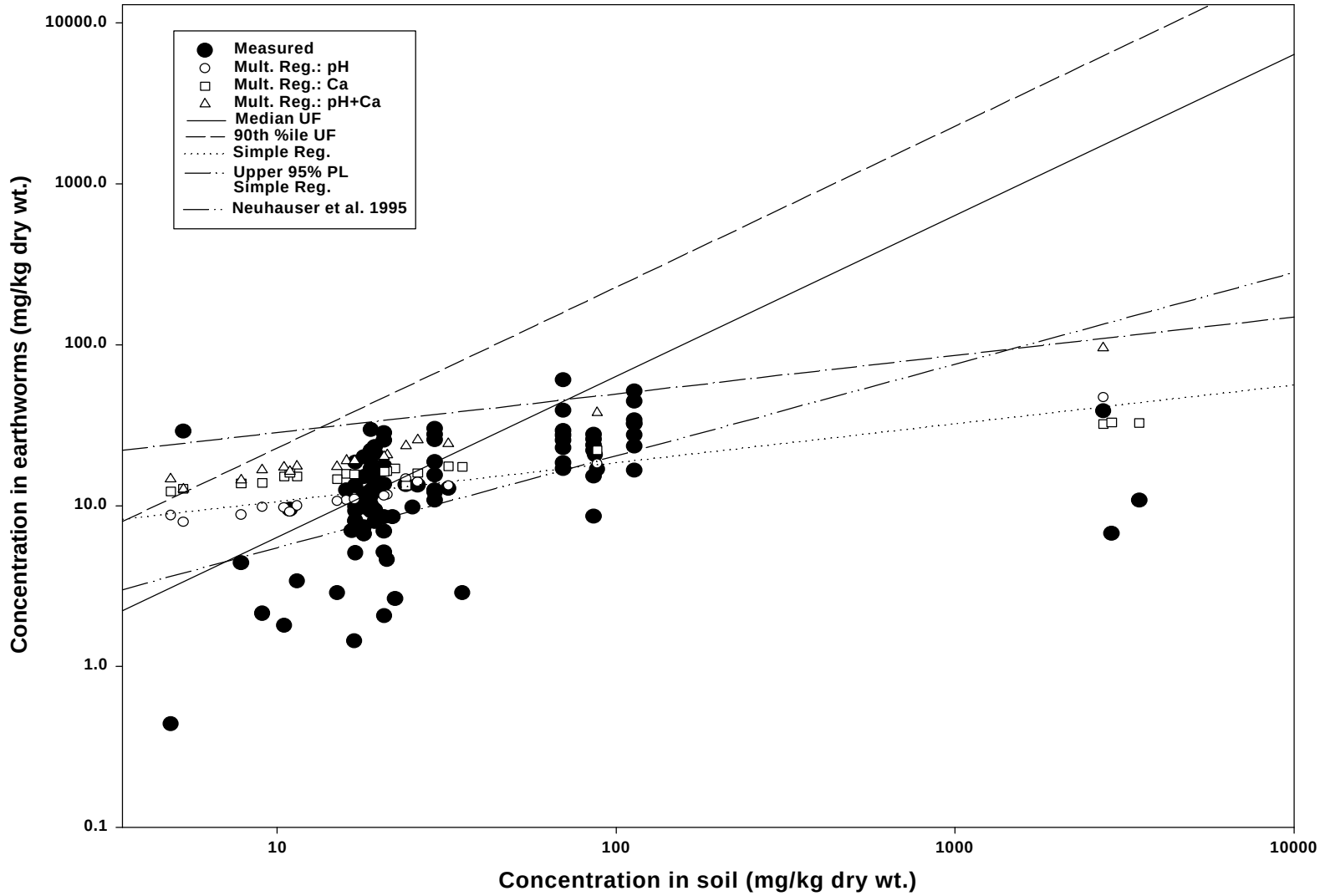

Fig. 10. Comparison of measured Cu concentrations in earthworms from the validation dataset to estimated Cu concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Cu concentrations in earthworms and estimates generated by the multiple regression models that included soil pH, soil Ca, and both pH and Ca are represented as point values. Estimates of Cu concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression models from this study and from Neuhauser et al. (1995) are represented as lines.

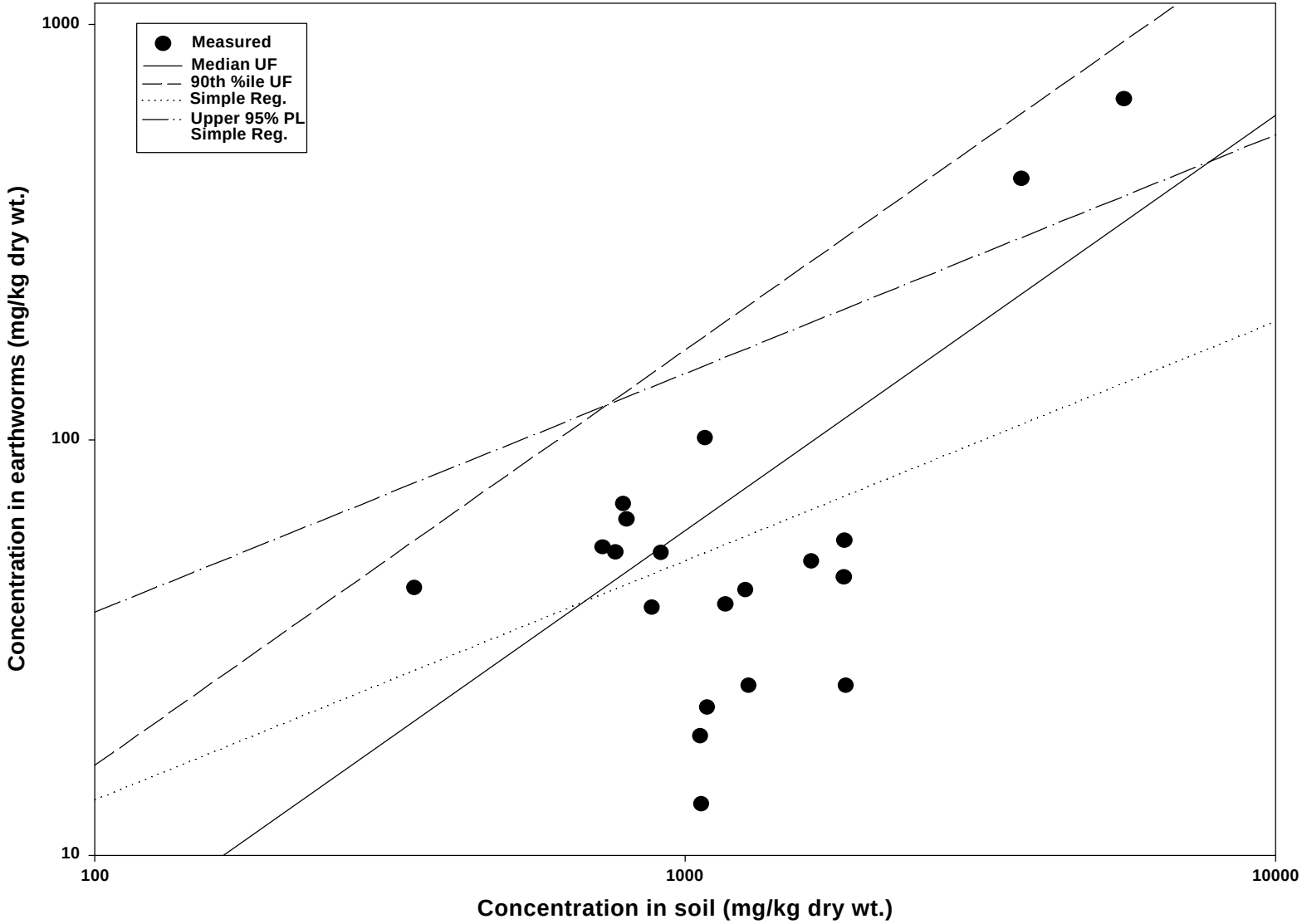

Fig. 11. Comparison of measured Hg concentrations in earthworms from the validation dataset to estimated Hg concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Hg concentrations in earthworms are represented as point values. Estimates of Hg concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression model from this study are represented as lines.

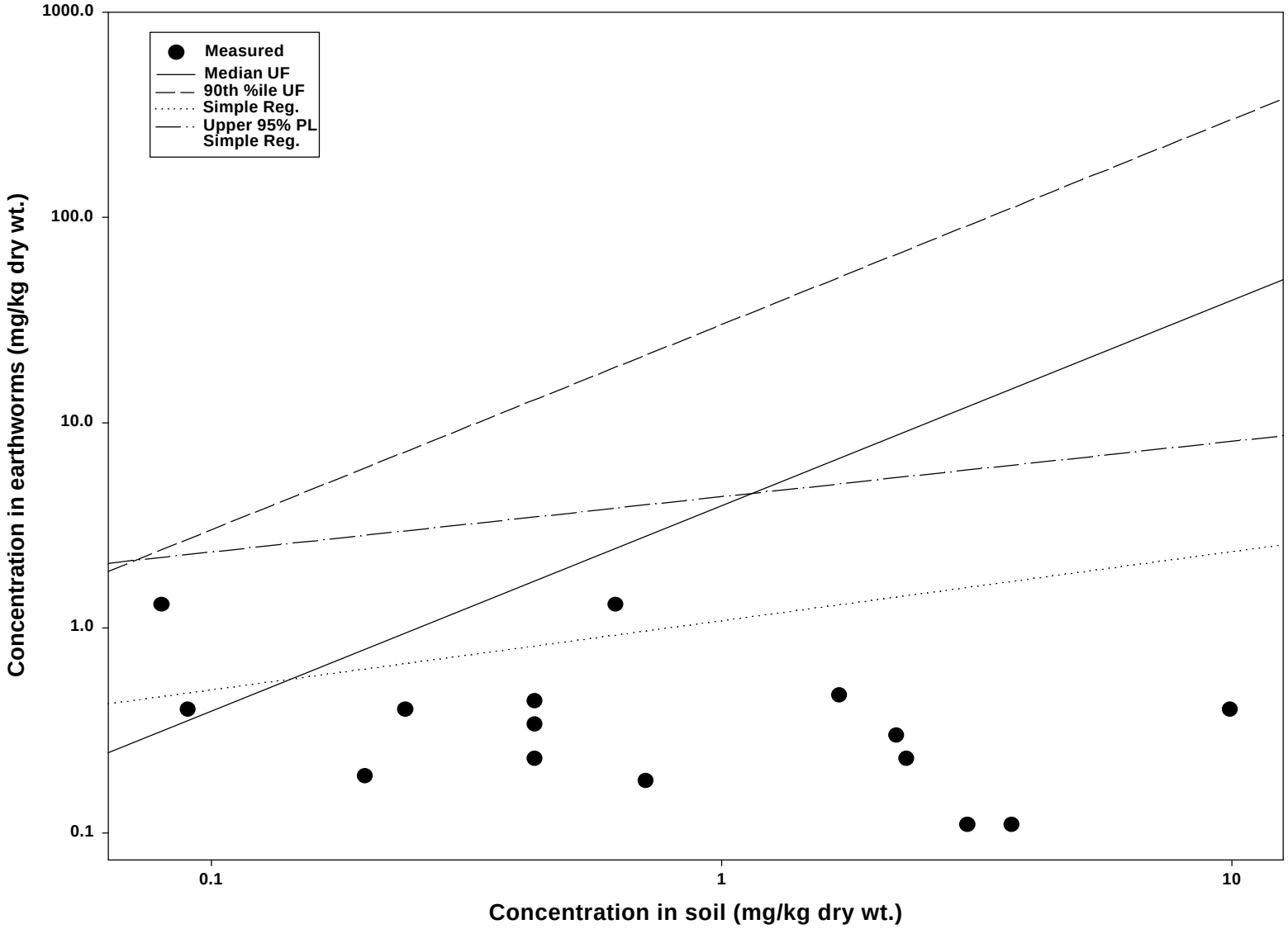

Fig. 12. Comparison of measured Mn concentrations in earthworms from the validation dataset to estimated Mn concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Mn concentrations in earthworms are represented as point values. Estimates of Mn concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression model from this study are represented as lines.

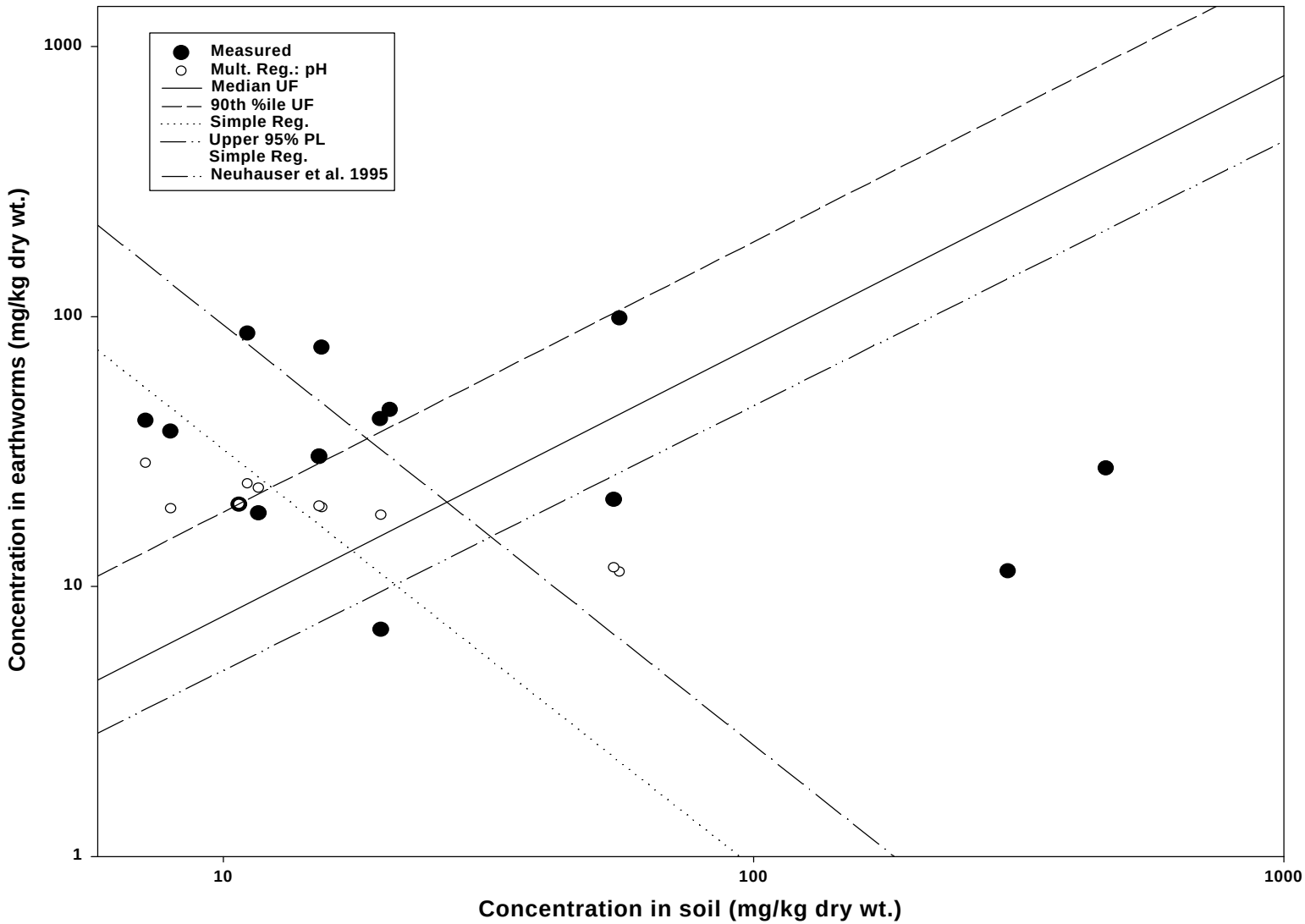

Fig. 13. Comparison of measured Ni concentrations in earthworms from the validation dataset to estimated Ni concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Ni concentrations in earthworms and estimates generated by the multiple regression model that included soil pH are represented as point values. Estimates of Ni concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression models from this study and from Neuhauser et al. (1995) are represented as lines.

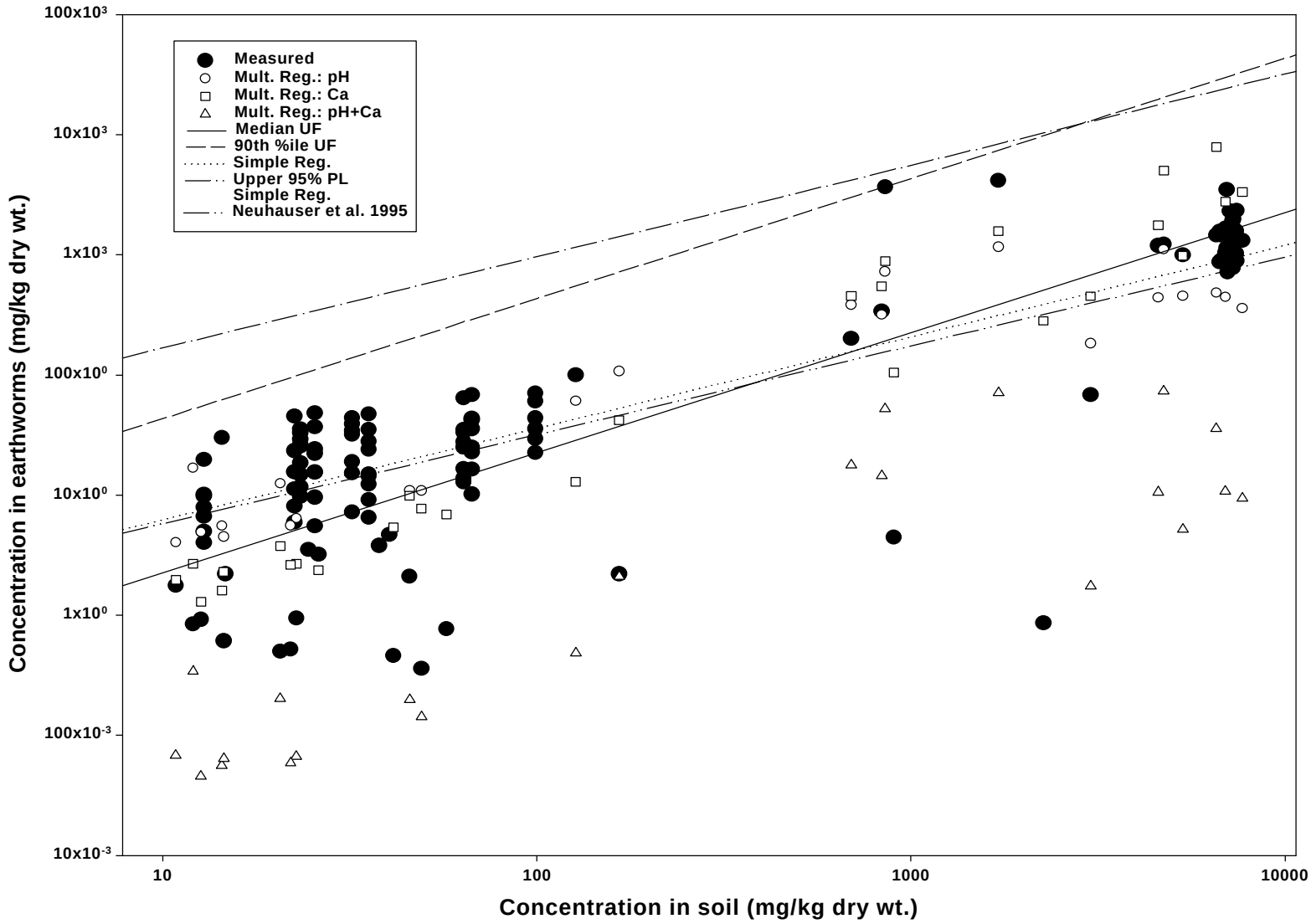

Fig. 14. Comparison of measured Pb concentrations in earthworms from the validation dataset to estimated Pb concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Pb concentrations in earthworms and estimates generated by the multiple regression models that included soil pH, soil Ca, and both pH and Ca are represented as point values. Estimates of Cu concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression models from this study and from Neuhauser et al. (1995) are represented as lines.

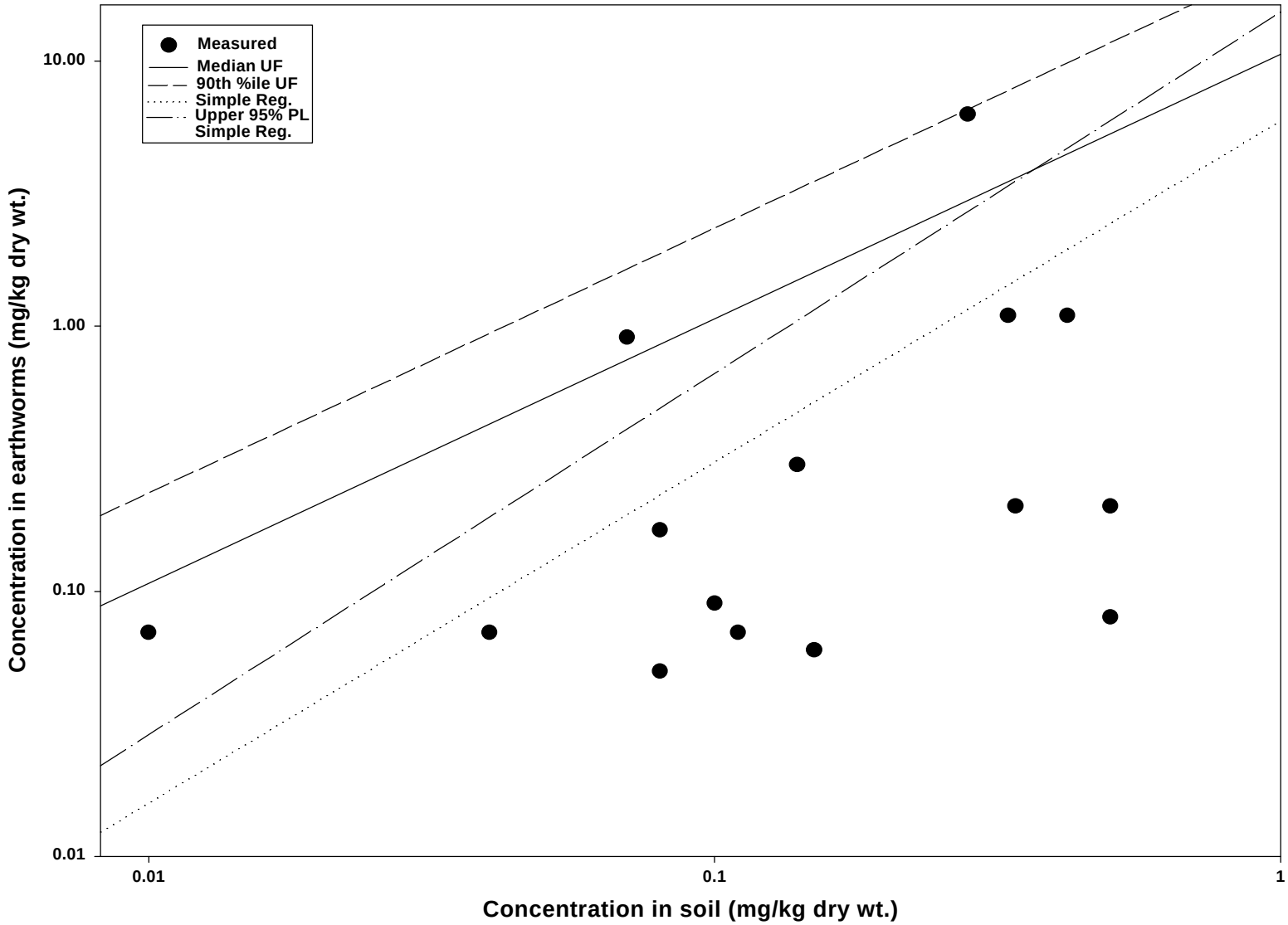

Fig. 15. Comparison of measured PCB concentrations in earthworms from the validation dataset to estimated PCB concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured PCB concentrations in earthworms are represented as point values. Estimates of PCB concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression model from this study are represented as lines.

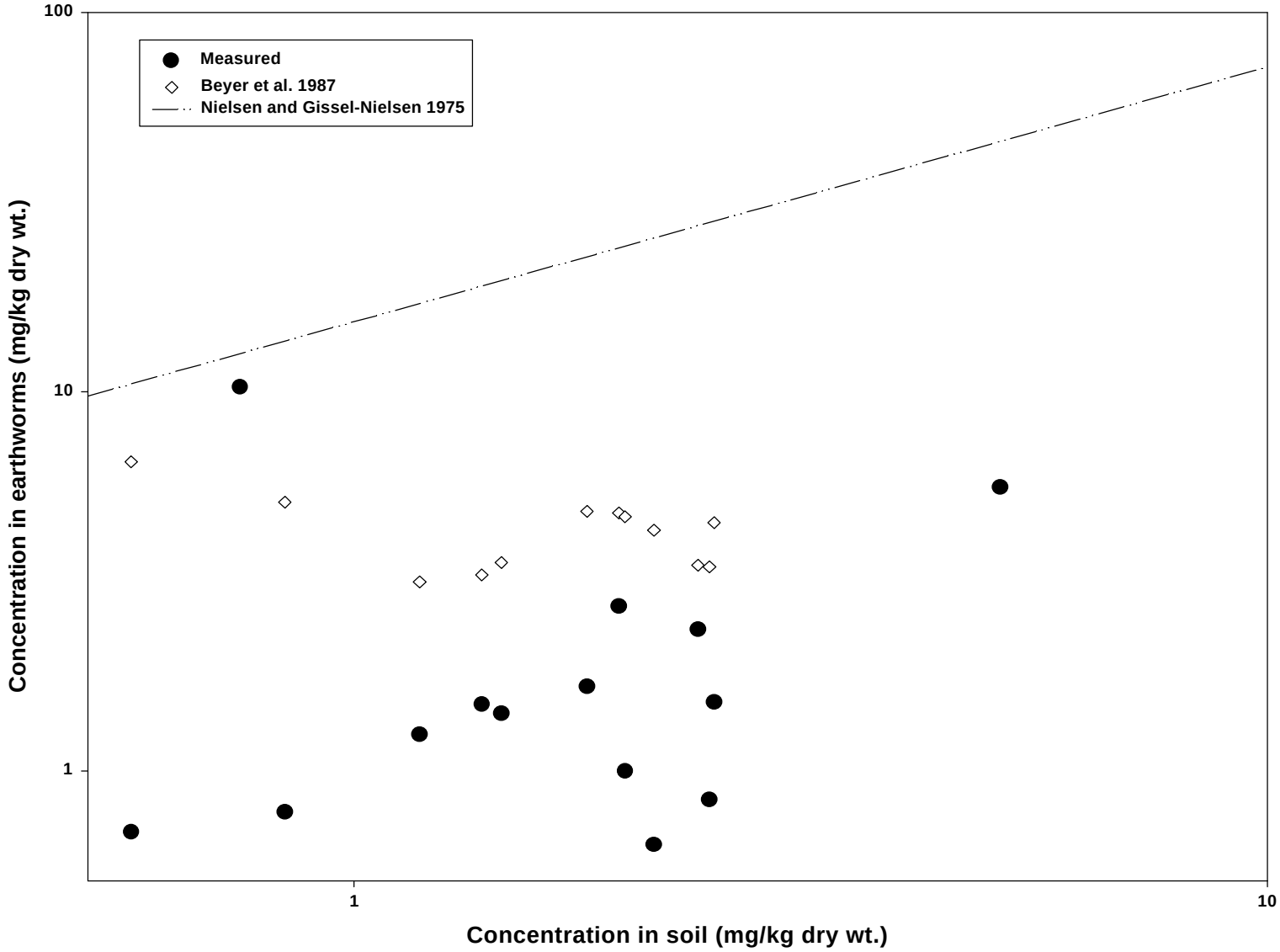

Fig. 16. Comparison of measured Se concentrations in earthworms from the validation dataset to estimated Se concentrations in earthworms. Estimates were generated by applying literature derived models to the measured soil concentration from the validation dataset. Measured Se concentrations in earthworms and estimates generated by the regression model from Beyer et al. (1987) are represented as point values. Estimates of Se concentrations in earthworms generated by the regression model from Nielsen and Gissel Nielsen (1975) are represented as lines.

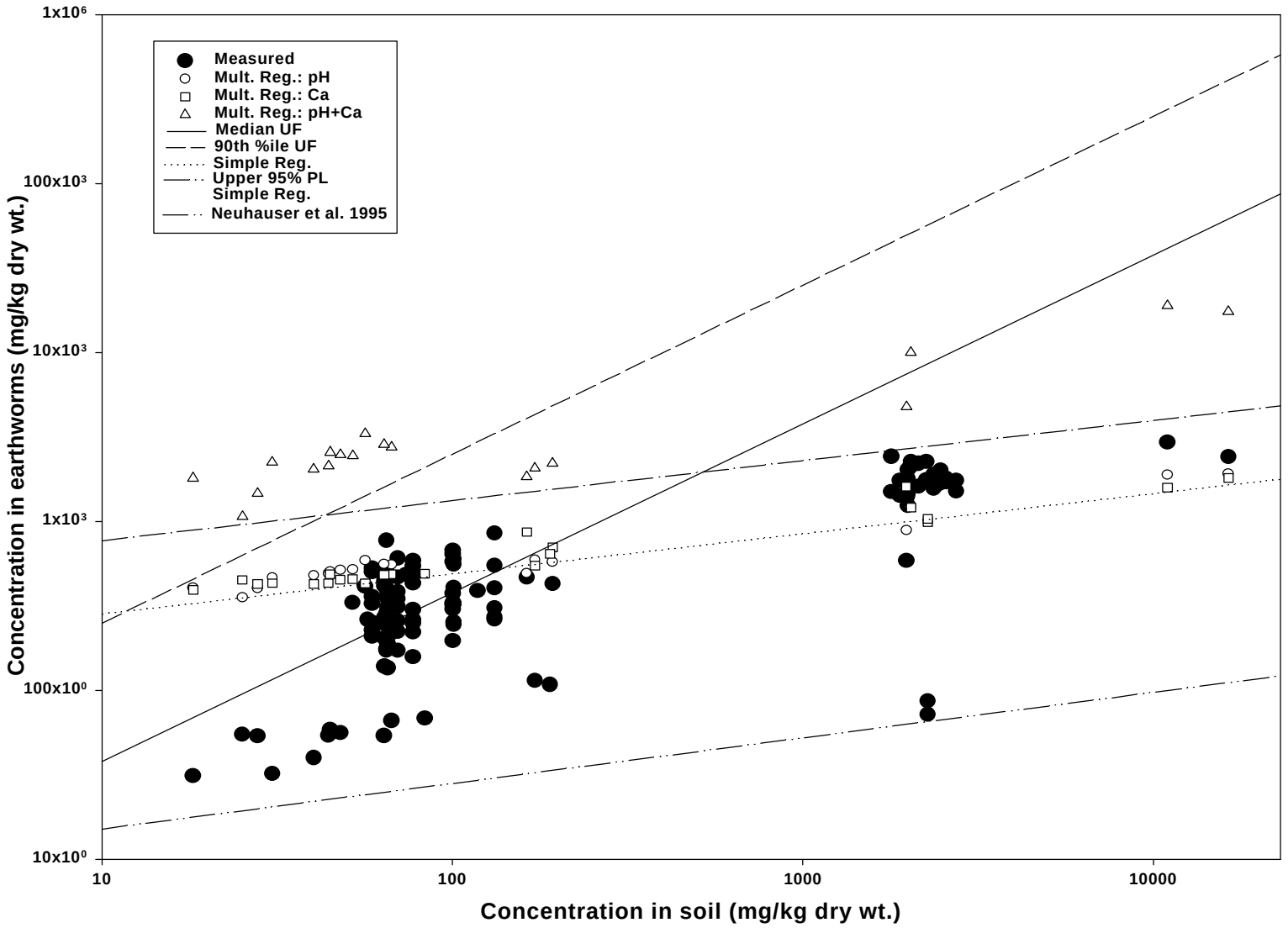

Fig. 17. Comparison of measured Zn concentrations in earthworms from the validation dataset to estimated Zn concentrations in earthworms. Estimates were generated by applying UFs or models to the measured soil concentration from the validation dataset. Measured Zn concentrations in earthworms and estimates generated by the multiple regression models that included soil pH, soil Ca, and both pH and Ca are represented as point values. Estimates of Zn concentrations in earthworms generated by the median UF, 90th percentile UF and simple regression models from this study and from Neuhauser et al. (1995) are represented as lines.

Table 9. Comparison of quality of general estimation methods as determined by the proportional deviation (PD) of the estimated values from measured values. PD = (measured-estimate)/measured. Negative PD values indicate overestimates while positive PD values indicate underestimates. Only observations from the "validation" dataset for which soil pH and soil Ca measurements were available were included

		Median UF		Simple regression model		Regression model w/ pH		Regression model w/ Ca		Regression model w/ pH and Ca	
Analyte	n	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated
As	11	-1.62[NS] (-12.95 to 0.71)	73	-0.89[NS] (-9.08 to 0.79)	73	-0.04[NS] (-4.57 to 0.89)	56				
Cd	13	-1.76[b] (-21.39 to 0.85)	85	-1.85[NS] (-6.43 to 0.50)	69	-1.52[NS] (-6.25 to 0.51)	69	-2.65[a] (-6.89 to 0.33)	69	-9.35[c] (-25.93 to 0.01)	92
Cu	17	-1.69[b] (-43.82 to 0.88)	82	-1.26[b] (-19.25 to 0.69)	76	-0.99[b] (-18.80 to 0.73)	82	-2.12[c] (-26.89 to 0.56)	82	-2.27[c] (-32.26 to 0.56)	94
Ni	10	0.60[b] (-1.23 to 0.90)	20	0.11[NS] (-0.60 to 0.98)	50	0.39[a] (-1.65 to 0.89)	30				
Pb	23	-0.38[NS] (-29.71 to 0.95)	65	0.13[NS] (-57.05 to 0.95)	48	-0.91[NS] (-47.74 to 0.81)	52	-1.65[a] (-20.50 to 0.95)	78	0.96[c] (0.05 to 1.00)	0
Zn	19	-2.23[b] (-24.67 to 0.48)	89	-5.41[NS] (-10.49 to 0.56)	84	-5.43[NS] (-13.46 to 0.46)	84	-6.35[a] (-12.42 to 0.47)	84	-18.51[c] (-68.66 to -2.94)	100

[NS] Estimate not significantly different from measured as determined by Wilcoxon signed-rank test.
[a] Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p < 0.05$.
[b] Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p < 0.01$.
[c] Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p < 0.001$.

No models were developed for Se as part of this study, but two were identified in the literature (Beyer et al. 1987, Nielsen and Gissel-Nielsen 1975). While both models significantly ($p>0.001$) overestimated 100% of measured values, the closest estimates were generated using the model from Beyer et al. (1987; Fig. 16). Median (range) PD for estimates generated by the models from Beyer et al. (1987) and Nielsen and Gissel-Nielsen (1975) were -1.71 (-5.76 to -0.48) and -12.36 (-37.95 to -7.59), respectively.

Among conservative estimation methods, both the 90th percentile UF and the 95% UPL significantly overestimated concentrations in earthworms for all analytes except Ni (Table 10). [**Note:** methods and parameters for calculating the 95% UPL are presented in Appendix D]. The 95% UPL produced the best, conservative estimate (i.e., smallest negative median and range PD) for Cd, Cu, Hg, PCB, and Zn with percent overestimates ranging from 81% to 100% (Table 10). The best conservative estimates for concentrations of As and Pb in earthworms were generated by the 90th percentile UF. Neither method produced a good conservative estimate for Ni; percent overestimation did not exceed 50% for either method (Table 10). Because a regression model could not be fit for Cr, only the 90th percentile UF was available for this analyte.

3.3 FINAL UFs AND MODELS

Final UFs and regression models, incorporating data from both the "model" and "validation" datasets, were calculated for all analytes. UFs based on the combined dataset were, in general, similar to those based only on the "model" dataset (Table 11). UFs for all analytes, except As and Ni, were lognormally distributed. Median UFs for As, Cr, Cu, Mn, Pb, and Se were <1 while those for Cd, Hg, Zn, PCB, and TCDD were >1 (Table 11). However, for Ni, the median UF increased from 0.78 to 1.058 in the combined dataset.

With the exception of Ni and Hg, results of simple regression analyses differed little between the "model" and combined datasets. For Ni and Hg, significant model fits that had been obtained using the "model" dataset were not obtained with the combined dataset (Table 12). For Se, using all 14 available observations did not result in a significant fit (Table 12). However, by excluding a single outlying observation (see Fig. 16), a significant model fit was obtained (Table 12).

Among models that included soil pH, pH dropped out as a significant variable for Zn while entering as a contributor for Cd; for Ni the model fit was no longer significant (Table 13). For models that include soil Ca, soil Ca entered as a significant variable for Zn, while the chemical concentration in soil was significant for Cu and Mn (Table 14). In the multiple regression models that included both soil pH and Ca, soil pH and intercept dropped out as significant parameters for Cu and Pb, respectively, while soil Ca entered as significant for Zn (Table 15). In virtually all cases, r^2 values declined with the inclusion of the "validation" data in both the simple linear and multiple regression models.

In addition to the analytes represented in both the "model" and "validation" datasets, another 20 analytes were represented in the "validation" dataset but not in the "model" dataset. Summary statistics for UFs for these analytes and scatterplots for chemicals with 5 or more observations are presented in Appendix C, Table C-1 and Figs C-1 to C-4.

Table 10. Comparison of quality of conservative estimation methods as determined by the proportional deviation (PD) of the estimated values from measured values.

PD = (measured-estimate)/measured. Negative PD values indicate overestimates while positive PD values indicate underestimates.

		90th Percentile UF		Upper 95% Prediction Limit for Simple regression model	
Analyte	N	Median PD (range)	% Over Estimated	Median PD (range)	% Over Estimated
As	17	-4.78[a] (-92.53 to 0.43)	82	-11.95[c] (-195.78 to -0.29)	100
Cd	112	-12.80[c] (-259.89 to 0.29)	99	-19.39[c] (-155.63 to 0.33)	90
Cr	19	-3.02[a] (-40.89 to 0.76)	79		
Cu	94	-4.43[c] (-983.23 to 0.58)	99	-1.69[c] (-53.16 to 0.25)	97
Hg	15	-55.09[c] (-1008.09 to -0.85)	100	-13.81[c] (-54.82 to -0.56)	100
Mn	20	-3.22[c] (-12.18 to -0.30)	100	-2.50[b] (-10.27 to 0.42)	90
Ni	14	0.025[NS] (-49.02 to 0.76)	50	0.16[NS] (-3.64 to 0.99)	43
PCB	16	-12.43[c] (-145.84 to -0.0442)	100	-3.23[a] (-72.33 to 0.61)	81
Pb	126	-12.57[c] (-11362 to -0.006)	100	-20.74 [c] (-12021 to -0.36)	100
Zn	121	-7.71[c] (-788.29 to -1.10)	100	-2.49[c] (-37.65 to -0.09)	100

[NS] Estimate not significantly different from measured as determined by Wilcoxon signed-rank test.

[a] Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p < 0.05$.

[b] Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p < 0.01$.

[c] Estimate significantly different from measured as determined by Wilcoxon signed-rank test; $p < 0.001$.

Table 11. Summary statistics for literature-derived soil-earthworm UFs following inclusion of validation data

Analyte	N (Studies)	N (Observations)	Mean	Standard Deviation	Minimum	Median	90th Percentile	Maximum	Mean of Natural Log-transformed values	Standard Deviation of Natural Log-transformed values	Distribution
As	4	53	0.258	0.236	0.006	0.224	0.523	0.925	-1.913	1.232	normal
Cd	21	226	17.105	29.389	0.253	7.708	40.690	190.000	2.036	1.245	lognormal
Cr	6	67	1.099	1.987	0.021	0.306	3.162	11.416	-1.139	1.637	lognormal
Cu	16	197	0.754	0.804	0.002	0.515	1.531	5.492	-0.759	1.130	lognormal
Hg	5	30	5.231	8.896	0.030	1.693	20.625	33.000	0.171	2.044	lognormal
Mn	3	36	0.064	0.047	0.012	0.054	0.124	0.228	-2.986	0.708	lognormal
Ni	4	31	1.656	1.850	0.033	1.059	4.730	7.802	-0.251	1.515	normal
Pb	20	245	3.342	18.822	0.000	0.266	1.522	228.261	-1.181	1.723	lognormal
Se	1	14	1.798	3.325	0.300	0.985	1.340	13.733	-0.018	0.859	lognormal
Zn	20	244	5.766	8.415	0.025	3.201	12.885	49.510	0.909	1.501	lognormal
PCB	3	32	8.909	12.118	0.000	6.667	15.909	65.227	1.458	1.440	lognormal
TCDD	2	19	11.740	9.808	1.191	11.011	22.229	42.068	2.113	0.892	lognormal

Table 12. Results of regression of ln (earthworm) on ln (soil) following inclusion of validation data

	N	B0±SE	B1±SE	R^2	P model fit
As	53	-1.421±0.327^{c}	0.706±0.169^{c}	0.26	0.0001
Cd	226	2.114±0.079^{c}	0.795±0.037^{c}	0.67	0.0001
Cr	67	2.481±0.581^{c}	-0.067±0.165^{NS}	0.0026	0.68
Cu	197	1.675±0.141^{c}	0.264±0.040^{c}	0.18	0.0001
Hg	30	-0.684±0.198^{b}	0.118±0.089^{NS}	0.06	0.19
Mn	36	-0.809±1.121^{NS}	0.682±0.163^{c}	0.34	0.0002
Ni	31	3.677±0.635^{c}	-0.260±0.196^{NS}	0.06	0.19
Pb	245	-0.218±0.245^{NS}	0.807±0.044^{c}	0.58	0.0001
Se (w/ outlier)	14	0.346±0.291^{NS}	0.253±0.397^{NS}	0.03	0.53
Se (w/o outlier)	13	-0.075±0.194^{NS}	0.733±0.256^{a}	0.43	0.016
Zn	244	4.449±0.132^{c}	0.328±0.024^{c}	0.45	0.0001
PCB	31	1.410±0.210^{c}	1.361±0.088^{c}	0.89	0.0001
TCDD	19	3.533±0.810^{c}	1.182± 0.074^{c}	0.94	0.0001

model: ln(earthworm)=B0+B1(ln[soil])
^{NS} Not Significant: p>0.05.
^{a} p<0.05.
^{b} p<0.01.
^{c} p<0.001.

Table 13. Results of regression of ln (earthworm) on ln (soil)and pH following inclusion of validation data

Analyte	N	B0±SE	B1±SE	B2±SE	R^2	P model fit
As	47	-0.185±0.996^{NS}	0.993±0.171^{c}	-0.291±0.173^{NS}	0.43	0.0001
Cd	87	4.249±0.580^{c}	0.553±0.045^{c}	-0.237±0.095^{a}	0.64	0.0001
Cu	100	2.262±0.447^{c}	0.337±0.0580^{c}	-0.149±0.078^{NS}	0.26	0.0001
Ni	23	2.014±0.999^{NS}	-0.118±0.289^{NS}	0.229±0.126^{NS}	0.14	0.23
Pb	103	5.459±1.129^{c}	0.841±0.086^{c}	-0.975±0.194^{c}	0.51	0.0001
Zn	105	4.618±0.482^{c}	0.316±0.039^{c}	-0.006±0.079^{NS}	0.39	0.0001

model: ln(earthworm)=B0+B1(ln[soil])+B2(pH)
^{NS} Not Significant: p>0.05.
^{a} p<0.05.
^{b} p<0.01.
^{c} p<0.001.

Table 14. Results of regression of ln (earthworm) on ln (soil) and ln (soil Ca) following inclusion of validation data

Analyte	N	B0±SE	B1±SE	B2±SE	R^2	P model fit
Cd	73	6.154±0.707[c]	0.878±0.082[c]	-0.474±0.096[c]	0.72	0.0001
Cu	53	1.998±0.605[b]	0.248±0.120[a]	-0.062±0.111[NS]	0.13	0.027
Mn	32	1.139±1.793[NS]	0.528±0.179[b]	-0.113±0.117[NS]	0.3	0.006
Pb	67	-0.120±0.855[NS]	1.324±0.087[c]	-0.461±0.104[c]	0.79	0.0001
Zn	77	6.001±0.510[c]	0.532±0.073[c]	-0.359±0.097[c]	0.5	0.0001

model: ln(earthworm)=B0+B1(ln[soil])+B2(ln[soil Ca])
[NS] Not Significant: p>0.05.
[a] p<0.05.
[b] p<0.01.
[c] p<0.001.

Table 15. Results of regression of ln (earthworm) on ln (soil), ln (soil Ca), and pH following inclusion of validation data

Analyte	N	B0±SE	B1±SE	B2±SE	B3±SE	R^2	P model fit
Cd	42	6.435±1.316[c]	0.860±0.131[c]	-0.477±0.175[b]	-0.032±0.179[NS]	0.74	0.0001
Cu	44	2.022±1.011[NS]	0.498±0.154[b]	-0.128±0.135[NS]	-0.021±0.187[NS]	0.31	0.002
Pb	35	2.453±1.414[NS]	1.176±0.097[c]	0.055±0.173[NS]	-0.934±0.300[b]	0.88	0.0001
Zn	48	3.206±1.027[b]	0.814±0.114[b]	-0.865±0.190[c]	0.832±0.237[b]	0.63	0.0001

model: ln(earthworm)=B0+B1(ln[soil])+B2(ln[soil Ca])+B3(pH)
[NS] Not Significant: p>0.05.
[a] p<0.05.
[b] p<0.01.
[c] p<0.001.

4. DISCUSSION

In this study, we used published data to develop UFs and regression models to describe the bioaccumulation of 9 inorganic and 2 organic chemicals by earthworms from soil. Our UFs are comparable to other, independent UFs reported in the literature; mean UFs for 11 chemicals fell generally within the range of UFs developed in this study (Table 16). In some cases mean literature UFs are virtually identical to those derived in this study (e.g., Cd, Cu, Fe; Table 16). Mean UFs that fell outside the range derived in our study included Mn and V reported in Braunschweiler (1996) and Fe reported in Ma (1982; Table 16). It should be noted that the data available for UF development for these analytes in our study was limited. In the cases of Fe and V, data were restricted to a single study from one location, the ORR in Tennessee. Lack of comparability may relate to the fact that UFs were based on non-overlapping ranges of soil concentrations. For example, the range of Fe concentrations considered by Ma (1982) was <5,000 to ~50,000 mg/kg, while that in our study was 200 to 1800 mg/kg.

Table 16. Comparison of mean UFs reported in literature[a] to those from this study

	Reference						UFs from this study	
Analyte	Braunschweiler 1996	Emmerling et al. 1997	Pascoe et al. 1996	Hendriks et al. 1995	Spurgeon and Hopkins 1996	Ma 1982	Mean	Range
Al	0.011						0.053	0.008 - 0.20
As			0.162				0.258	0.006 - 0.93
Cd	9.7	36.5	3.78	9.6	23.43	42.2	17.12	0.253 - 190
Cr						0.072	1.1	0.02 - 11.4
Cu	0.76		0.132	0.31	0.74	0.867	0.75	0.002 - 5.2
Fe	0.038					0.203	0.038	0.006 - 0.1
Hg	1.2						5.23	0.03 - 33
Mn	0.29			0.11		0.177	0.064	0.012 - 0.23
Pb		0.38		0.089	0.28	0.932	3.34	0 - 228
Ni				0.13		0.346	1.66	0.033 - 7.8
V	0.12						0.039	0 - 0.088
Zn	3.4	4.8	0.544	1.8	2.08	16.117	5.77	0.025 - 49.5

[a] These studies were not used for model development because no raw data were presented. Only mean UFs were reported by the authors.

Regression models developed in our study are also comparable to others reported in the literature. Slopes from log-regression models for five chemicals obtained from four published studies generally fell within, or just outside of the 95% confidence limits for the slopes for simple regression models from our study (Table 17). The only exception to this rule is Ni, which is discussed in more detail in Table 17.

Table 17. Comparison of slopes from log-regression models from the literature to those from this study

Analyte	Spurgeon and Hopkin 1996	Corp and Morgan 1991	Ma et al. 1983	Neuhauser et al. 1995	This study		
					slope±SE	Lower 95% Confidence Limit	Upper 95% Confidence Limit
Cd	0.45	0.55	0.49	0.66	0.55±0.03	0.484	0.616
Cu	0.45	0.29	0.34	0.57	0.26±0.04	0.182	0.338
Ni				0.98	-1.58±0.31	-2.188	-0.972
Pb	0.64	0.64	0.99	0.74	0.8±0.04	0.714	0.886
Zn	0.22	0.29	0.24	0.27	0.24±0.02	0.193	0.287

Following model development, we used independent data, derived from the ORR and from published studies, to validate UFs and models produced in our study and by other researchers. Chemical concentrations in earthworms were best estimated by simple ln-ln regression models for 8 of 10 analytes (As, Cd, Cu, Hg, Mn, Pb, Zn, and PCB) for which models were developed and validation data were available. (It should be noted that the model that best estimated Cd concentrations in earthworms was from Neuhauser et al. (1995) and not the current study.) Exceptions were Cr and Ni, for which no estimation method worked well.

The observation that simple ln-ln regression models best fit the data indicates that the bioaccumulation of contaminants by earthworms decreases as soil concentrations increase. Similar conclusions are reported by Neuhauser et al. (1995). Mechanisms for this decrease in accumulation may include an increase in elimination rate as soil concentration increases or toxicity. Terhivuo et al. (1994) observed higher uptake rates for Pb among earthworms from uncontaminated sites than was observed for Pb-contaminated soils adjacent to a smelter. They suggest that while earthworms from uncontaminated areas are unable to regulate Pb uptake, earthworms residing in contaminated soils "acclimatize" and develop mechanisms to regulate Pb. Fordham and Wilber (1992) observed that bioaccumulation was lower while mortality was higher among earthworms in sewage-sludge-amended soils with increasing concentrations of Cd and Pb. An increase in toxicity at higher soil concentrations was suggested as a possible explanation for the decrease in accumulation.

In comparison to ln-ln regression models, the assumption implicit with UFs, that the rate of uptake is constant across all soil concentrations, is clearly not supported by the validation data. The results of our analysis argue for a shift away from the use of simplistic UFs and toward the application of more appropriate, biologically relevant models of bioaccumulation.

In a recent study, Abdul Rada and Bouche (1995) sampled and analyzed Cd, Cu, Ni, Pb, and Zn content in soil and earthworms from 186 locations across France. Although they used data similar to the published data we used (e.g., co-located soil and earthworm samples, strong acid extractions, and total chemical analysis), Abdul Rada and Bouche (1995) concluded that despite some correlation between soil analyses and chemical content in earthworms, contaminant levels in earthworms could not be predicted from concentrations in soil. The primary reason for this conclusion could be the lack of an adequately large range of soil concentrations. For example, in their study, maximum Cd and Pb concentrations were 8 and 9000 mg/kg, respectively. In contrast, our models for Cd and Pb were based on data with maximum soil concentrations of 467 and 24550 mg/kg, respectively. Development of models based on broader ranges of soil concentrations allows patterns of uptake to be observed that may not be evident across more narrow ranges of soil concentrations.

Other researchers have found that other soil parameters such as soil pH and soil Ca concentration may influence uptake of certain chemicals by earthworms. For example, Beyer et al. (1987) observed that, in addition to soil organic matter and Mg content, Pb uptake was inversely correlated to soil pH. Corp and Morgan (1991) also report an inverse relation between Pb uptake and pH. Pb uptake has also been found to be inversely correlated to soil Ca (Morris and Morgan 1986, Morgan and Morgan 1991). Ma (1987) observed that bioaccumulation of both Pb and Cd increased at lower pH. As would be expected, because data from these studies were included in our database, we obtained similar results.

However, while inclusion of these additional variables may help describe uptake of contaminants by earthworms, we found that their utility in predicting concentrations was marginal. Models that included soil Ca or both soil Ca and pH produced poorer estimates than the simple regression models. While models that included pH produced better estimates for As, Cd, and Cu, only for As was there a significant difference between simple and multiple regression estimates. Due to a limited number of observations in the "validation" dataset that possessed all the needed measurements, conclusions concerning the utility or lack thereof for these multiple regression models, however, must be viewed with caution. Additional validation of these models, using data representing more locations and soil conditions, is needed.

Available data indicate that Cr concentrations in earthworms are poorly predicted by soil Cr concentrations. The bioaccumulation of Cr is highly dependent on chemical species; Cr+6 is more bioavailable than Cr +3 (Eisler 1986). Because information concerning Cr species in soil was not available for any study considered and therefore was not included in models or UFs, the lack of fit we observed may be related to differences in Cr speciation in soil. Additional research focusing on the potential influence of Cr speciation on bioavailability and bioaccumulation in earthworms is needed.

Prediction of Ni concentrations in earthworms was also problematic. Available data are contradictory. For example, field data collected by Neuhauser et al. (1995) indicated a significant, positive relationship between soil Ni and concentrations in earthworm tissues. In contrast, no correlation between soil Ni and concentrations in earthworm tissues was observed by Abdul Rada and Bouche (1995) and Beyer et al. (1982), while combined data from other studies indicated a negative relationship (Neuhauser et al. 1995, this study). Neuhauser et al. (1995) attributes the lack of agreement among studies to the narrow ranges of soil Ni concentrations considered (most, including this one, are based on soil Ni of $\leq$60 mg/kg) or variability in depuration times. Our results also suggest that soil pH may influence Ni accumulation by earthworms. Despite producing estimates that differed significantly from measured values (Table 9), the distribution of estimates from the multiple regression model that included pH more closely reflect the distribution of measured values than estimates generated by any other method (Fig. 13). Additional research is needed to investigate the influence of soil pH on bioaccumulation of Ni by earthworms.

The models and UFs we developed are very generalized, representing multiple earthworm species, seasons, and soil types and characteristics. Contaminant uptake has been shown to differ by earthworm species (Morgan and Morgan 1993, Terhivuo et al. 1994, Spurgeon and Hopkins 1996). Contaminant uptake may also differ seasonally. Morgan and Morgan (1993) report Cd and Zn concentrations to be lower during diapause than in "active" worms. Bengtsson and Rundgren (1992) observed lower uptake rates for Pb during winter. Similar seasonal variation in contaminant concentration in earthworm tissues is reported by Braunsweiler (1996). As a consequence of the generalized nature of the UFs and

models, uncertainty associated with estimates generated for a given location may be high. Uncertainty associated with estimated concentrations in earthworms could be reduced if future models are developed to incorporate these sources of variation.

Co-occurring chemicals in soil may also influence bioaccumulation. For example, Beyer et al. (1982) observed that while soil Cd accounted for 87% of the variability of Cd in earthworms, inclusion of Zn in the model significantly improved the model fit and accounted for an additional 5% of variability. Soil Zn was negatively correlated with Cd in worms. Other regression models developed by Beyer et al. (1987) indicate that Cu concentrations in earthworms are a function of decreasing soil Ca and increasing soil K, and that Se concentrations in earthworms are a function of increasing Ca in soil. In neither case did Cu or Se contribute significantly to explaining bioaccumulation. Because multiple analytes are present at most contaminated sites, uncertainty may be reduced by incorporating multiple analytes in bioaccumulation models.

5. RECOMMENDATIONS

In the context of an ecological risk assessment, the best data to use to estimate bioaccumulation of contaminants in soil by earthworms will always be site-specific data. Ideally, earthworms should be collected from multiple areas within the contaminated site and from reference areas (preferably at locations where soil samples are also collected), and analyses for contaminants of concern in earthworm tissue should be performed. In the absence of site-specific data, UFs or models should be used.

Because the available data indicate that bioaccumulation by earthworms is non-linear, decreasing as soil concentration increases, and UFs implicitly assume that accumulation is linear and constant across all soil concentrations, the use of log-linear regression models to estimate earthworm bioaccumulation is recommended. For applications where conservative estimates are desired, such as screening ecological risk assessments, the 95% UPL for the simple regression is recommended. Methods and parameters for calculating the 95% UPL are presented in Appendix D. In general, because they are based on a larger, more robust dataset, the regression models and UFs from the combined datasets (Tables 11 through 15) should be used. Due to the uncertainties associated with the models, it is highly recommended that users perform uncertainty analyses. It should be noted that, because the models incorporate data from multiple sites and species, as well as multiple studies, these calculated uncertainties would represent variance among sites and combinations of species and not simply lack of knowledge (i.e., true uncertainty). Contaminant-specific recommendations and justifications are outlined in Table 18.

Table 18. Recommended application of bioaccumulation models. All recommendations are from the combined validation dataset unless otherwise noted

Analyte	For general estimates	For conservative estimates
As	simple regression or multiple regression that includes pH	90th percentile UF
Cd	simple regression or model from Neuhauser et al. (1995)	95% UPL
Cr	None[a]	90th percentile UF
Cu	simple regression	95% UPL
Hg	simple regression based on model data [b]	95% UPL
Mn	simple regression	95% UPL
Ni	None [a]	90th percentile UF
Pb	simple regression	90th percentile UF
Se	simple regression with outlyer removed [c]	95% UPL
Zn	simple regression	95% UPL
PCB	simple regression	95% UPL
TCDD	simple regression	95% UPL

Table 18. (cont.)

Analyte	For general estimates	For conservative estimates
Analytes in Appendix C	median UF [d]	90th percentile UF[d]

[a] None recommended because no method accurately predicted bioaccumulation.
[b] Recommended because addition of validation data resulted in non-significant model.
[c] Recommended because significant model fit was obtained with outlying value removed.
[d] Recommended because regression analyses were not performed.

6. REFERENCES

Abdul Rada, A. M. M., and M. B. Bouche. 1995. "Earthworm contribution to ecotoxicological assessments." *Acta Zool. Fennica.* 196: 307-310

Andersen, C. 1979. "Cadmium, lead, and calcium content, number and biomass, in earthworms (Lumbricidae) from sewage sludge treated soil." *Pedobiologia* 19: 309-319.

Andersen, C., and J. Laursen. 1982. "Distribution of heavy metals in *Lumbricus terrestris, Aporrectodea longa*, and *A. rosea* measured by atomic absorption and x-ray fluorescence spectrometry." *Pedobiologia* 24: 347-356.

Beyer, W. N., and E. J. Cromartie. 1987. "A survey of Pb, Cu, Zn, Cd, Cr, As, and Se in earthworms and soil from diverse sites." *Environ. Monit. Assess*. 8: 27-36.

Beyer, W. N., R. L. Chaney, and B. M. Mulhern. 1982. "Heavy metal concentration in earthworms from soil amended with sewage sludge." *J. Environ. Qual*. 11: 381-385.

Beyer, W. N., O. H. Pattee, L. Sileo, D. J. Hoffman, and B. M. Mulhern. 1985. "Metal contamination in wildlife living near two zinc smelters." *Environ. Pollut.* (Series A) 38:63-86.

Beyer, W. N., G. Hensler, and J. Moore. 1987. "Relation of pH and other soil variables to concentrations of Pb, Cu, Zn, and Se in earthworms." *Pedobiologia.* 30: 167-172.

Bengtsson, G., and S. Rundgren. 1992. "Seasonal variation of lead uptake in the earthworm *Lumbricus terrestris* and the influence of soil liming and acidification." *Arch. Environ. Contam. Toxicol.* 23: 198-205.

Braunschweiler, H. 1996. "Seasonal variation in the content of metals in the earthworm *Dendrobaena octaedra* (Sav.) In Finnish forest soils." *Acta Zool. Fenn.* 196: 314-317

Bull, K. R., R. D. Roberts, M. J. Inskip, G. T. Goodman. 1977. "Mercury concentrations in soil, grass, earthworms and small mammals near an industrial emission source." *Environ. Poll.* 12: 135-140.

Carter, A. 1983. "Cadmium, copper, and zinc in soil animals and their food in a red clover system." *Can. J. Zool.* 61: 2751-2757.

Corp, N. and A. J. Morgan. 1991. "Accumulation of heavy metals from polluted soils by the earthworm, *Lumbricus rubellus*: can laboratory exposure of "control" worms reduce biomonitoring problems?" *Environ. Pollut.* 74: 39-52.

Czarnowska, K., and K. Jopkiewicz. 1978. "Heavy metals in earthworms as an index of soil contamination." *Polish J. Soil Sci.* 11: 57-62.

Diercxsens, P. And D. de Weck, N. Borsinger, B. Rosset, and J. Tarradellas. 1985. "Earthworm contamination by PCBs and heavy metals." *Chemosphere*. 14: 511-522.

Dowdy, S., and S. Wearden. 1983. *Statistics for Research.* John Wiley and Sons, New York.

Draper, N., and H. Smith. 1981. *Applied Regression Analysis.* John Wiley and Sons. New York. 709 pp.

Efroymson, R., B. L. Jackson, D. S. Jones, B. E. Sample, G. W. Suter II and C. J. E. Welsh. 1996. *Waste Area Grouping 2 Phase I Task Data Report and White Oak Creek Watershed Screening Ecological Risk Assessment*. ORNL/ER-366. Oak Ridge National Laboratory, Oak Ridge, TN.

Efroymson, R., B. E. Sample, G. W. Suter, II, and T. L. Ashwood. 1997. *Soil-Plant Contaminant Uptake Factors: Review and Recommendations for the Oak Ridge Reservation.* ES/ER/TM-198. Oak Ridge National Laboratory, Oak Ridge, TN.

Eisler, R. 1986. "Chromium hazards to fish, wildlife, and invertebrates: a synoptic review." *U.S. Fish and Wildlife Serv. Biol. Rept.* 85(1.6). 60 pp.

Emmerling, C., K. Krause, and D. Schroder. 1997. "The use of earthworms in monitoring soil pollution by heavy metals." *Z. Pflanzenernahr. Bodenk.* 160: 33-39.

EPA (U. S. Environmental Protection Agency). 1993. "Wildlife Exposure Factors Handbook." Volume I. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

ERT. 1987. *Land treatment effects on wildlife populations in red pine plantations: Final Report*. Prepared for Nekoosa Papers, Inc. 160 pp.

Fischer, E., and L. Koszorus. 1992. "Sublethal effects, accumulation capacities and elimination rates of As, Hg, and Se in the manure room, *Eisenia fetida* (Oligochaeta, Lumbricidae)." *Pedobiologia* 36: 172-178.

Fordham, C. L., and C. G. Wilber. 1992. "Effects of composted sewage sludge on the earthworm *Lumbricus terrestris*." pp. 238-244. In: *Ecotoxicology of Earthworms,* ed. P.W. Grieg-Smith, H. Becker, P.J. Edwards, and R.Heimbach. Intercept, LTD., Andover, UK.

Gish, C. D., and R. E. Christensen. 1973. "Cadmium, nickel, lead, and zinc in earthworms from roadside soil." *Environ. Sci. Technol.* 7: 1060-1062.

Helmke, P. A., W. P. Robarge, R. L. Korotev, and P. J. Schomberg. 1979. "Effects of soil-applied sewage sludge on concentrations of elements in earthworms." *J. Environ. Qual.* 8: 322-327.

Hendriks, A. J., W.-C. Ma, J. J. Brouns, E. M. de Ruiter-Dijkman, and R. Gast. 1995. "Modelling and monitoring organochlorine and heavy metal accumulation in soils, earthworms, and shrews in Rhine-Delta floodplains." *Arch. Environ. Contam. Toxicol.* 29: 115-127.

Ireland, M. P. 1975. "Metal content of *Dendrobaena rubida* (Oligochaeta) in a base metal mining area." *Oikos* 26: 74-79.

Ireland, M. P. 1979. "Metal accumulation by the earthworms *Lumbricus rubellus, Dendrobaena venata,* and *Eiseniella tetraedra* living in heavy metal polluted sites." *Environ. Poll.* 19: 201-206.

Jones, D. S., R. A. Efroymson, C. Hadden, B. L. Jackson, B. E. Sample, G. W. Suter, II, and C. J. E. Welsh 1996. *Report on the Remedial Investigation of Bear Creek Valley at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Vol. 6 Appendix G - Baseline Ecological Risk Assessment Report and Vol. 1 Chapter 6 - Baseline Ecological Risk Assessment*. DOE/OR/01-1455/V1 and V6&D1. Oak Ridge National Laboratory, Oak Ridge, TN.

Jones, D. S., B. E. Sample, and G. W. Suter, II. 1997. *Biota-sediment accumulation factors for invertebrates: review and recommendations for the Oak Ridge Reservation*. ES/ER/TM-214. Oak Ridge National Laboratory, Oak Ridge, TN.

Kreis, B., P. Edwards, G. Cuendet, and J. Tarrdellas. 1987. "The dynamics of PCBs between earthworm populations and agricultural soils." *Pedobiologia* 30: 379-388.

Ma, W.-C. 1982. "The influence of soil properties and worm-related factors on the concentration of heavy metals in earthworms." *Pedobiologia* 24: 109-119.

Ma, W.-C. 1987. "Heavy metal accumulation in the mole, *Talpa euorpa*, and earthworms as an indicator of metal bioavailability in terrestrial environments." *Bull. Environ. Contam. Toxicol.* 39: 933-938.

Ma, W., T. Edelman, I. van Beersum, and T. Jans. 1983. "Uptake of cadmium, zinc, lead, and copper by earthworms near a zinc-smelting complex: influence of soil pH and organic matter." *Bull. Environ. Contam. Toxicol.* 30: 424-427.

Marino, F., A. Ligero, and D. J. Diaz Cosin. 1992. "Heavy metals and earthworms on the border of a road next to Santiago (Galicia, Northwest of Spain). Initial results." *Soil Biol. Biochem.* 24: 1705-1709.

Martinucci, G. B., P. Crespi, P. Omodeo, G. Osella, and G. Traldi. 1983. *Earthworms and TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin) in Seveso*. pp 275-283 in J. E. Satchell, ed. Earthworm Ecology. Chapman and Hall, NY. 495 pp.

Morgan, J. E., and A. J. Morgan. 1990. "The distribution of cadmium, copper, lead, zinc, and calcium in the tissues of the earthworm *Lumbricus rubellus* sampled from one uncontaminated and four polluted soils." *Oecologia.* 84: 559-566.

Morgan, J. E., and A. J. Morgan. 1991. "Differences in the accumulated metal concentrations in two epigeic earthworm species (*Lumbricus rubellus* and *Dendrodrilus rubidus*) living in contaminated soils." *Bull. Environ. Contam. Toxicol.* 47: 296-301.

Morgan, J. E., and A. J. Morgan. 1993. "Seasonal changes in the tissue-metal (Cd, Zn, and Pb) concentrations in two ecophysiologically dissimilar earthworm species: pollution-monitoring implications." *Environ. Pollut.* 82: 1-7.

Morgan, A. J., and B. Morris. 1982. "The accumulation and intracellular compartmentation of cadmium, lead, zinc, and calcium in two earthworm species (*Dendrobaena rubida* and *Lumbricus rubellus*) living in highly contaminated soil." *Histochemistry* 75: 269-285.

Morris, B., and A. J. Morgan. 1986. “Calcium-lead interactions in earthworms: observations on *Lumbricus terrestris* L. sampled from a calcareous abandoned lead mine site.” *Bull. Environ. Contam. Toxicol.* 37: 226-233.

Neuhauser, E. F., Z. V. Cukic, M. R. Malecki, R. C. Loehr, and P. R. Durkin. 1995. “Bioconcentration and biokinetics of heavy metals in the earthworm.” *Environ. Poll.* 89: 293-301.

Nielsen, M. G., and G. Gissel-Nielsen. 1975. “Selenium in soil animal relationships.” *Pedobiologia* 15: 65-67.

Palisades Corp. 1994. @RISK: *Risk analysis for spreadsheets.* Palisade Corporation, Newfield, NY. 302 pp.

Pascoe, G. A., R. J. Blanchet, and G. Linder. 1996. “Food chain analysis of exposures and risks to wildlife at a metals-contaminated wetland.” *Arch. Environ. Contam. Toxicol.* 30: 306-318.

Pietz, R. I., J. R. Peterson, J. E. Prater, and D. R. Zenz. 1984. “Metal concentrations in earthworms from sewage sludge amended soils at a strip mine reclamation site.” *J. Environ. Qual.* 13: 651-654.

Pizl, V., and G. Josens. 1995. “Earthworm communities along a gradient of urbanization.” *Environ. Poll.* 90:7-14.

Sample, B. E., J. Beauchamp, R. Efroymson, G. W. Suter, II, and T.L. Ashwood. 1997. *Development and Validation of Literature-based Bioaccumulation Models for Small Mammals.* ES/ER/TM-219. Oak Ridge National Laboratory, Oak Ridge, TN.

SAS Inst. Inc. 1988a. *SAS Procedures Guide, Release 6.03 Edition.* SAS Institute Inc., Cary, NC. 441 pp.

SAS Inst. Inc. 1988b. *SAS/STAT User’s Guide, Release 6.03 Edition*. SAS Institute Inc., Cary, NC 1028 pp.

Spurgeon, D. J., and S. P. Hopkins. 1996. “Risk assessment of the threat of secondary poisoning by metals to predators of earthworms in the vicinity of a primary smelting works.” *Sci. Total. Environ.* 187: 167-183.

Talmage, S. S., and B. T. Walton. 1993. “Food chain transfer and potential renal toxicity of mercury to small mammals at a contaminated terrestrial field site.” *Ecotoxicology* 2: 243-256.

Terhivuo, J., E. Pankakoski, H. Hyvarinen, and I. Koivisto. 1994. “Pb uptake by ecologically dissimilar earthworm (Lumbricidae) species near a lead smelter in south Finland.” *Environ. Pollut.* 85: 87-96.

van Hook, R. I. 1974. “Cadmium, lead, and zinc distributions between earthworms and soils: potentials for biological accumulation.” *Bull. Environ. Contam. Toxicol.* 12:509-512.

van Rhee, J. A. 1977. “Effects of soil pollution on earthworms.” *Pedobiologia* 17: 201-208.

Yeates, G. W., V. A. Orchard, T. W. Speir, J. L. Hunt, and M. C. C. Hermans. 1994. “Impact of pasture contamination by copper, chromium, and arsenic timber preservative on soil biological activity.” *Biol. Fert. Soils.* 18: 200-208.

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Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation

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PREFACE

The purpose of this report is to acquire contaminant uptake data from published and unpublished literature, develop and present biota-sediment accumulation factors and regression equations for estimating chemical concentrations in benthic invertebrates for use on the Oak Ridge Reservation, and compare these to contaminant uptake data for emergent adult insects. This work was performed under Work break down Structure 1.4.12.2.3.04.05.03 (Activity Data Sheet 8304). The equations and biota-sediment accumulation factors presented in this report will facilitate the estimation of contaminant exposure experienced by wildlife consuming flying insects on the Oak Ridge Reservation. This report also provides a foundation for the process of developing body burden benchmarks for effects to benthic invertebrates and biota-sediment accumulation factors for fish. This report was originally issued as a draft under number ES/ER/TM-214.

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EXECUTIVE SUMMARY

Benthic invertebrates, fish, and flying insectivores are important assessment endpoints for the evaluation of ecological risks at aquatic sites on and near the Oak Ridge Reservation. One of the primary exposure pathways for these organisms is the consumption of contaminated food. Deposited sediments often act as a local sink for contaminants, which may increase the contaminant exposure for sediment-associated biota that indiscriminately ingest sediment particles while foraging. Benthic invertebrates are an important food source for fish and some terrestrial wildlife. Flying insectivores such as swifts, swallows, and bats, including the threatened and endangered grey bat, forage over water and consume adult insects that have aquatic larval stages (e.g., mayflies and midges). Therefore, larval infauna can be an important vector for the movement of chemicals out of sediment deposits and into the water column and terrestrial foodchains.

The simplest method for estimating contaminant loads in biota is the use of accumulation factors (AFS). AFs consist of ratios of the concentration of a given contaminant in biota to that in an abiotic medium. For the evaluation of sediments, this is commonly presented as the biota-sediment accumulation factor (BSAF). The concentration in biota may be estimated by multiplying the sediment concentration by the BSAF. This method is particularly useful for ecological risk assessments because ambient media concentrations are usually available; ambient media data are needed for the site characterization and human health assessments typically conducted in conjunction with ecological assessments. Concentrations in most biota are used only for the ecological risk assessment and are frequently not available, especially for screening level assessments. Separate BSAFs are required for each chemical because they are empirically derived, rather than based on general physico-chemical parameters. Bioavailability of contaminants for uptake can be influenced by sediment conditions including the pH and the amount of acid-volatile-sulfide that is available for complexing with divalent metals (e.g., Cd, Cu, Pb, Ni, and Zn).

The purpose of this report is to acquire contaminant uptake data from published and unpublished literature, develop and present BSAFs and regression equations for estimating chemical concentrations in benthic invertebrates for use on the Oak Ridge Reservation, and compare these to contaminant uptake data for emergent adult insects. The equations and BSAFs presented in this report will facilitate the estimation of contaminant exposure experienced by wildlife consuming flying insects on the Oak Ridge Reservation. This report also provides a foundation for the process of developing body burden benchmarks for effects to benthic invertebrates and BSAFs for fish.

1. INTRODUCTION

Benthic invertebrates, fish, and flying insectivores are important assessment endpoints for the evaluation of ecological risks at aquatic sites on and near the ORR. One of the primary exposure pathways for these organisms is the consumption of contaminated food. Deposited sediments often act as a local sink for contaminants, which may increase the contaminant exposure for sediment-associated biota that indiscriminately ingest sediment particles while foraging. Benthic invertebrates are an important food source for fish and some terrestrial wildlife. Flying insectivores such as swifts, swallows, and bats, including the Threatened and Endangered grey bat, forage over water and consume adult insects which have aquatic larval stages (e.g., mayflies and midges). Hence, larval infauna can be an important vector for the movement of chemicals out of sediment deposits and into the water column and terrestrial foodchains(Currie et al. 1997, Froese et al. 1998, and Larsson 1984)

Concentrations of bioavailable contaminants in sediment are needed to evaluate foodchain transfer and the potential toxicity of sediment contaminants. The bioavailable fraction can be measured directly by collecting and analyzing benthic invertebrates or it can be estimated. Contaminant concentrations in flying insects are needed to estimate the magnitude of contaminant exposure that flying insectivores may experience at a contaminated site. These concentrations also may be acquired either by direct measurement of contaminants in flying insects or by estimation. Direct measurement is the preferred approach because it contributes the least uncertainty to exposure estimates. That is, it provides information on the actual contaminant loading in on-site biota. However, direct measurement of contaminant concentrations in biota may not be feasible because of a lack time, personnel, or finances to support field sampling. When direct measurement of contaminants in biota is not possible, estimation is the only alternative.

Contaminant concentrations in biota may be estimated using a variety of methods, ranging from complex mechanistic process models to simple accumulation factors. While mechanistic process models for the estimation of contaminant concentrations in biota may give more accurate estimates, they require information which is not generally available for a risk assessment. An example of a mechanistic contaminant uptake model for fish is presented in Thomann et al. (1992).

The simplest method for estimation of contaminant loads in biota is the use of accumulation factors (AFs). AFs consist of ratios of the concentration of a given contaminant in biota to that in an abiotic medium. For the evaluation of sediments this is commonly presented as the biota-sediment accumulation factor (BSAF). The concentration in biota may be estimated by multiplying the sediment concentration by the BSAF. This method is particularly useful for ecological risk assessments because ambient media concentrations are usually available; ambient media data are needed for the site characterization and human health assessments typically conducted in conjunction with ecological assessments. Concentrations in most biota are used only for the ecological risk assessment and are frequently not available, especially for screening level assessments. Separate BSAFs are required for each chemical because they are empirically derived, rather than being based on generalizable physico-chemical parameters. Bioavailability of contaminants for uptake can be influenced by sediment conditions including the pH and the amount of acid-volatile-sulfide (AVS) that is available for complexing with divalent metals (i.e., Cd, Cu, Pb, Ni, and Zn).

The use of uptake factors, including BSAFs, depends on the assumption that the concentration of chemicals in organisms is a linear no threshold function of the concentration in sediment. This

will not be the case if uptake or depuration of the chemical in question is well-regulated by the organism, either because it is an essential nutrient or because it is a toxicant for which the organism has inducible mechanisms for metabolism or excretion. Well regulated chemicals will have nearly constant concentrations regardless of sediment concentrations, at least within the effective concentration range for the regulating mechanism. Various complex patterns also are possible due to lack of induction at low concentrations, saturation kinetics at high concentrations, toxicity at high concentrations, or other processes. Despite these conditions that lead to violation of the assumptions, accumulation factors are commonly used in risk assessments.

The purpose of this report is to acquire contaminant uptake data from published and unpublished literature, develop and present BSAFs and regression equations for estimating chemical concentrations in benthic invertebrates for use on the ORR, and compare these to contaminant uptake data for emergent adult insects. Sediment to emergent adult BSAFs and regression equations also are included if sufficient data are available (i.e., PCBs). The equations and BSAFs presented in this report will facilitate the estimation of contaminant exposure experienced by wildlife consuming flying insects on the ORR. This report also provides a foundation for the process of developing body burden benchmarks for effects to benthic invertebrates and BSAFs for fish.

2. MATERIALS AND METHODS

2.1. LITERATURE REVIEW

To determine how contaminant uptake varies across locations, contaminant levels, and sediment conditions, we performed a literature search for studies reporting chemical concentrations in co-located sediment and invertebrate samples. Literature was reviewed for eight chemicals: arsenic, cadmium, chromium, copper, mercury, lead, nickel, zinc, and PCBs (Table 1). Sediment and invertebrate contaminant concentration data were extracted from each paper and used to calculate an accumulation factor.

Data were recorded for freshwater invertebrates, with particular emphasis on invertebrates that have terrestrial adult life stages (e.g., mayflies) or are generally consumed by fish (e.g., amphipods and tubificid worms). Data for marine and estuarine biota were not included in this evaluation. BSAFs and regression equations for metals were calculated on a dry weight basis. Biota concentrations reported in the literature only on a wet weight basis (e.g., mg Cu/kg fresh tissue) were included only if a wet-weight to dry-weight conversion factor also was presented. For PCBs, the BSAFs and regression equations were derived using sediment concentrations normalized to organic carbon content (e.g., ug PCB/g organic carbon) and organism concentrations normalized to lipid content (e.g., ug PCB/g lipid). Reported PCB concentrations were included only if organic carbon and lipid content values were presented. Biota concentrations presented only on a per organism basis (e.g., mg Cu/individual) were not included. Some studies were designed to elucidate mechanisms of uptake by using non-standard extraction methods. Only the results for methods typically used in environmental assessments

Table 1. Summary of Sources for Sediment and Invertebrate Concentration Data

Analytes	Study Locations	No. Sample Locations	Organisms	Depurated	Reference
			Benthic Organisms		
Cd, Cr, Cu, Ni, Pb, Zn	Wisconsin	3	Oligochaetes (*Lumbriculus variegatus)*	Yes	Ankley et at. 1944
Cd, Hg	Upper Miss. River	12	Mayfly (*Hexagenia spp.*)	No	Beauvais et al. 1995
Cu, Pb, Zn	Salmon River	2	Oligochaetes (*Limnodrilus hoffmeistri, Tubifex tubifex*)	Yes	Bindra & Hall 1977, cited in Chapman et al. 1979
As, Cd, Cu, Pb, Zn	Montana	9	Caddisfly, Mayfly, Stonefly, Hemiptera (Various species)	No	Cain et al. 1992
Cd, Cu, Pb	Montana	5	Caddisfly, Stonefly (Various species)	Yes	Cain et al. 1995
Cd	East River, Pequayman Lake, West Bearskin Lake	9	Oligochaetes (*Lumbriculus variegatus*)	Yes	Carlson et al. 1991
Cu, Hg, Ni, Pb, Zn	Canada	2	Oligochaetes (*Limnodrilus hoffmeistri, Tubifex tubifex*)	Yes	Chapman et al. 1979
As, Cd, Cu, Hg, Pb, Zn	S. Africa	1	Oligochaetes & Composite	No	Greichus et al. 1978
As, Cd, Cu, Zn	Quebec	1	Mayfly (*Hexagenia limbata*)	Yes	Hare et al. 1989
Cd, Cu, Zn	Quebec	3	Alderfly, Mayfly, Phantom midge, and Midge (*Sialis spp., Hexagenia limbata, Chaorobus punctipennis, Chironomus sp., Glyptotendipes sp., Procladius spp.*)	Yes	Hare & Campbell 1992
Cd, Cu, Pb, Zn	Laboratory[a]	2	Midge (*Chironomus tentans*)	No	Harrahy & Clements 1997
As, Cd, Cu, Pb, Zn	Montana	7	Amphipod (*Hyallela azteca*)	No	Ingersoll et al. 1994

Table 1. (Continued)

Analytes	Study Locations	No. Sample Locations	Organisms	Depurated	Reference
Cd, Cr, Cu, Ni, Pb, Zn	Maryland	20	Dragonfly (Various species) & Composite[b]	No	Karouna-Renier 1995; MS Thesis
As, Cd, Cr, Cu, Ni, Pb, Zn	Lake Ontario	5	Oligochaetes	Yes	Krantzberg 1994
Pb	Illinois	3	Damselfly, Mayfly, Midge, Moth Flies, Oligochaetes (Anisoptera, Hexagenia limbata, Chirnomidae, Psychodidae, Tubificidae and Oligochaeta)	No	Leland & McNurney 1974
Cd, Cr, Cu, Ni, Pb, Zn	Illinois	1	Oligochaetes (*Limnodrilus hoffmeistri, Tubifex tubifex*)	No	Mathis & Cummings 1973
Cu, Pb, Zn	Oklahoma	1	Composite[b]	No	Namminga et al. 1974
As, Cd, Cu, Pb, Zn	Montana	6	Composite[b]	No	Poulton et al. 1995
Cr, Zn	North Carolina	8	Composite[b]	No	Shuman et al. 1977
Cd, Cu, Pb, Zn	Netherlands	1	Amphipod, Caddisfly, Dragonfly, Hemiptera, Isopod, Midge (Various species)	Yes	Timmermans et al. 1989
PCBs	Wisconsin	1	Oligochaetes (*Lumbriculus sp.* and *Lumbriculus variegatus*)	N/A[c]	Ankley et al. 1992
PCBs	Michigan	1	Mayfly (*Hexagenia limbata*)	N/A[c]	Drouillard et al. 1996
PCBs	Ontario	1	Mayfly (*Hexagenia limbata*)	N/A[c]	Gobas et al. 1989
PCBs	Lake Erie	1	Zebra mussel, Caddisfly, Amphipod, and Crayfish (*Dreissena polymorpha, Hydropsyche alterans, Gammarus fasciatus, and Orconectec propinquus*)	N/A[c]	Morrison et al. 1996

Table 1. (Continued)

Analytes	Study Locations	No. Sample Locations	Organisms	Depurated	Reference
PCBs	Lake Ontario	6	Oligochaetes (*Limnodrilus hoffmeistri and Tubifex tubifex*)	N/A[c]	Oliver 1987
PCBs	Netherlands	1	Mollusc and Crustaceans (*Dreisena polymorpha* and various species)	N/A[c]	van der Oost et al. 1988
			Emergent Adults		
Cd	Ontario	1	Dragonfly and Mayfly (*Odonata spp. And Hexagenia spp.*)	N/A[d]	Currie et al. 1997
As, Pb, Hg, Zn	Tennessee	3	Mayfly (*Hexegenia rigida*)	N/A[d]	Department of Energy 1996
Cd, Cu, Zn	Michigan	2	Midge (Chironomidae spp.)	N/A[d]	Young and Harvey 1988
PCBs	Michigan	1	Emergent Insects (Various species)	N/A[d]	Froese et al. 1998
PCBs	Laboratory[a]	9	Midge (*Chironomus plumosus*)	N/A[d]	Larsson 1984

[a] Results from a spiked-sediment bioassay.
[b] Composite of various benthic invertebrates analyzed together
[c] Not Applicable for analyses of PCBs, which are normalized to the organism lipid content.
[d] Not applicable to analyses of emergent adults.

(e.g., hot acid extraction of sediment metals) were used from such studies. Unfortunately, many potentially useful studies had to be eliminated for the aforementioned reasons.

Metal concentrations in biota were recorded as "depurated" for organisms that were allowed to purge their gut contents in clean water or sediment or were dissected to remove their gut contents. Biota concentrations that included gut contents were recorded as "Non-Depurated." Gut contents are presumed to be a negligible source of error for lipid-normalized organic chemical concentrations and were not explicitly accounted for in this evaluation.

Other relevant sediment and biota characteristics also were recorded. Sediment characteristics included percent sand, silt, and clay; percent organic carbon content; AVS and simultaneously extracted metal (SEM) concentrations; and interstitial water concentrations. Biota characteristics included the scientific and common name; life stages analyzed (larvae, pupae, or adult); feeding behavior (water column filter feeders, sediment ingesters, etc.); organism habits and habitats (e.g., burrowing in sediment depositional areas); and concurrently measured adverse effects (e.g., survival or density). These sediment and biota characteristics were recorded for future use and were not explicitly incorporated into the current evaluation.

2.2. MODEL DEVELOPMENT

2.2.1 Metals

BSAFs were calculated for each analyte, site, and species combination reported in a given study. Replicate sediment and biota measurements for a site and species combination were averaged together. Most of the available studies reported uptake from a limited number of locations or represented only a small range of sediment concentrations. However, a broad range of sediment concentrations are needed to best evaluate the relationship between concentrations of contaminants in sediment and those in benthic invertebrates. To that end, biota and sediment concentrations and the resulting BSAFs for each analyte were placed in one of two groups: those for which depurated organisms were analyzed ("Depurated") and those for which undepurated organisms were analyzed ("Non-Depurated"). BSAFs and accumulation models were subsequently developed for each group independently and for the entire data set ("All").

Summary statistics were calculated for BSAFs for each chemical and data set combination. The Shapiro-Wilk test (PROC UNIVARIATE; SAS Inst. Inc. 1988a) was applied to the untransformed and log-transformed BSAFs for each analyte to determine if the distribution of the BSAFs was normal or log-normal, respectively. Distributions were fit only for data sets with four or more BSAFs. A uniform distribution (i.e., all values are equally likely) was assumed if there were fewer than four BSAFs.

Regression analyses of the sediment and biota data also were performed for each chemical and data set combination. Because data concerning the number of individuals included in composites or means were not available for all observations, no weighting of observations was applied. Data were evaluated graphically and considered to be best fit by a power model. This is consistent with evaluations reported elsewhere (Sample et al. 1997). The power model of the form

$$y = a(x)^b \quad (1)$$

was linearized for the regression analyses by log-transforming the sediment and biota concentrations. The transformed model is:

$$\log(y) = a' + b \log(x). \quad (2)$$

where:

y = chemical concentration in the organism (mg/kg dry wt.)
x = chemical concentration in sediment (mg/kg dry wt.)
a' = log-transformed y intercept
b = slope

2.2.2 PCBs

BSAFs were calculated for each site and species combination reported in a given study. Replicate measurements for a site and species combination were averaged together. Most of the available studies were designed to evaluate the uptake of non-ionic organic chemicals relative to chemical-specific characteristics (e.g., the organic carbon-partitioning coefficient). Such studies generally presented concentrations of individual congeners. The reported coongener concentrations were summed to obtain a total PCB concentration, because congener-specific data are not typically available for screening ecological risk assessments.

Summary statistics were generated for the PCB BSAFs. As with the BSAFs for metals, the Shapiro-Wilk test (PROC UNIVARIATE; SAS Inst. Inc. 1988a) was applied to the untransformed and log-transformed BSAFs to determine if the distribution of the BSAFs was normal or log-normal, respectively.

Regression analyses of the sediment and biota data also were performed for PCBs using the linearized power model (Eq. 2). Where "y" is the PCB concentration in the organism (ug/g lipid) and "x" is the PCB concentration in sediment (ug/g organic carbon)

2.3 VALIDATION

BSAFs and regression models developed from the benthos data were applied to the sediment concentration data in the validation dataset, and estimated contaminant concentrations in emergent adult insects were generated. "Most likely" estimates were generated using the median BSAF and the regression model. Conservative estimates for use in screening assessments were generated using the 90th percentile BSAF and the upper 95% prediction limit (95% UPL) for the regression models. The 95% UPL was calculated according to Dowdy and Wearden (1983) [Note: methods and parameters for calculating the 95% UPL are presented in Appendix A].

The appropriateness and accuracy of the estimation methods was evaluated for each analyte, data set, and estimation method. Differences between estimated and measured concentrations in emergent adults were evaluated using Wilcoxon signed-rank tests (PROC UNIVARIATE; SAS Inst. Inc. 1988a). Differences were considered significant if $p(H_0=0) \leq 0.05$. Relative accuracy and quality of different estimation methods were evaluated by calculating the proportional deviation of the estimate from the measured value:

$$PD = (Mi - Ei) / Mi$$

where

PD= proportional deviation
Mi = measured concentration in emergent adult insects at sediment concentration (i)
Ei = estimated concentration in emergent adult insects at sediment concentration (i)

Negative values for PD indicate overestimation while positive PD values indicate underestimation. The percentage of estimated values that exceeded their corresponding measured value was also tabulated for each chemical and estimation method. Relative quality of the "Most Likely" estimation methods was evaluated by the following criteria:

1) median PD closest to 0 (indicates estimates center around measured values);
2) PD with narrowest range (indicates relative accuracy of method);
3) percentage overestimation closest to 50% (indicates estimates center around measured values);
4) difference between estimated and measured values not significantly different as determined by Wilcoxon signed-rank tests.

Relative quality of conservative estimation methods was evaluated by

1) smallest, negative median PD value (indicates method overestimates while minimizing the degree of overestimation);
2) PD with narrowest range (to minimize the degree of overestimation);

In addition to the use of PD values, the concentrations in emergent adult insects relative to that of benthic organisms was evaluated graphically. Validation data (concentrations in adults and sediment) were included in the scatter plots of the model data (concentrations in benthos and sediment) to allow comparison of the ranges of sediment concentrations, the trends in biota concentrations relative to sediment concentrations, and the trends in observed adult concentrations relative to those predicted by the regression model. BSAFs for emergent adults and benthos also were plotted to allow comparison of the trends of predictions based on accumulation factors.

There was sufficient PCB validation data (ten observations) to develop a linear regression equation for the log-transformed sediment and emergent adult concentrations. This model was compared to regressions developed from the benthos data using the F-test procedure for comparing regression lines outlined in Draper and Smith (1981). Differences were considered significant if $p \leq 0.05$.

3. RESULTS

3.1 MODELING RESULTS

Summary statistics for the BSAFs for each chemical and data set combination are presented in Table 2. Data sets for which the median BSAFs were less than 1 included the "All"

Table 2. Summary statistics for literature-derived sediment-invertebrate accumulation factors

Analyte	Data Set[a]	N	Mean	Standard Deviation	Minimum	Median	90th Percentile	Maximum	Mean of Log-Trans-formed Values	Standard Deviation of Log-Trans-formed Values	Distribution
As	All	55	0.329	0.597	0.018	0.143	0.690	4.330	-0.764	0.476	Lognormal
As	Non-Dep.	49	0.240	0.236	0.018	0.127	0.675	0.889	-0.828	0.442	Lognormal
As	Dep.	6	1.058	1.611	0.278	0.373	4.330	4.330	-0.245	0.457	Lognormal[b]
Cd	All	120	2.822	5.227	0.001	0.600	7.990	41.550	-0.099	0.749	Lognormal[b]
Cd	Non-Dep.	88	3.438	5.938	0.049	0.614	9.240	41.550	0.005	0.710	Lognormal[b]
Cd	Dep.	32	1.126	1.362	0.001	0.459	3.073	4.878	-0.387	0.789	Lognormal[b]
Cr	All	34	0.179	0.227	0.015	0.100	0.468	1.101	-0.941	0.390	Lognormal
Cr	Non-Dep.	26	0.206	0.252	0.015	0.108	0.588	1.101	-0.883	0.396	Lognormal
Cr	Dep.	8	0.090	0.055	0.018	0.083	0.186	0.186	-1.133	0.322	Normal b
Cu	All	112	2.424	3.755	0.032	1.556	5.250	23.870	0.005	0.633	Lognormal[b]
Cu	Non-Dep.	74	2.140	2.621	0.032	1.647	3.872	16.630	0.050	0.565	Lognormal[b]
Cu	Dep.	38	2.976	5.318	0.047	0.661	7.957	23.870	-0.084	0.750	Lognormal
Hg	All	15	1.422	0.940	0.286	1.136	2.868	3.981	0.074	0.275	Lognormal
Hg	Non-Dep.	13	1.204	0.653	0.286	1.081	1.735	2.868	0.022	0.245	Lognormal[c]
Hg	Dep.	2	2.837	1.619	1.692	2.837	3.981	3.981	0.414	0.263	Lognormalv
Ni	All	26	0.857	1.230	0.055	0.486	2.320	5.746	-0.375	0.534	Lognormal

Table 2. (continued)

Analyte	Data Set[a]	N	Mean	Standard Deviation	Minimum	Median	90th Percentile	Maximum	Mean of Log-Trans-formed Values	Standard Deviation of Log-Trans-formed Values	Distribution
Ni	Non-Dep.	16	1.313	1.395	0.397	0.818	3.150	5.746	-0.024	0.329	Lognormal
Ni	Dep.	10	0.129	0.059	0.055	0.134	0.214	0.237	-0.935	0.214	Normal[c]
Pb	All	114	0.276	0.787	0.004	0.071	0.607	7.080	-1.069	0.575	Lognormal[b]
Pb	Non-Dep.	83	0.331	0.915	0.004	0.066	0.946	7.080	-1.063	0.624	Lognormal[b]
Pb	Dep.	31	0.129	0.132	0.009	0.080	0.326	0.503	-1.084	0.423	Lognormal
Zn	All	112	3.092	3.335	0.026	1.936	7.527	14.512	0.160	0.622	Lognormal[b]
Zn	Non-Dep.	84	3.473	3.577	0.026	2.330	8.465	14.512	0.229	0.610	Lognormal[b]
Zn	Dep.	28	1.952	2.141	0.079	0.840	4.759	8.479	-0.047	0.622	Lognormal
PCBs	Model (infauna)	16	9.016	12.796	0.739	4.670	21.886	51.313	0.652	0.530	Lognormal
PCBs	Validation (adult)	10	37.193	19.118	11.176	36.215	64.122	67.132	1.508	0.261	Normall[c]

[a] All = depurated and non-depurated invertebrates combined, Dep. = invertebrates depurated prior to analysis, Non-Dep. = invertebrates not depurated prior to analysis, Model = benthic invertebrates analyzed for PCBs, Validation = emergent adult insect analyzed for PCBs.
[b] $p<0.05$ for both normal and lognormal distributions
[c] $p>0.05$ for both normal and lognormal distributions

and "Non-Depurated" data for As, Cd, Cr, Ni, and Pb and the "Depurated" data for Cu and Zn. This indicates that the invertebrates analyzed in most of the evaluated studies did not accumulate these analytes to levels greater than those measured in the associated sediments. The maximum BSAFs for Cr, Ni, and Pb in depurated organisms also were less than 1. However, at least one reported BSAF was greater than 1 for all chemicals. The maximum BSAF for all metals was 23.9 for Cu in depurated organisms. The maximum BSAF for PCBs were 51.3 for benthos and 67.1 for emergent adults. The minimum BSAF for all analytes was 0.001 for Cd in depurated organisms.

For three metals (As, Hg, and Pb) the median BSAF for depurated organisms was greater than the median BSAF for non-depurated organisms. This is consistent with expected results for Hg, which should accumulate in the tissue to concentrations higher than those found in sediment. For As and Pb, it is more likely because of sampling error (measured sediment concentrations not representative of organism exposures) or differences in the taxa included in the two data sets. The median BSAF for all organisms was between the median BSAFs for each of the individual data sets for all metals. The 90th percentile BSAF for three metals (As, Cu, and Hg) in depurated organisms was greater than that for the non-depurated organisms.

The distributions of BSAFs for most analytes and data set combinations (22 of 26) were better described by a lognormal distribution than by a normal distribution. The three BSAF distributions that were better described by a normal distribution were also not significantly different ($p < 0.05$) from a lognormal distribution. Only one distribution better described by a lognormal distribution was also not significantly different ($p < 0.05$) from a normal distribution. Each of these four data sets was relatively small(8 to 13 observations). Ten of BSAF distributions better described by a lognormal distribution were significantly different ($p < 0.05$) from both a normal and lognormal distribution. This determination appeared to be independent of sample size. There also was no obvious relationship between the type of distribution and the range of sediment concentrations (Table 3).

Results of the regression analyses are presented in Table 3. Figures 1-5 present the log-log scatter plots of sediment and biota concentrations, the fitted line, and the 95% prediction interval. The regression lines presented in each figure are based on all of the available data (depurated and non-depurated) for all metals except Ni, for which the equations for depurated and non-depurated organisms are presented separately.

The metal concentrations in all invertebrates (depurated and non-depurated) were significantly positively correlated with the sediment concentrations for all but two analytes (Hg and Ni). That is, higher biota concentrations were observed at higher sediment concentrations. For those models with significantly positive slopes ($p < 0.05$), the amount of variation in biota metal concentrations explained by the sediment metal concentrations (R^2) ranged from 60% for As to 20% for Cr. Sediment PCB concentrations explained 65% of the variation in biota PCB concentrations. The slope for Hg was not significantly different from zero ($p > 0.05$), but the available sediment data covered a very small range of concentrations (0.038 mg/kg to 0.28 mg/kg). The ranges of sediment concentrations for most other analytes covered two or three orders of magnitude.

Table 3. Summary results for regression analyses of log-transformed sediment and invertebrate metal concentrations reported in the literature[a]

Analyte	Data Set[b]	N	Range of X (mg/kg dry wt.)	Est. (a′)	s.e. (a′)	Est. (b)	s.e. (b)	Slope > Zero[c]	R^2
As	All	55	1.15 - 764	-0.292	0.174	0.754	0.0851	Y ($p<0.001$)	0.60
As	Non-Dep.	49	4 - 764	-0.572	0.200	0.873	0.0943	Y ($p<0.001$)	0.65
As	Dep.	6	1.15 - 79	0.566	0.150	0.289	0.118	Y ($p<0.05$)	0.60
Cd	All	120	0.179 - 3000	0.0395	0.0685	0.692	0.0623	Y ($p<0.001$)	0.51
Cd	Non-Dep.	88	0.2 - 3000	0.191	0.0739	0.668	0.0608	Y ($p<0.001$)	0.58
Cd	Dep.	32	0.179 - 63.1	-0.314	0.132	0.513	0.192	Y ($p<0.01$)	0.19
Cr	All	34	10.4 - 1648	0.2092	0.237	0.365	0.128	Y ($p<0.01$)	0.20
Cr	Non-Dep.	26	10.4 - 1648	0.246	0.280	0.341	0.160	Y ($p<0.05$)	0.16
Cr	Dep.	8	54.15 - 279	0.0445	0.817	0.448	0.380	N ($p=0.14$)	0.19
Cu	All	112	2.765 - 7820	1.089	0.0623	0.278	0.0369	Y ($p<0.001$)	0.34
Cu	Non-Dep.	74	3.44 - 7820	1.037	0.0680	0.359	0.0394	Y ($p<0.001$)	0.54
Cu	Dep.	38	2.765 - 729	1.23	0.094	0.079	0.0583	N ($p=0.09$)	0.05
Hg	All	15	0.038 - 0.28	-0.67	0.279	0.327	0.246	N ($p=0.10$)	0.12
Ni	All	26	6.38 - 93	1.48	0.213	-0.425	0.159	N[d] ($p<0.01$)	0.23

Table 3. (continued)

Analyte	Data Set[b]	N	Range of X (mg/kg dry wt.)	Est. (a′)	s.e. (a′)	Est. (b)	s.e. (b)	Slope > Zero[c]	R^2
Ni	Non-Dep.	16	6.38 - 27	1.59	0.275	-0.463	0.247	N[d] (p<0.05)	0.20
Ni	Dep.	10	21.9 - 93	-0.440	0.491	0.695	0.300	Y (p<0.05)	0.40
Pb	All	114	6.89 - 679	-0.776	0.160	0.801	0.102	Y (p<0.001)	0.35
Pb	Non-Dep.	83	6.89 - 679	-0.864	0.205	0.859	0.137	Y (p<0.001)	0.33
Pb	Dep.	31	10.555 - 375	-0.515	0.223	0.653	0.129	Y (p<0.01)	0.47
Zn	All	112	12.02 - 10100	1.80	0.0720	0.208	0.0328	Y (p<0.001)	0.27
Zn	Non-Dep.	84	12.02 - 10100	1.77	0.0828	0.242	0.0384	Y (p<0.001)	0.33
Zn	Dep.	28	29.84 - 3210	1.89	0.1274	0.126	0.0549	Y (p<0.05)	0.17
PCBs	Model (benthos)	16	0.398 - 41.5[e]	0.59	0.177	1.110	0.2174	Y (p<0.001)	0.65
PCBs	Validation (adults)	10	0.126 - 326[e]	1.60	0.148	0.939	0.0841	Y (p<0.001)	0.94

[a] Equation is $\log(y) = a' + b[\log(x)]$, where y = concentration in biota and x = concentration in sediment, a' = estimated intercept in log units, and b = estimated slope in log units.

[b] All = depurated and non-depurated invertebrates combined, Dep. = invertebrates depurated prior to analysis, Non-Dep. = invertebrates not depurated prior to analysis, Model = benthic invertebrates analyzed for PCBs, Validation = emergent adult insect analyzed for PCBs.

[c] Significantly different from zero based on the one-tailed t-test with (n-2) degrees of freedom.

[d] Slope is significantly different from zero, but is negatively correlated with sediment concentrations.

[e] Sediment concentrations are ug PCB/g organic carbon

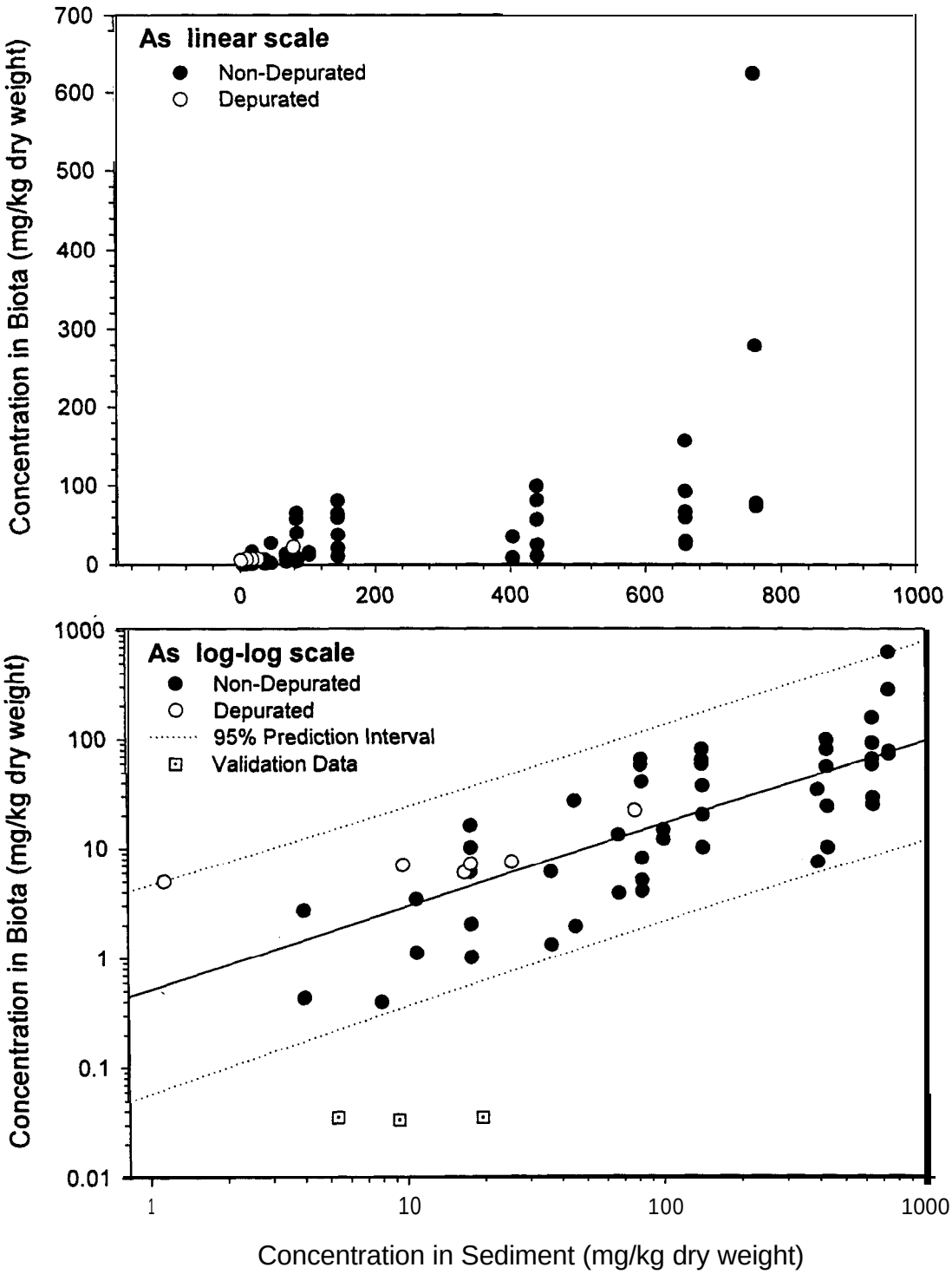

Figure 1. Linear and Log-log scatterplots of arsenic concentrations in sediment, benthic invertebrates, and emergent adult insects, The regression lines are based on all of the available data for benthics (depurated and non-depurated).

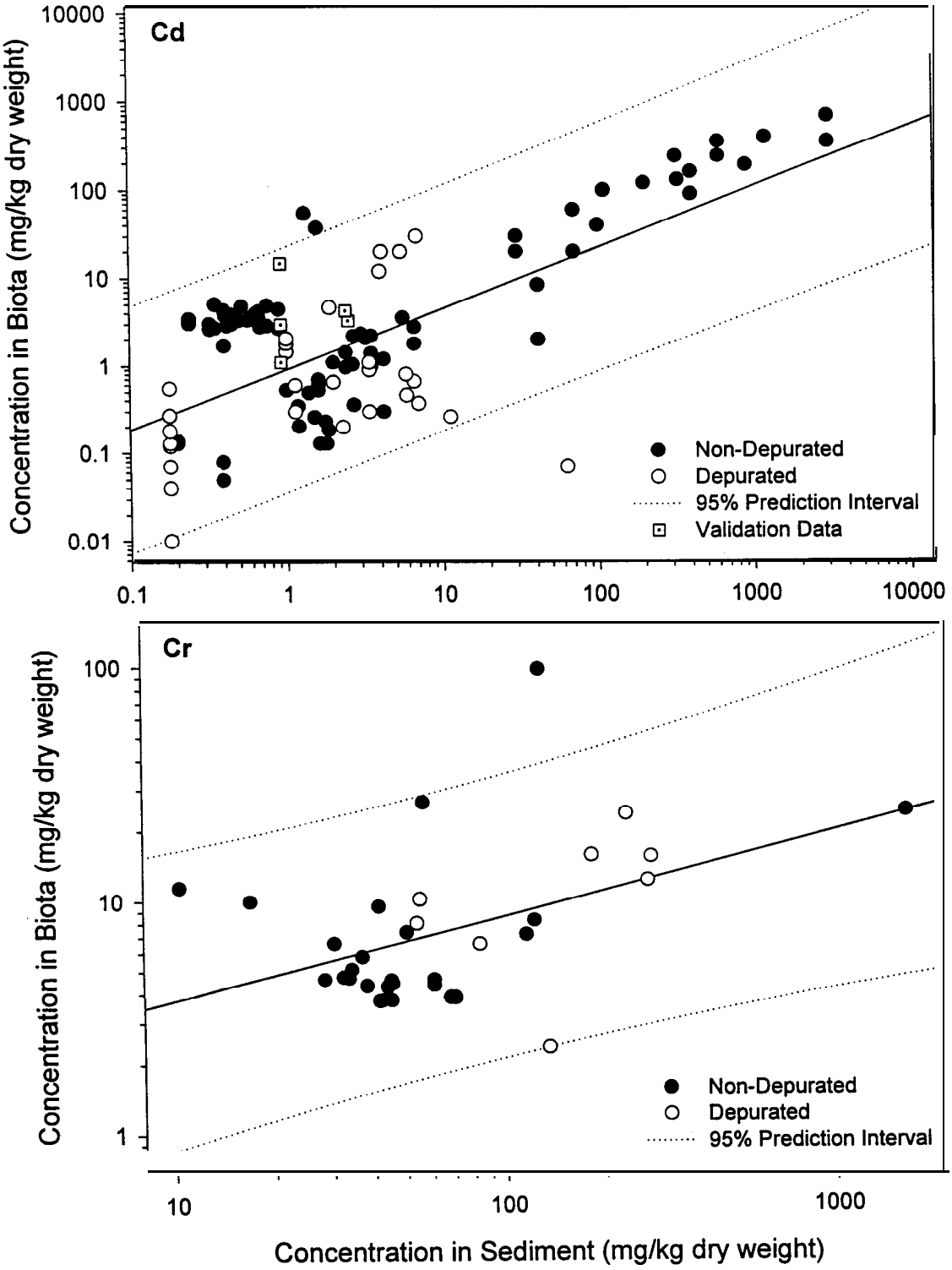

Figure 2. Log-log scatterplots of cadmium and chromium concentrations in sediment, benthic invertebrates, and emergent adult insects. The regression lines are based on all of the available data for benthics (depurated and non-depurated).

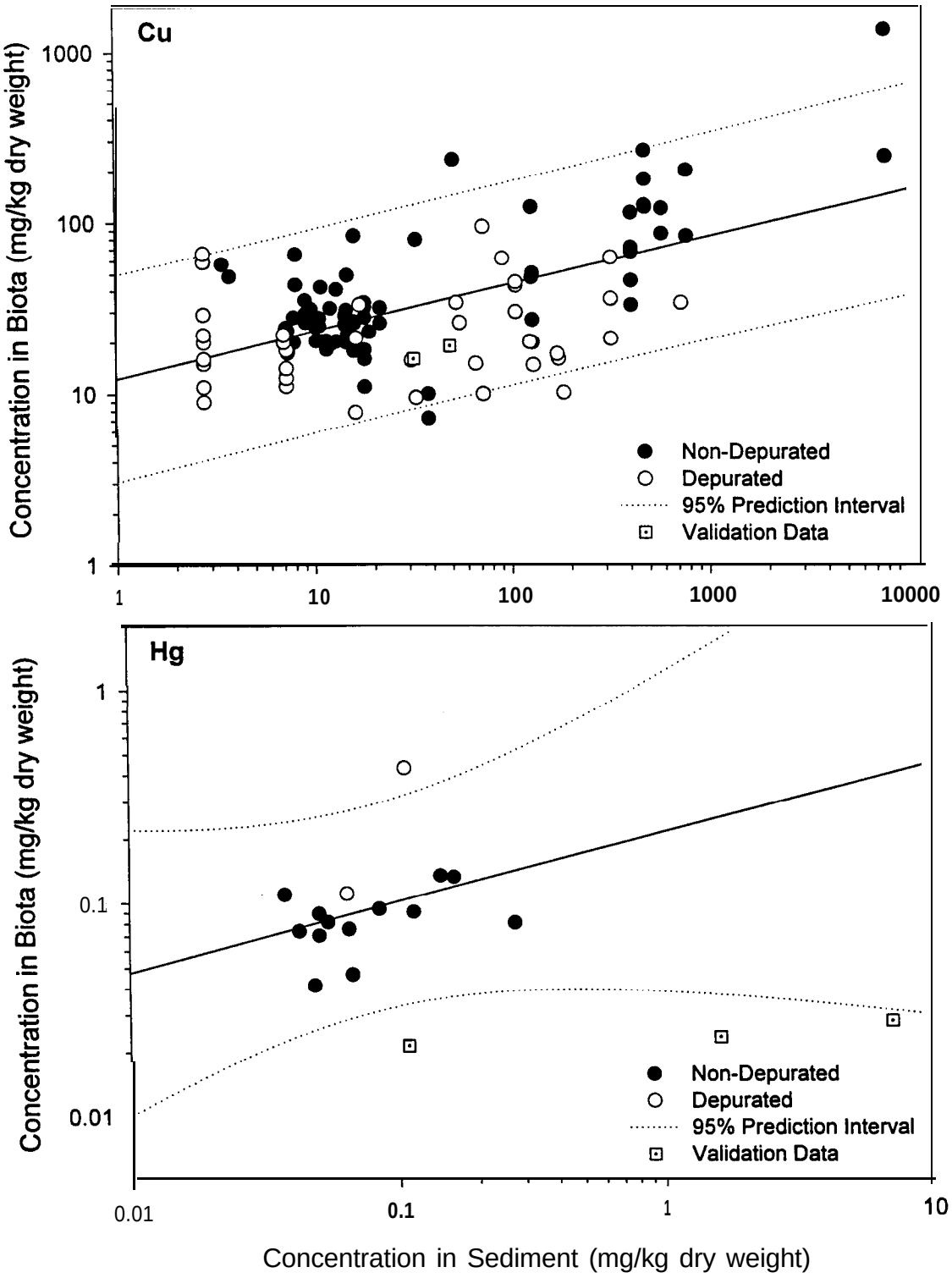

Figure 3. Log-log scatterplots of copper and mercury concentrations in sediment, benthic invertebrates, and emergent adult insects. The regression lines are based on all of the available data for benthics (depurated and non-depurated).

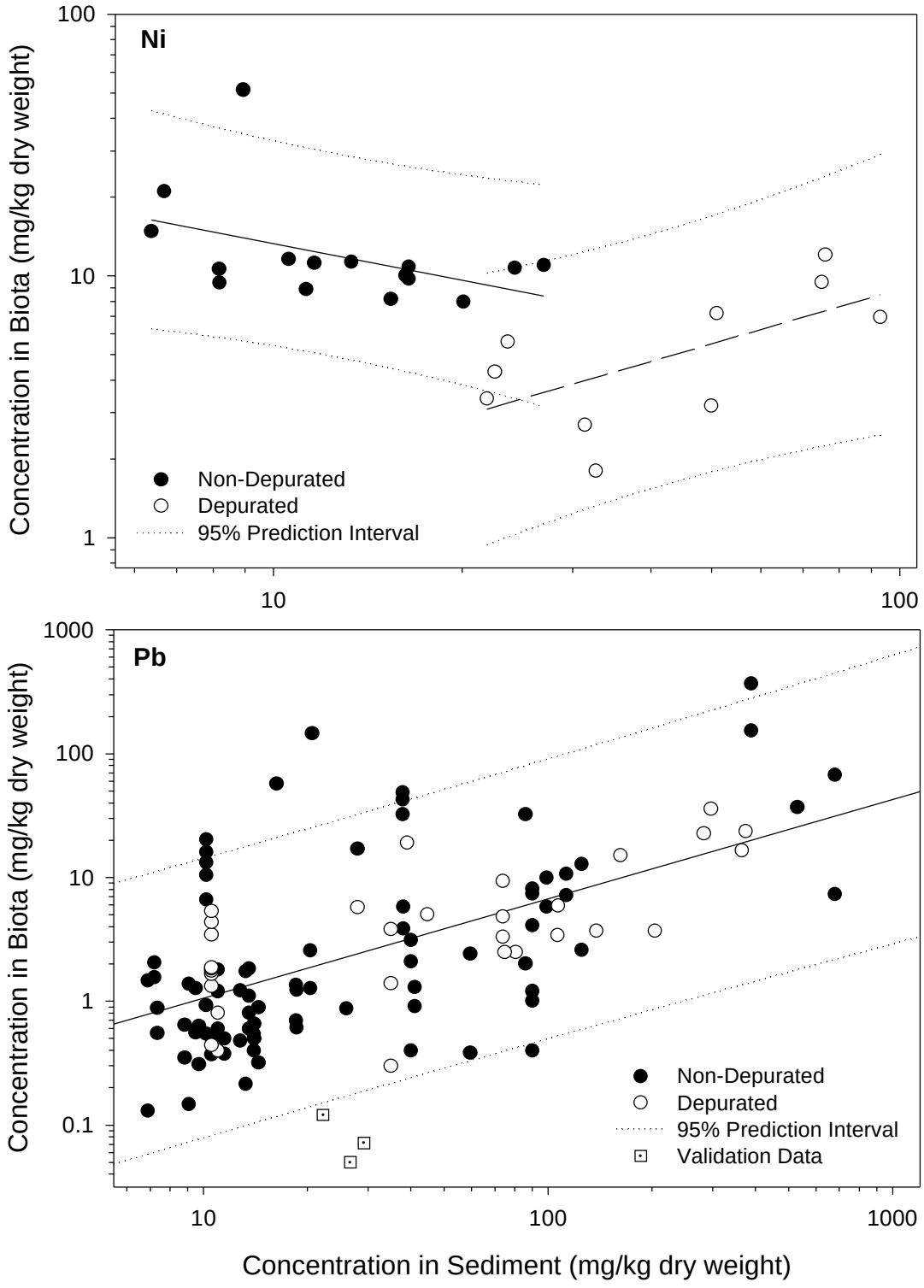

Figure 4. Log-log scatterplots of nickel and lead concentrations in sediment, benthic invertebrates, and emergent adult insects. The regression lines for lead are based on all of the available data for benthics (depurated and non-depurated).

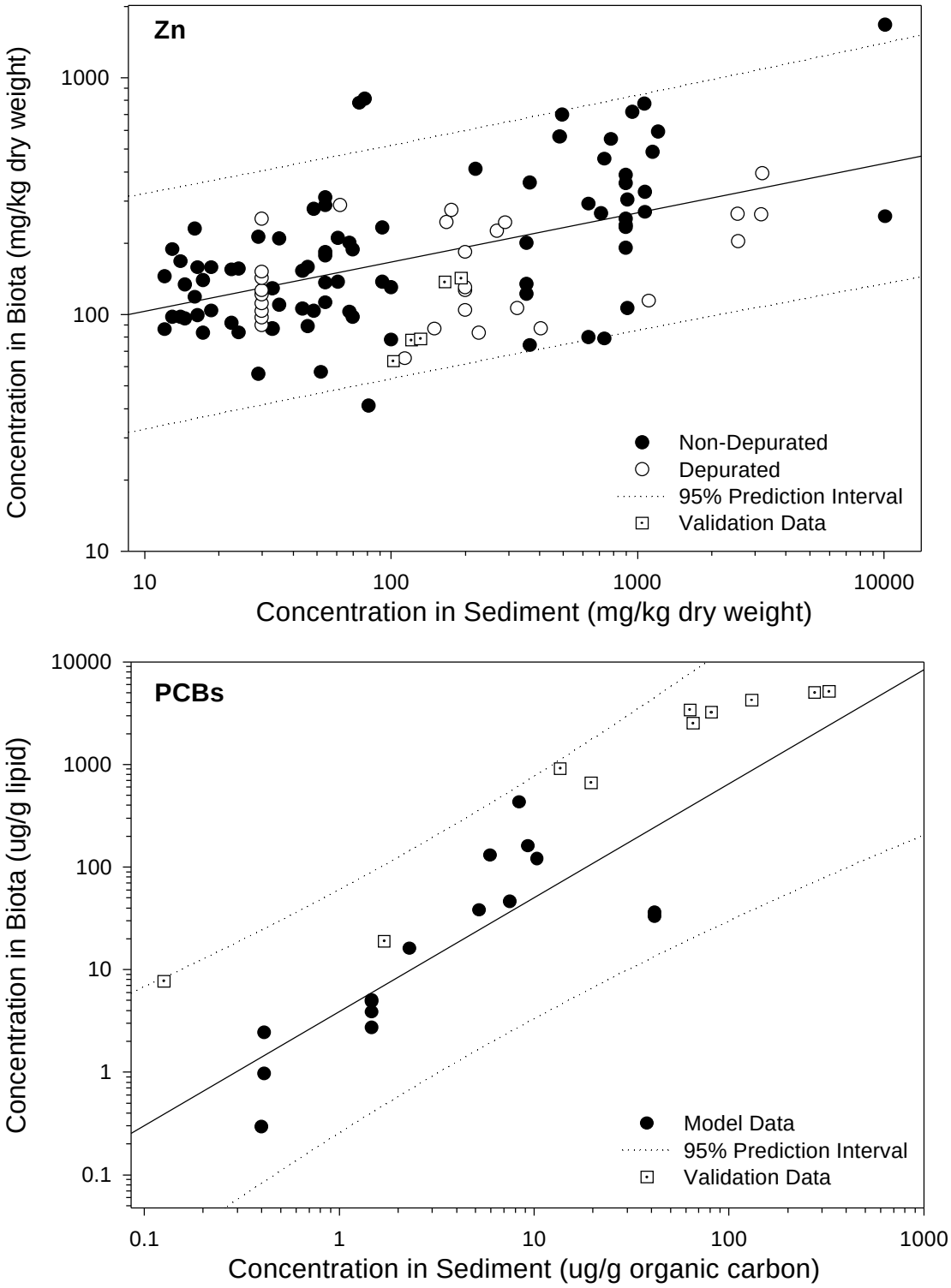

Figure 5. Log-log scatterplots of zinc and PCB concentrations in sediment, benthic invertebrates, and emergent adult insects. The regression lines for zinc are based on all of the available data for benthics (depurated and non-depurated). The regression lines for PCBs are based on the data for benthics.

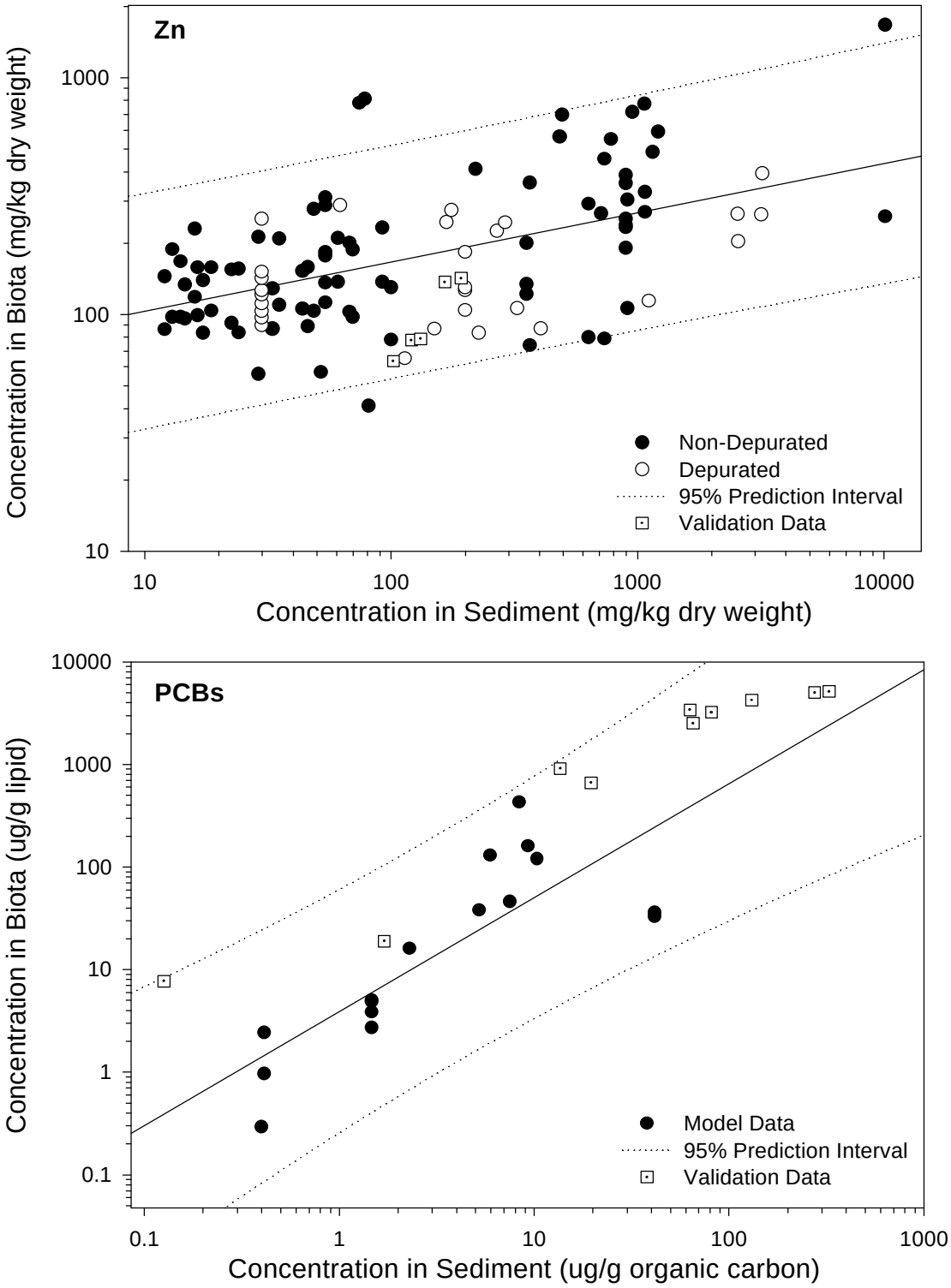

Figure 5. Log-log scatterplots of zinc and PCB concentrations in sediment, benthic invertebrates, and emergent adult insects. The regression lines for zinc are based on all of the available data for benthics (depurated and non-depurated). The regression lines for PCBs are based on the data for benthics.

The range of sediment concentrations also may have affected the observed relationship between sediment and organism concentrations for Ni. Concentrations of Ni in all invertebrates (depurated and non-depurated combined) were significantly negatively correlated with the sediment concentrations. Although the slope was significantly different from zero ($p < 0.05$), the depurated and non-depurated data sets appear to represent very different relationships (Figure 4). The regression model for non-depurated organisms is consistent with that of the combined data sets. Ni concentrations in depurated organisms are significantly positively correlated with sediment concentrations ($\alpha \leq 0.05$) and the model explains a higher proportion of the variation in organism concentrations than does either of the other two models (Table 3). However, comparison of these data sets is complicated by the narrow range of sediment concentrations for each data set and the limited overlap of these ranges.

3.2 VALIDATION RESULTS

Data for model validation were available for all analytes except Cr and Ni. However, the number of observations was very small (two to five) for all metals and they were associated with a relatively small range of sediment concentrations for all metals except Hg (Figures 1-5). Slightly more validation data (ten observations) were available for PCBs (Figure 5). The sediment concentrations cover three orders of magnitude, but nine of those exposures were from one study using spiked-sediment concentrations.

Concentrations estimated using the "Most Likely" estimation methods (i.e., the median BSAF and the log-log regression model) were not significantly different ($p < 0.05$) from the concentrations observed in emergent adults for each metal and data set combination (Table 4). The median BSAF overestimated 100% of the concentrations for all metals except Cd, for which it underestimated 100% of the concentrations. The regression models also overestimated 100% of the concentrations for all metals except Cd. The model based on non-depurated organisms underestimated four of the five observed concentrations (Table 4). Figures 1-5 depict the emergent adult data relative to the model data and the regression model based on "All" data. Arsenic and Pb concentrations in adults are clearly overestimated by the regression model, whereas Cd, Cu, and Zn concentrations fall within the 95% Prediction Intervals. Figures 6-8 depict the BSAFs for emergent adults relative to the BSAFs for benthos. These also indicate consistent overestimation of concentrations in adults for As and Pb. For Cd, Cu, and Zn, the ratios of concentrations in emergent adults and associated sediment are within the range of benthos-sediment ratios for each data set (i.e., depurated, non-depurated, and all organisms). Mercury appears to be slightly overestimated by the BSAFs for depurated benthos, but not by the BSAFs for non-depurated organisms (Figure 7). Based on the selection criteria outlined above, the best estimates of adult concentrations are provided by the regression models for Cd and Cu and by the median BSAFs for Hg and Zn. All estimates for As and Pb are likely to be conservative, though the BSAFs appear to be somewhat better than the regression models.

PCB concentrations estimated using the "Most Likely" estimation methods were significantly different ($P < 0.01$) from the observed concentrations (Table 4). Concentrations of PCBs observed in emergent adults were within the 95% Prediction Interval for the regression model (Figure 5) and the range of BSAFs for adults were within the range for benthos (Figure 9). However, the data for emergent adults was consistently underestimated by both methods, which is consistent with the PD results presented in Table 4. Based on these evaluations, neither estimation method appears to be appropriate.

Table 4. Quality of "Most Likely" estimation methods as determined by the proportional deviation (PD) of the estimated values from measured values[a]

			Log-Log Model				Median BSAF			
Analyte	**Data set[b]**	**N**	**Median**	**Minimum**	**Maximum**	**Over**	**Median**	**Minimum**	**Maximum**	**Over**
As	All	3	-81.53	-138.87	-50.76	100%	-39.09	-80.75	-20.96	100%
As	Non-Dep.	3	-55.52	-103.74	-32.20	100%	-34.65	-71.69	-18.53	100%
As	Dep.	3	-210.87	-252.29	-170.47	100%	-103.49	-212.05	-56.24	100%
Cd	All	5	0.53	0.06	0.93	0%	0.67	0.49	0.96	0%
Cd	Non-Dep.	5	0.35	-0.34	0.90	20%	0.66	0.48	0.96	0%
Cd	Dep.	5	0.82	0.58	0.97	0%	0.74	0.61	0.97	0%
Cu	All	2	-0.96	-1.01	-0.90	100%	-2.56	-3.01	-2.11	100%
Cu	Non-Dep.	2	-1.34	-1.36	-1.32	100%	-2.77	-3.25	-2.29	100%
Cu	Dep.	2	-0.30	-0.39	-0.21	100%	-0.51	-0.71	-0.32	100%
Hg	All	3					-79.48	-294.17	-4.90	100%
Hg	Non-Dep.	3					-75.59	-279.89	-4.61	100%
Hg	Dep.	3					-199.92	-735.87	-13.72	100%
Pb	All	3	-33.89	-45.59	-15.67	100%	-28.07	-37.11	-12.15	100%
Pb	Non-Dep.	3	-33.62	-44.97	-15.27	100%	-25.98	-34.37	-11.20	100%
Pb	Dep.	3	-37.56	-51.18	-18.18	100%	-31.54	-41.66	-13.72	100%
Zn	All	5	-1.22	-1.63	-0.34	100%	-2.00	-2.23	-1.33	100%
Zn	Non-Dep.	5	-1.40	-1.82	-0.47	100%	-2.62	-2.89	-1.81	100%
Zn	Dep.	5	-0.84	-1.22	-0.07	100%	-0.30	-0.40	-0.01	100%
PCBs	Model	10	0.84	0.53	0.95	0%	0.87	0.58	0.93	0%

[a] PD = (measured-estimated)/measured. Negative PD values indicate overestimates; positive PD values indicate underestimates.
[b] All = depurated and non-depurated invertebrates combined, Dep. = invertebrates depurated prior to analysis, Non-Dep. = invertebrates not depurated prior to analysis, Model = benthic invertebrates analyzed for PCBs.

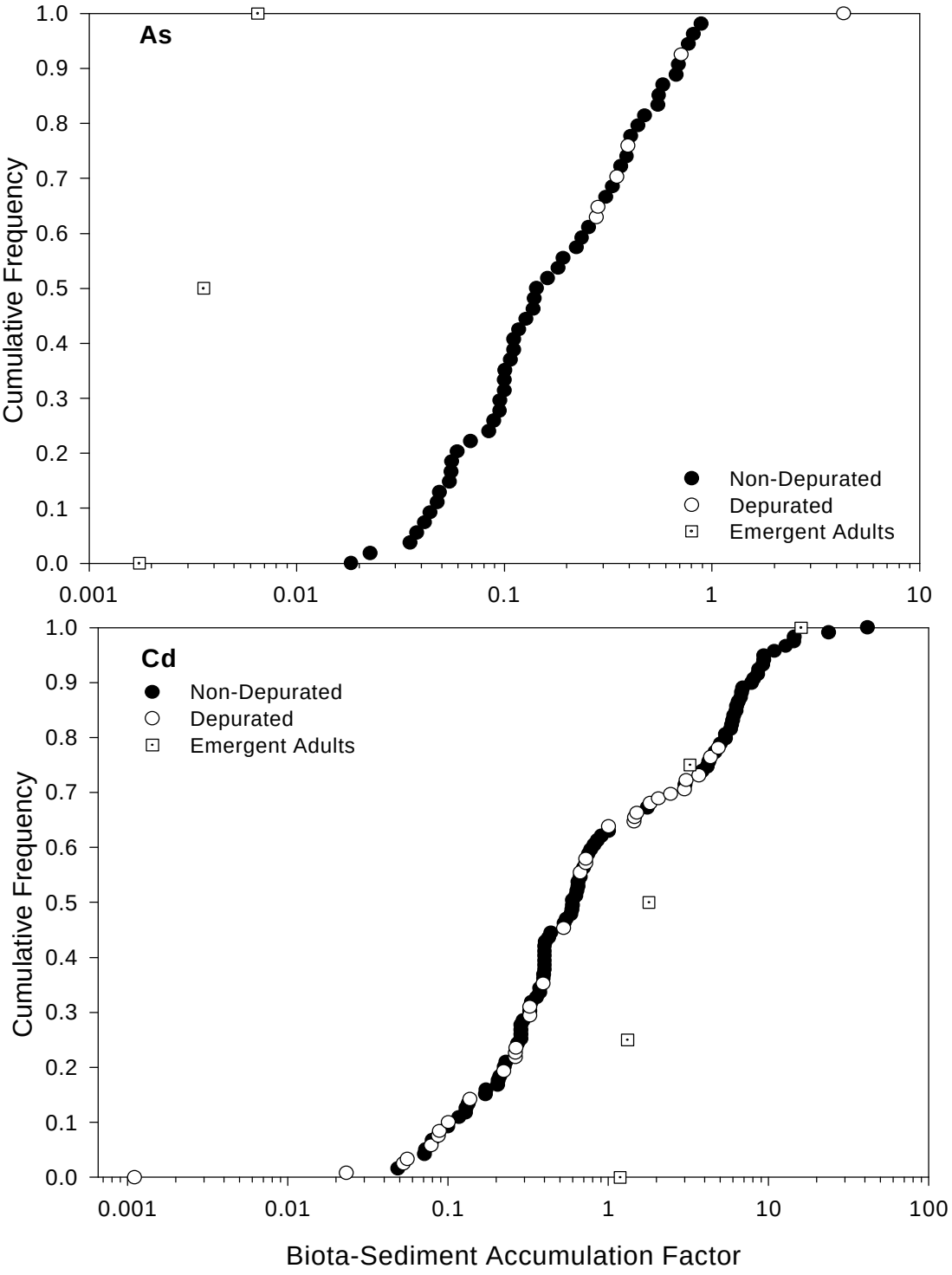

Figure 6. Cumulative distributions of arsenic and cadmium BSAFs for benthic invertebrates (depurated and non-depurated) and emergent adult insects.

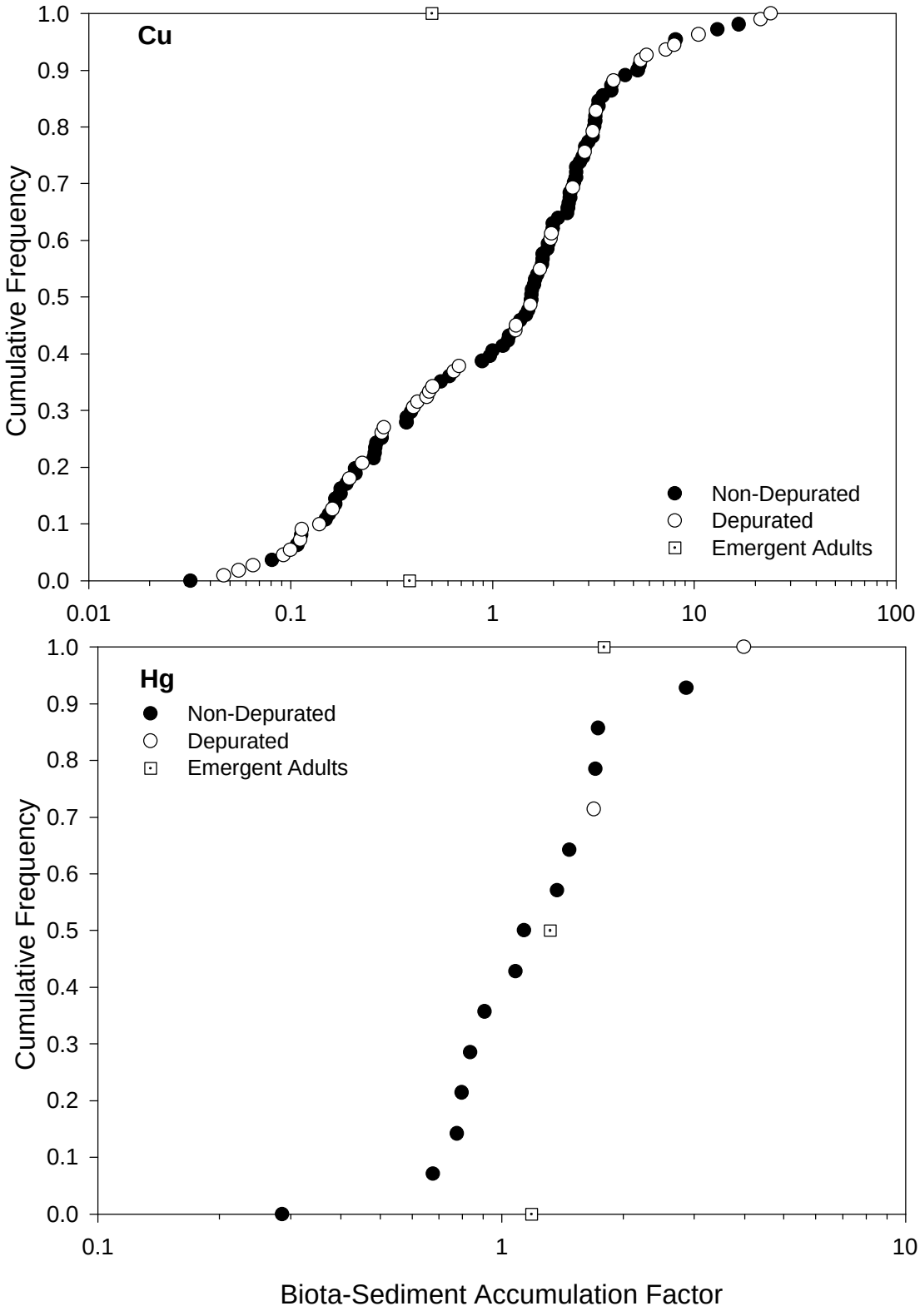

Figure 7. Cumulative distributions of copper and mercury BSAFs for benthic invertebrates (depurated and non-depurated) and emergent adult insects.

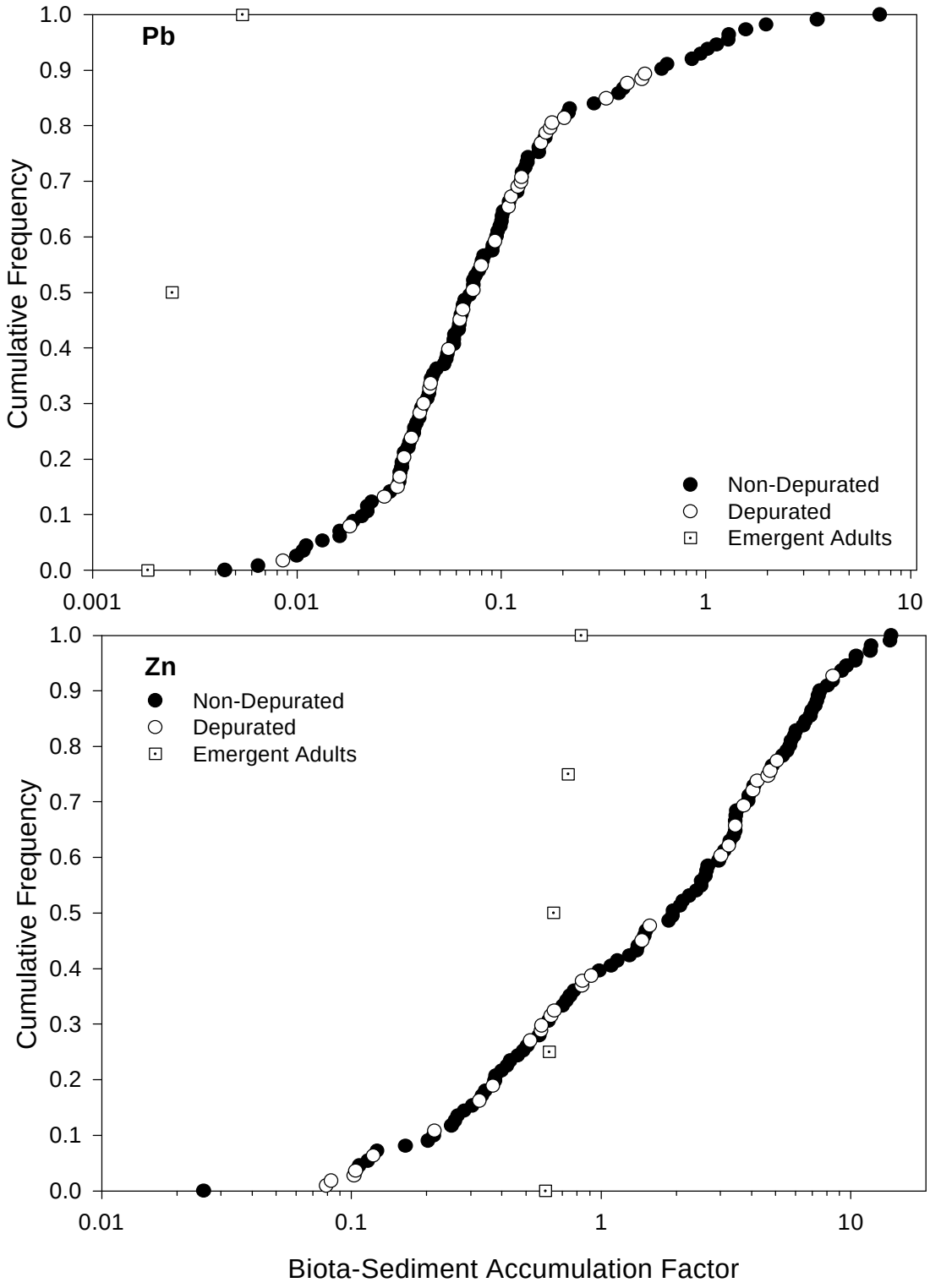

Figure 8. Cumulative distributions of lead and zinc BSAFs for benthic invertebrates (depurated and non-depurated) and emergent adult insects.

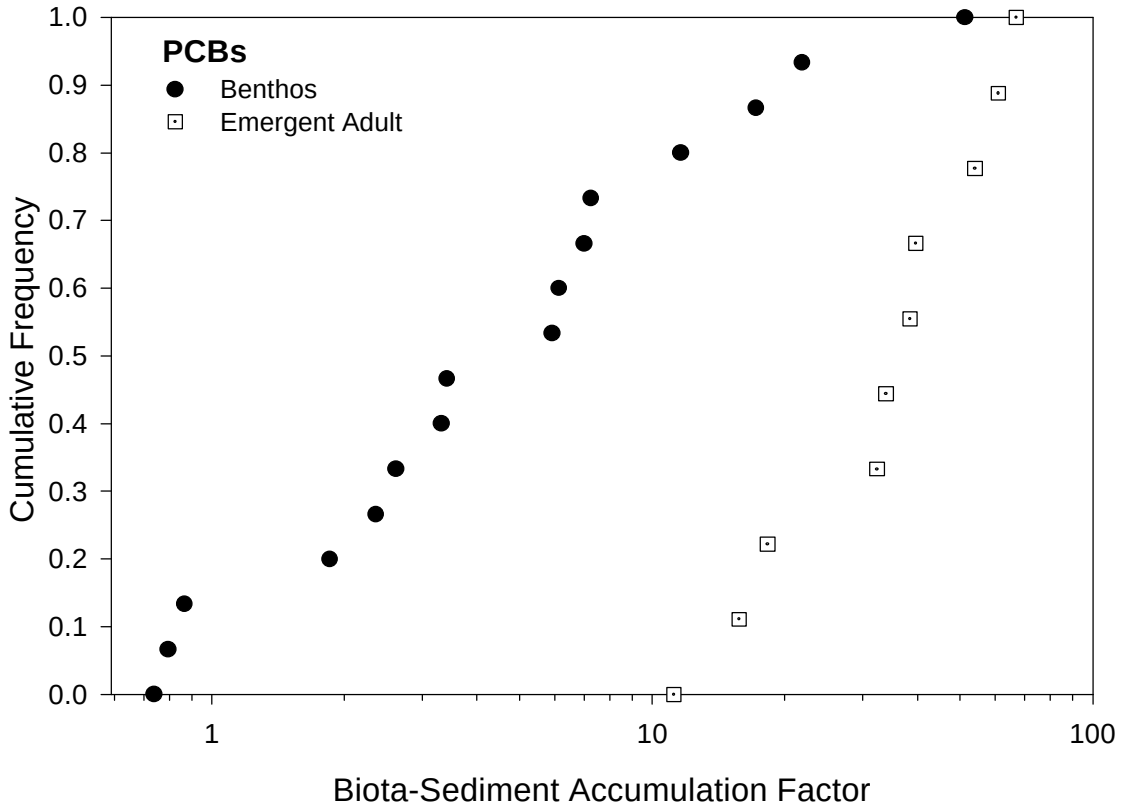

Figure 9. Cumulative distributions of PCB BSAFs for benthic invertebrates (depurated and non-depurated) and emergent adult insects.

Concentrations estimated using the conservative estimation methods (i.e., the 90th percentile BSAF and the upper 95% prediction limit of the regression model) were not significantly different ($p < 0.05$) from the concentrations observed in emergent adults for each metal and data set combination (Table 5). The BSAFs and 95%UPLs overestimated 100% of the concentrations for all metals except Cd. The BSAFs underestimated one or two of the five observed concentrations and the 95% UPLs (depurated and all organisms) underestimated two of the five observed concentrations (Table 5). Based on the aforementioned selection criteria and the an evaluation of Figures 1-8, both estimation methods appear to be adequately conservative for all metals except Hg, for which a model could not be fit. The degree of overestimation is minimized with the 90th percentile BSAFs for Cd (depurated organisms) and the 95% UPLs for Cu (all organisms) and Zn (depurated). For As and Pb, the "Most Likely" estimation methods are expected to be sufficiently conservative for screening, while minimizing the degree of overestimation.

PCB concentrations estimated from the 95% UPL were significantly different ($P < 0.05$) from the observed concentrations, whereas those estimated from the 90th Percentile BSAF were not (Table 5). However, the data for emergent adults was consistently underestimated by both (Table 5). Based on the results in Table 5 and an evaluation of Figures 5 and 9, neither estimation method appears to be appropriately conservative.

Table 5. Quality of conservative estimation methods as determined by the proportional deviation (PD) of the estimated values from measured values[a]

			Log-Log Model UPL				BSAF 90th Percentile			
Analyte	**Data set[b]**	**N**	**Median**	**Minimum**	**Maximum**	**Over**	**Median**	**Minimum**	**Maximum**	**Over**
As	All	3	-465.98	-792.14	-291.20	100%	-192.40	-393.33	-104.95	100%
As	Non-Dep.	3	-310.24	-577.24	-181.39	100%	-188.06	-384.50	-102.57	100%
As	Dep.	3	-495.83	-593.20	-397.75	100%	-1211.91	-2472.13	-663.45	100%
Cd	All	5	-5.43	-11.85	0.04	80%	-3.46	-5.74	0.50	80%
Cd	Non-Dep.	5	-5.91	-13.10	-0.05	100%	-4.16	-6.79	0.42	80%
Cd	Dep.	5	-1.35	-5.31	0.53	80%	-0.71	-1.59	0.81	60%
Cu	All	2	-5.20	-5.36	-5.03	100%	-11.02	-12.54	-9.50	100%
Cu	Non-Dep.	2	-5.48	-5.54	-5.42	100%	-7.86	-8.99	-6.74	100%
Cu	Dep.	2	-2.76	-3.02	-2.50	100%	-17.22	-19.52	-14.91	100%
Hg	All	3					-202.15	-744.06	-13.88	100%
Hg	Non-Dep.	3					-121.90	-449.74	-8.00	100%
Hg	Dep.	3					-280.98	-1033.18	-19.66	100%
Pb	All	3	-306.71	-409.83	-145.95	100%	-246.40	-323.34	-110.91	100%
Pb	Non-Dep.	3	-381.53	-507.03	-178.83	100%	-384.42	-504.30	-173.35	100%
Pb	Dep.	3	-177.32	-240.30	-87.65	100%	-131.80	-173.10	-59.07	100%
Zn	All	5	-4.77	-5.84	-2.48	100%	-10.68	-11.56	-8.07	100%
Zn	Non-Dep.	5	-5.43	-6.57	-2.94	100%	-12.13	-13.13	-9.20	100%
Zn	Dep.	5	-2.99	-3.80	-1.32	100%	-6.38	-6.94	-4.73	100%
PCBs	Model	10	0.25	-2.15	0.77	22%	0.39	-0.96	0.67	30%

[a] PD = (measured-estimated)/measured. Negative PD values indicate overestimates; positive PD values indicate underestimates.

[b] All = depurated and non-depurated invertebrates combined, Dep. = invertebrates depurated prior to analysis, Non-Dep. = invertebrates not depurated prior to analysis, Model = benthic invertebrates analyzed for PCBs.

A regression model also was developed from the PCB concentrations in emergent adults and sediments. Results of the regression analyses are presented in Table 3. Figure 10 presents the log-log scatter plots of sediment and biota concentrations, the fitted line, and the 95% prediction interval. The PCB concentrations in adult insects were significantly positively correlated ($p < 0.001$) with the sediment concentrations and the sediment concentrations explained 94% of the variation in biota concentrations.

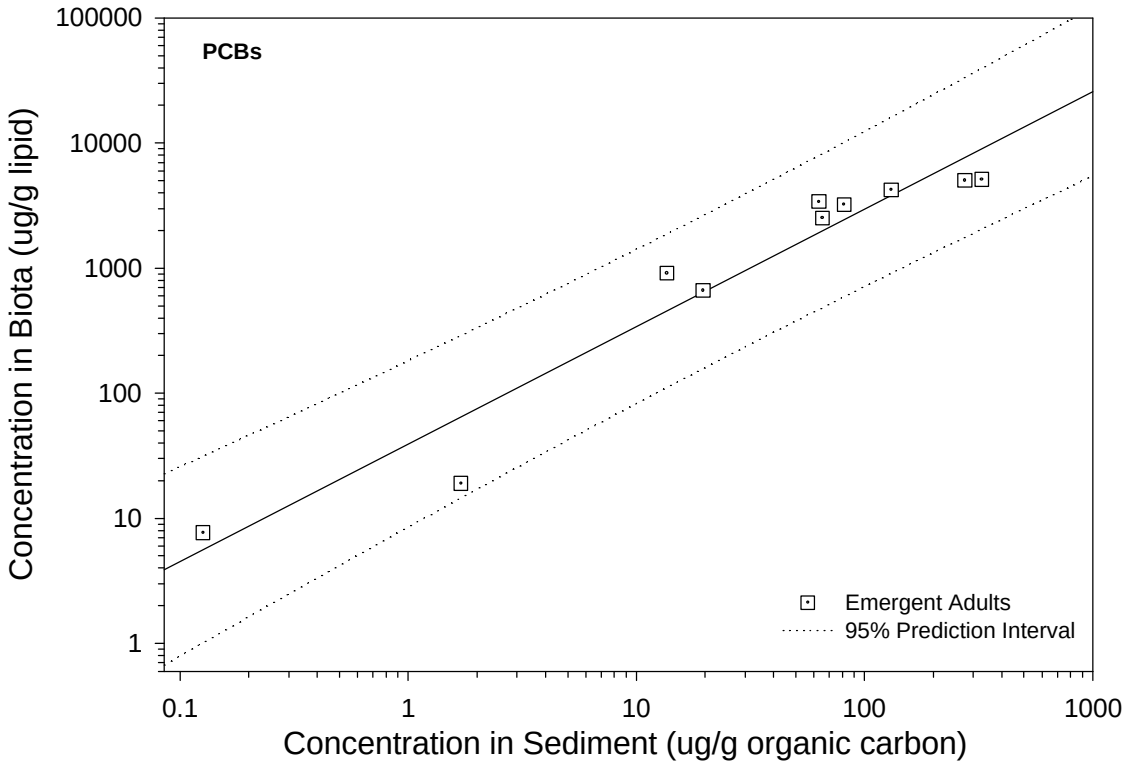

Figure 10. Log-log scatterplot of PCB concentrations in sediment and emergent adult insects. The regression lines are based on the available data for emergent adults.

4. DISCUSSION

This report presents a preliminary, exploratory analysis of the sediment-invertebrate accumulation data available in the literature. While it provides better accumulation factors than are currently available, it suggests the need to incorporate more explanatory factors into the estimation of chemical accumulation. It also suggests that aquatic stages may not be predictive of emergent stages for PCBs and some metals. However, the conservative estimation methods presented herein (i.e., 90th percentile BSAFs and 95% UPLs) appear to be appropriately conservative for screening sediment contaminant concentrations for the potential risks to flying insectivores. These data might also be used in uncertainty analyses to indicate the benefits of measuring site-specific contaminant concentrations in flying insects when such data are not available.

A preliminary evaluation of the regression models suggests that few of the relationships shown in this report fit the assumptions required for use of accumulation factors. Conventionally, an accumulation factor assumes a linear no threshold relationship between the biota concentration and the sediment concentration (i.e., biota concentrations are directly proportional to sediment concentrations across all sediment concentrations). The BSAF is represented in a linear model by the biota concentration (y) divided by the sediment concentration (x). This corresponds to the slope (b) of the linear regression equation (i.e., $b = y/x$ and $y = bx$). Therefore, the BSAF will describe the relationship between x and y only if the y-intercept (a) of the linear model is zero (i.e., $y = 0 + bx$). However, in the power model ($y = a(x)^b$) the BSAF is represented by the y-intercept (a), rather than the slope (b). Therefore, the slope (b) must be 1 (i.e., $x^1 = x$) for the accumulation factor to accurately describe the relationship between the sediment concentration (x) and the biota concentration (y). When the slope is 1 the biota concentration is equal to the BSAF times the sediment concentration (i.e., $y=ax$). However, nearly all of the estimated slopes (b) presented in Table 3 are less than 1 by at least two times the standard error of (b).

It is not clear whether the apparent non-linearity indicates that the assumptions are violated (i.e., uptake or depuration is well-regulated by the organism) or that the true relationship is obscured by the influences of confounding factors (e.g., variations in pH). For biologically well-regulated chemicals (e.g., Cu and Zn), the use of an uptake factor will tend to overestimate exposures at high concentrations and underestimate exposure at low concentrations. This is not unacceptable in practice because it tends to result in conservative (i.e., protective) risk estimates at contaminated sites but not at uncontaminated sites. However, it is undesirable to use models and assumptions that are not supported by the available evidence. Therefore, the effects of confounding factors should be further evaluated in future revisions of this document to help clarify the influence of these factors on the equilibrium concentrations of the chemicals in invertebrates.

Some of these factors include the lack of depuration of biota and the speciation of analytes. Including the gut contents in the analysis of biota tends to obscure the true accumulation factor. Specifically, the BSAF is forced towards 1 as the amount of sediment in the gut increases. Chemicals with true BSAFs less than 1 will be over estimated because the concentration in the sediment is greater than the tissue concentration. True BSAFs greater than 1 will be underestimated because the sediment has lower chemical concentrations than the tissue. However, excluding all data for non-depurated organisms may increase the uncertainty in the analyses, because it would greatly reduce the number of measurements and range of sediment concentrations. This may be of less concern for some chemicals (e.g., Cu, Pb, and Zn) and of more concern for others (As and Cr). Also, total analyte concentrations in sediment and gut contents may not accurately represent the bioavailable fractions, because some analyte species may be more readily available than others. All of the available studies determined total analyte concentrations in sediment and biota and provided no information on the relative proportions of different analyte species or forms.

Comparison of the data for benthic invertebrates and adult insects suggests that the models and BSAFs in this report can be used to provide conservative estimates of metal concentrations in emergent insects. However, the data available for model validation is very limited. The number of observations was small and they generally constituted a small range of sediment concentrations. Further research is needed to provide sufficient data for a thorough evaluation of these models.

PCB concentrations in emergent adults were consistently underestimated by the concentrations in benthos. This may be due to differences in the types of lipids found in immature and adult life stages (Larsson 1984). Ideally, sufficient adult insect data would be available to allow for model development *and* validation. In the absence of such data, conservative estimates (i.e., the 95%UPL

or the 90th percentile BSAF) from models and BSAFs based on the emergent adult data should be adequate for screening purpose.

5. RECOMMENDATIONS

These BSAFs and regression models are intended for use in ERAs performed on the Oak Ridge Reservation. To facilitate the most appropriate and consistent use of these values, the following recommendations should be followed.

1) The available BSAFs and regressions model are appropriate for use in screening ecological risk assessments to determine the need for further evaluation or site-specific data. The uncertainties in the estimation of emergent insect concentrations indicate that these data should not be used as the sole basis for a definitive characterization of risks to flying insectivores.

2) The 90th percentile BSAFs and the 95% UPLs are adequately conservative for all metals and can be used as a preliminary screening tool. The degree of overestimation can be minimized by using the 90th percentile BSAFs for Cd (depurated organisms), the 95% UPL for Cu (all organisms) and Zn (depurated), and the median BSAFs for As (non-depurated) and Pb (non-depurated). These values can be used as a secondary screening level as needed, provided that the limitations of the available validation data are explicitly included in the assessment.

3) Models and BSAFs for PCBs based on benthic invertebrate data should not be used to estimate PCB concentrations in emergent adult insects. Rather, the models derived using the PCB data for adult insects should be used.

4) Contaminants for which the models could not be validated (PCBs in adults and Cr and Ni in benthics) can be estimated using the 90th percentile BSAF and the 95% UPL for statistically significant regression equations (e.g., Ni in depurated benthos). The regression models should be used to the extent practicable. Most of these data do not appear to satisfy the assumptions for use as accumulation factors (i.e., linear no-threshold uptake). Although the regressions models developed herein also fail to address some confounding factors, they are likely to describe the sediment-invertebrate relationships better than the BSAFs.

3) If the uptake data are to be used in Monte Carlo simulation, selection of values to use is dependent on the distribution that best fits the data. If the distribution of the BSAF is fit better by the lognormal than the normal distribution, then the lognormal mean and standard deviation should be used. If the distribution of the BSAF is fit better by the normal than the lognormal distribution, then the normal mean and standard deviation should be used. If the distribution of the BSAF is uniform, the minimum and maximum observed BSAFs should be used.

6. REFERENCES

Ankley, G. T., P. M. Cook, A. R. Carlson, D. J. Call, J. A. Swenson, H. F. Corcoran and R. A. Hoke. 1992. Bioaccumulation of PCBs from sediments by oligochaetes and fishes. Can J Fish Aquatic Sci 49:2080-2085.

Ankley, G. T., E. N. Leonard and V. R. Mattson. 1994. Predicition of bioaccumulation of metals from contaminated sediments by the oligochaete, Lubriculus Variegatus. Water Resources 28(5):1071-1076.

Beauvais, S. L., J. G. Weiner and G. J. Artchison. 1995. Cadmium and mercury in sediment and burrowing mayfly mymphs (*Hexagenia*) in the Upper Mississippi River, USA. Archives of Environmental Contamination and Toxicology 28(2):178-183.

Bindra, K. S. and K. J. Hall. 1977. Geochemical partitioning of trace metals in sediments and factors affecting bioaccumulation in benthic organisms. Unpublished report prepared for NRC, Ottawa.

Cain, D. J., S. N. Luoma and E. V. Axtmann. 1995. Influence of gut content in immature aquatic insects on assessments of environmental metal contamination. Canadian Journal of Fisheries and Aquatic ScienceCanadian Journal of Fisheries and Aquatic Science 52:2736-2746.

Cain, D. J., S. N. Luoma, J. L. Carter and S. V. Fend. 1992. Aquatic insects as bioindicators of trace element contamination in cobble-bottom rivers and streams. Canadian Journal of Fish and Aquatic Science 49:2141-2154.

Carlson, A. R., G. L. Phipps and V. R. Mattson. 1991. The role of acid-volatile sulfide in determining cadmium bioavailability and toxicity in freshwater sediments. Environmental Toxicology and Chemistry 10:1309-1319.

Chapman, P. M., L. M. Churchland, P. A. Thomason and E. Michnowsky. 1979. Heavy metal studies with oligochaetes: pp. 477-502. R. O. Brinkhurst and D. G. Cook (eds.), Aquatic Oligochaete Biology. Plenum Press, New York.

Currie, R. S., W. L. Fairchild and D. C. G. Muir. 1997. Remobilization and export of cadmium from lake sediments by emerging insects. Environmental Toxicology and Chemistry 16(11):2333-2338.

Department of Energy. 1996. Remedial Investigation/ Feasibility Study of the Clinch River/Poplar Creek Operable Unit. ORNL/ER-315. U.S. DOE, Office of Environmental Management, Oak Ridge, TN, USA.

Dowdy, S., and S. Wearden. 1983. Statistics for Research. John Wiley and Sons, New York.

Draper, N., and H. Smith. 1966. Applied regression analysis. John Wiley and Sons. New York. 709 pp.

Drouillard, K. G., J. J. H. Ciborowski, R. Lazar and G. D. Haffner. 1996. Estimation of the uptake of organochlorines by the mayfly Hexagenia limbata (Ephemeroptera: Ephemeridae). Journal of Great Lakes Research 22(1):26-35.

Froese, K. L., D. A. Verbrugge, G. T. Ankley, G. J. Niemi, C. P. Larsen and J. P. Giesy. 1998. Bioaccumulation of polychlorinated biphenyls from sediments to aquatic insects and tree swallow eggs and nestlings in Saginaw Bay, Michigan, USA. Environmental Toxicology and Chemistry 17(3):484-492.

Gobas, F., D. C. Bedard, J. J. H. Ciborowski and G. D. Haffner. 1989. Bioaccumulation of Chlorinated Hydrocarbons By the Mayfly (Hexagenia-Limbata) in Lake St Clair. Journal of Great Lakes Research 15(4):581-588.

Greichus, Y. A., A. Greichus, B. D. Amman and J. Hopcraft. 1978. Insecticides, polychlorinate biphenyls and metals in African lake ecosystems. Bulletin of Environmental Contamination and Toxicology 20:444-453.

Hare, L., P. G. C. Campbell, A. Tessier and N. Belzile. 1989. Gut sediments in a burrowing mayfly (Ephemeroptera, Hexagenia limbata): Their contribution to animal trace element burdens, their removal, and the efficacy of a correction for their presence. Canadian Journal of Fish and Aquatic Science 46:451-456.

Hare, L. and P. G. C. Campbell. 1992. Temporal Variations of Trace-Metals in Aquatic Insects. Freshwater Biology 27(1):13-27.

Harrahy, E. A. and W. H. Clements. 1997. Toxicity and bioaccumulation of a mixture of heavy metals in Chironomus tentans (Diptera: Chironomidae) in synthetic sediment. Environmental Toxicology and Chemistry 16(2):317-327.

Ingersoll, C. G. and et al. 1994. Bioaccumulation of metals by Hyalella azteca exposed to contaminated sediments from the Upper Clark Fork River, Montana. Environmental Toxicology and Chemistry 13(12):2013-2020.

Karouna-Renier, N. K. 1995. An assessment of contaminant toxicity to aquatic macroinvertebrates in urban storm water treatment ponds, University of Maryland**:**161.

Krantzberg, G. 1994. Spatial and temporal variability in metal bioavailability and toxicity of sediment from Hamilton harbour, Lake Ontario. Environmental Toxicology and Chemistry 13(10):1685-1698.

Larsson, P. 1984. Transport of PCBs from aquatic to terrestrial environments by emerging chironomids. Environ. Pollut. Ser. A 34:283-289.

Leland, H. V. and J. M. McNurney. 1974. Lead transport in a river ecosystem. Proceedings of the International Conference on Transport of Persistent Chemicals in Aquatic Ecosystems, Ottawa, Canada, May 1-3, 1974, National Research Council of Canada.

Mathis, B. J. and T. F. Cummings. 1973. Selected metals in sediments, water, and biota in the Illinois River. Journal - Water Pollution Control Federation 45(7):1573-1583.

Morrison, H. A., F. Gobas, R. Lazar and G. D. Haffner. 1996. Development and verification of a bioaccumulation model for organic contaminants in benthic invertebrates. Environmental Science & Technology 30(11):3377-3384.

Oliver, B. G. 1987. Biouptake of chlorinated hydrocarbons from laboratory-spiked and field sediments by oligochaete worms. Environmental Science and Technology 21(8):785-790.

Namminga, H. E., J. E. Scott and S. L. Burks. 1974. Distribution of copper, lead, and zinc in selected components of a pond ecosystem. Proceedings of the Oklahoma Academy of Science 54:62-64.

Palisade Corp. 1994. BestFit: Distribution Fitting Software for Windows. Palisade Corporation, Newfield, NY. 156 pp.

Poulton, B. C., D. P. Monda, D. F. Woodward, M. l. Wildhaber and W. G. Brumbaugh. 1995. Relations between benthic community structure and metals concentrations in aquatic macroinvertebrates - Clark Fork Montana. Journal of Freshwater Ecology 10(3):277-293.

Reynoldson, T. B. 1987. Interactions between sediment contaminants and benthic organisms. Hydrobiologia 149:53-66.

Sample, B. E., M. S. Aplin, R. A. Efroymson, G. W. Suter II and C. J. E. Welsh. 1997. Methods and Tools for Estimation of Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National Laboratory, Oak Ridge.

SAS Inst. Inc. 1988a. SAS Procedures Guide, Release 6.03 Edition. SAS Institute Inc., Cary, NC. 441 pp.

Shuman, M. S., L. A. Smock and C. L. Haynie. 1977. Metals in water, sediments and biota of the Haw and Hew Hope Rivers, North Carolina. Report No. 124. University of North Carolina at Chapel Hill, .

Thomann, R. V., J. P. Connolly and T. F. Parkerton. 1992. An equilibrium model of organic chemical accumulation in aquatic food webs with sediment interaction. Environmental Toxicology and Chemistry 11:615-629.

Timmermans, K. R., B. Van Hattum, M. H. S. Kraak and C. Davids. 1989. Trace metals in a littoral foodweb: concentrations in organisms, sediment, and water. The Science of the Total Environment 87/88:477-494.

Timmermans, K. R., B. Van Hattum, M. H. S. Kraak and C. Davids. 1989. Trace metals in a littoral foodweb: concentrations in organisms, sediment, and water. The Science of the Total Environment 87/88:477-494.

van der Oost, R., H. Heida and A. Opperhuizen. 1988. Polychlorinated biphenyl congeners in sediments, plankton, molluscs, crustaceans, and eel in a freshwater lake: Implications of using reference chemicals and indicator organisms in bioaccumulation studies. Archives of Environmental Contamination and Toxicology 17:721-729.

Young, L. B. and H. H. Harvey. 1988. Metals in Chironomidae larvae and adults in relation to lake pH and lake oxygen deficiency. Limnol. Theor. Appl. 23(1):246-251.

APPENDIX A

PROCEDURE FOR CALCULATION OF PREDICTION LIMITS FOR ESTIMATES GENERATED BY THE REGRESSION MODELS

APPENDIX A.

PROCEDURE FOR CALCULATION OF PREDICTION LIMITS FOR ESTIMATES GENERATED BY THE REGRESSION MODELS.

Prediction limits for estimates generated by the regression models presented in Table 3 may be calculated using the following equation (Dowdy and Wearden 1983):

$$Prediction\ Limit = \hat{y} \pm t_{\alpha=0.05,\ df=n-2} * RMSE * \sqrt{1 + \frac{1}{n} + \frac{(x^* - \bar{x})^2}{Sxx}}$$

$\hat{y}$ = log-transformed concentration of analyte in emergent adults estimated using regression models from Table 3.

$t_{\alpha=0.05,\ df=n-2}$ = t-statistic for 95% one-tailed limits or 90% two-tailed intervals with n-2 degrees of freedom. (Presented in Table A-1).

n = Sample size for regression model. (Presented in Table A-1).

RMSE = Root mean square error for regression model. (Presented in Table A-1).

x^* = log-transformed sediment concentration for which emergent adult concentrations are being estimated. (Site specific).

$\bar{x}$ = Mean log-transformed sediment concentration from regression model. (Presented in Table A-1).

Sxx = Variance of sediment concentrations from regression model. $Sxx = (\sum x^2 - (\sum x)^2) /n$. (Presented in Table A-1).

The procedure for calculating an upper 95% prediction limit for an estimate ($\hat{y}_{UPL}$) is as follows:

1) Use regression model from Table 3 and estimate the log-transformed concentration of analyte in emergent adults ($\hat{y}$) from the log-transformed sediment concentration of the analyte of concern (x^*).

2) Obtain values for t, n, RMSE, $\bar{x}$, and Sxx from Table A-1.

3) Apply the values from step 2 along with x^* to the equation outlined above and add the product to $\hat{y}$ to generate the upper 95% prediction limit for $\hat{y}$ ($\hat{y}_{UPL}$).

4) $\hat{y}_{UPL}$ as calculated by the above equation is log-transformed and must be back-transformed.

A lower 95% prediction limit ($\hat{y}_{LPL}$) can be calculated by subtracting the product from step 3 from $\hat{y}$, then back transforming the result. The 90% prediction interval (PI) is calculated if both the UPL and LPL are calculated. In application, 95% of all estimates are expected to fall below or above the UPL and LPL, respectively, and 90% of all estimates are expected to fall between the UPL and LPL.

Table A-1. Values for estimating upper and lower prediction limits for estimates generated by regression models.

Analyte	Data Set	n	$\bar{x}$	$\sum x$	$\sum x^2$	Root Mean Square Error (RMSE)	Sxx	t statistic ($\alpha = 0.05$, df = n-2)
As	All	55	1.916	105.364	229.370	0.447	-197.68	1.674
As	Non-Dep.	49	2.011	98.515	219.692	0.438	-193.58	1.678
As	Dep.	6	1.142	6.849	9.677	0.161	-6.21	2.132
Cd	All	120	0.451	54.100	145.153	0.684	-23.18	1.658
Cd	Non-Dep.	88	0.560	49.280	130.086	0.615	-26.12	1.663
Cd	Dep.	32	0.151	4.820	15.067	0.728	-0.255	1.697
Cr	All	34	1.812	61.611	117.076	0.298	-108.20	1.694
Cr	No	26	1.714	44.565	80.137	0.309	-73.30	1.711
Cu	All	112	1.501	168.165	318.839	0.301	-249.65	1.659
Cu	Non-Dep.	74	1.541	114.028	220.270	0.263	-172.73	1.666
Ni	Yes	10	1.621	16.210	26.780	0.213	-23.60	1.860
Pb	All	117	1.462	171.011	281.205	0.568	-247.55	1.658
Pb	Non-Dep.	86	1.398	120.232	189.139	0.624	-165.89	1.663
Pb	Dep.	31	1.638	50.779	92.066	0.385	-80.21	1.699
Zn	All	112	2.077	232.627	540.751	0.249	-478.34	1.659
Zn	Non-Dep.	84	2.029	170.424	390.170	0.256	-341.12	1.664
Zn	Dep.	28	2.222	62.203	150.581	0.193	-132.81	1.706
PCBs	Model (benthos)	16	0.523	8.367	10.635	0.516	-3.71	1.761
PCBs	Validation (adults)	10	1.435	14.352	30.752	0.268	-17.52	1.860

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ATTACHMENT 9

SUMMARY OF FEBRUARY 2011 SEDIMENT TOXICITY TEST FOR LOWER SOUTH DITCH SEDIMENT SAMPLE ISCO2

(Provided on CD ROM)

SUMMARY OF FEBRUARY 2011 SEDIMENT TOXICITY TEST FOR LOWER SOUTH DITCH SEDIMENT SAMPLE ISCO2

During development of the RI/FS Work Plan USEPA suggested conducting a 42-day chronic exposure *Hyalella azteca* whole sediment toxicity test using sediment from Lower South Ditch that would represent media with the highest potential hazard quotient calculated from available data. Prior risk assessment conducted under the MCP had indicated potential for toxicity to ecological receptors from exposure to Lower South Ditch sediments which had not been removed during the 2000/2001 Upper South Ditch removal action. The rationale for conducting the test was to provide a better indication whether sediment in South Ditch exhibited toxicity to aquatic macro-invertebrates. If the testing did not indicate toxicity, it would be a direct line of evidence that the sediment was likely not a significant contributor to ecological risks.

Page 4-11 of the RI/FS Work Plan proposed sample collection consistent with this rationale and prescribed that the test protocol would be conducted consistent with USEPA Guidance (referenced below). A prescriptive Work Plan was therefore not prepared describing the test methodology. Subsequently, proposals were solicited from several qualified subcontractors, work was awarded to EnviroSystems, Inc. (ESI) and USEPA was notified of that selection.

On February 17, 2011, sediment samples were collected by MACTEC personnel for sediment toxicity testing and chemical analysis. One sample was collected from location ISCO2, corresponding to the location in Lower South Ditch that previously registered the highest concentrations of contaminants of potential concern and highest hazard quotients. Samples were also collected from two reference locations, one located in the southern end of Maple Meadow Brook Wetland (SDBK-02) and another from the northern end of Maple Meadow Brook (MMB-SW/SD-1). Locations for samples ISCO2 and MMB-SW/SD-1 are identified in **Figure 2.2-4** of the RI Report (included herein for convenience). The location of sample SDBK-02 is shown in **Figure 2.5-1** of the RI Report. Sample collection activities were observed by Rick Sugatt of USEPA New England. At each sampling location, a sediment sample was prepared and submitted under chain of custody to Test America for laboratory chemical analysis. The remaining sediment was distributed among three one-gallon plastic pails for submittal to the toxicity testing laboratory. The samples were transferred under chain of custody to the ESI laboratory in Hampton, NH for a 42-day survival, growth and reproduction test using *Hyalella azteca* and following the procedures outlined in:

- Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates (ASTM Method E 1706-05, 2010),
- Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates (USEPA 2000); and
- Standard Methods for the Examination of Water and Wastewater, 20th Edition (APHA 1998).

The sample from the South Ditch and the two samples from reference locations were subjected to the test protocols. In addition, as required by the test protocol, the laboratory ran the toxicity test on a control sample.

The Lower South Ditch is a groundwater discharge area for groundwater that has elevated concentrations of ammonia that could potentially result in toxicity to the test organisms. Prior to the start of the test, as observed by USEPA, ammonia purging was conducted to eliminate the potentially confounding effects of ammonia from the sediments. During the toxicity test (on days 0, 7, 14, 21, 28, 35, and 42 of the test) samples of overlying water were collected from the test chambers for each of the samples and were analyzed for ammonia. The data indicate ammonia concentrations were either very low or not-detected in the overlying water samples from the beginning of the test through day 42. At the beginning of the test (day 0), the ammonia was not detected in the control sample nor in the two reference samples. The ammonia concentration in overlying water for sample ISCO2 was 0.11 mg/L and all overlying water samples for all four samples through day 28 of the test concentrations had no detectable ammonia (reporting limit of 0.1 mg/L). This information indicates that any site-related ammonia (from surface water or groundwater) that might have been present in the sediment samples when they were collected had been purged sufficiently such that there was not ammonia in the test water that would be contributing to the toxicity observed in the test. Therefore, the test results are reflective of non-ammonia contaminants in the sediment samples.

For each of the four samples, twelve test chambers (also referred to as replicates) were prepared by taking a clean 400 mL beaker, adding 100 mL of test sediment, and then covering the sediment with 225 mL of laboratory water. The control substrate was an artificial sediment prepared according to guidance presented in the USEPA/ASTM method. Organic detritus from amphipod cultures and disintegrated paper pulp was used to provide organic content. Overlying water for the sediment toxicity tests was a mixture of natural surface water, collected from the upper portion of the Taylor River watershed in Hampton Falls, New Hampshire, and moderately hard water prepared by the laboratory (reconstituted water). Use of natural surface water mixed with artificial reconstituted water is recommended by the protocol (USEPA, 2000; ASTM, 2010). Consistent with the USEPA and ASTM protocols, ten individual amphipods were added randomly from the lab culture to each test chamber at the start the test. Test chambers were maintained in a water bath during the test. Overlying water was renewed daily. Prior to the daily overlying water renewal, dissolved oxygen, pH, specific conductance and temperature were measured for each treatment. Overlying water in each replicate was then renewed. The volume of water added to each test chamber was approximately two volumes. After overlying water renewal each replicate was fed 1.0 ml of a yeast/trout chow/alfalfa suspension. Alkalinity, ammonia and hardness of the overlying water were measured on days 0, 7, 14, 21, 28, 35 and 42. The total organic carbon of the overlying water was measured on days 0 and 28.

On day 28 of the test, four replicate chambers from each sample were removed from the test. Amphipods in each chamber were removed and the number of survivors

counted and then dried in warm ovens at 104°C, and weighed to obtain growth in terms of dry weight. At this time, amphipods in the remaining eight test chambers were transferred to new test chambers containing only water for the remainder of the test. On Day 35, survival was again checked and the number of juveniles counted. Then, on day 42, the test was terminated, and the number of juveniles in each chamber were counted and divided by the number of females to calculate the number of young per female per beaker to determine reproduction. Some minor protocol deviations were noted but did not appear to affect the test outcome, and test methods met all acceptability criteria (*e.g.* control survival > 80%; increased weight in control sample; production of juveniles in control sample; and temperature tolerances).

Results for the Lower South Ditch sample (ISCO2) were compared to the results from the laboratory control and to the results from the reference areas samples (SDBK-02 and MMB-SW/SD-1). Statistical significance was calculated using analysis of variance (ANOVA) in accordance with the requirements and recommendations published with the testing method protocols. The statistical analysis is documented in the 2011 Envirosystems, Inc. report *Toxicological Evaluation of Freshwater Sediment Samples, South Ditch Sediment Evaluation, Olin Chemical Superfund Site, Wilmington, Massachusetts, 42 Day Hyalella azteca Survival, Growth and Reproduction Sediment Toxicity Test (included as Attachment 6 to this BERA). As* shown in **Table 1**, sample ISCO2 exhibited significantly lower amphipod survival (day 28, Day 35, and Day 42), growth (Day 28 and Day 42), and reproduction (Day 42) relative to the lab control. For example, on Day 28 of the test, survival in the control sample was 93.3% but survival in ISCO2 was on 41.7%. Survival, growth, and reproduction for sample ISCO2 were significantly lower than both reference samples (**Table 2**). These results clearly demonstrate that the sediment sample ISCO2 exhibited significantly greater toxicity to *Hyalella azteca* than the two reference samples and the laboratory control.

Sediment samples used in toxicity tests were concurrently analyzed for VOCs, SVOCs, total metals, and inorganic constituents such as chloride, sulfate, ammonia, nitrate, and nitrite. A review of the analytical data (**Table 3**) suggests that toxicity in ISCO2 was likely the result of concentrations of BEHP (480 mg/kg) and chromium (3,000 mg/kg) that were orders of magnitude higher than concentrations in reference samples, where BEHP was not detected in either sample (reporting limit < 0.3 mg/kg) and where chromium concentrations were reported at 5 mg/kg and 11 mg/kg. The concentrations of BEHP (11 – 920 mg/kg, mean of 322 mg/kg) and chromium (570 – 3,000 mg/kg, mean of 1,922 mg/kg) in sediment samples from the Lower South Ditch (reported in Table 3.13-12 of the Draft Final BERA) are consistent with the reported concentrations in the ISCO2 sediment sample that was the focus of the toxicity test. The comparison of Lower South Ditch sediment concentrations for BEHP and chromium to sediment benchmarks resulted in RME and CTE hazard quotients greater than 10 for each of the analytes (Table 4.3-11 of the Draft Final BERA). The available information indicates that remedial alternatives for Lower South Ditch sediments should be evaluated.

Table 1.
Summary of 42-Day *Hyalella azteca* Sediment Toxicity Test at ISCO2 vs. Lab Control
Olin Chemical Superfund Site

	Survival (%)			Average Growth (mg dry weight)		Reproduction (Young Per Female)
Sample ID [a]	**Day 28**	**Day 35**	**Day 42**	**Day 28**	**Day 42**	**Day 42**
Lab Control	93.3	87.1	85.7	0.840	0.915	6.33
ISCO-2**	41.7	38.6	37.1	0.193	0.446	0.5

Notes

Shaded box indicates a statistically significant result (p<0.05) relative to Lab Control

** Denotes the location of the test sample from Lower South Ditch that previously registered the highest concentrations of contaminants of potential concern.

Table 2.

Summary of 42-Day *Hyalella azteca* Sediment Toxicity Test at ISCO2 vs. Reference Samples

Olin Chemical Superfund Site

	Survival (%)			Average Growth (mg dry weight)		Reproduction (Young Per Female)
Sample ID [a]	**Day 28**	**Day 35**	**Day 42**	**Day 28**	**Day 42**	**Day 42**
SDBK-02*	95.8	94.3	91.4	0.364	0.597	3.86
MMB-SD/SW-1*	95.0	92.3	90.0	0.457	0.659	4.51
ISCO-2**	41.7	38.6	37.1	0.193	0.446	0.5

Notes

Shaded box indicates a statistically significant result (p<0.05) relative to reference samples.

* Denotes reference samples

** Denotes the location of the test sample from Lower South Ditch that previously registered the highest concentrations of contaminants of potential concern.

Table 3.
Summary of Detected Analytes in Toxicity Test Sediment Samples

	Medium	SED		SED		SED		
	Location	ISCO2		MMB-SW/SD-1		SDBK-002		
	Field Sample ID	OC-SD-ISCO-2-XXX		OC-SD-MMB-SW/SD-1-XXX		OC-SD-SDBK-002-XXX		
	Field Sample Date	2/17/2011 9:40		2/17/2011 13:30		2/17/2011 11:30		
	Lab SDG	360-32369-1		360-32369-1		360-32369-1		
	Qc Code	FS		FS		FS		
Parameter		Result	Qualifier	Result	Qualifier	Result	Qualifier	
VOCs (ug/kg)								
2,4,4-Trimethyl-1-pentene	ug/kg	20		12	U	6.8	U	
2-Butanone	ug/kg	38	J	86		37		
Acetone	ug/kg	120	J	240	J	120	J	
SVOCs (ug/kg)								
Benzoic Acid	ug/kg	27,000	UJ	1,400	J	1,200	U	
Bis(2-Ethylhexyl)phthalate	ug/kg	480,000		310	U	230	U	
Total Metals (mg/kg)								
Aluminum	mg/kg	8,100		6,000		3,200		
Arsenic	mg/kg	6.7		3.5		3		
Barium	mg/kg	14		26		20		
Beryllium	mg/kg	0.77		0.44	U	0.35	U	
Cadmium	mg/kg	0.58		0.31	J	0.23	J	
Calcium	mg/kg	1,100		1,500		850		
Chromium	mg/kg	3,000		11		5		
Cobalt	mg/kg	17		2.3		2.6		
Copper	mg/kg	20		8.1		5.5		
Iron	mg/kg	4,300		7,200		7,000		
Lead	mg/kg	11		28		11		
Magnesium	mg/kg	410		1700		530		
Manganese	mg/kg	49		110		240		
Nickel	mg/kg	17		8.5		3.5		
Potassium	mg/kg	1,500		730		180	J	
Silver	mg/kg	62		1.1	U	0.87	U	
Sodium	mg/kg	110	J	180	J	34	J	
Vanadium	mg/kg	8		12		4.9		
Zinc	mg/kg	30		36		50		
Mercury	mg/kg	0.22		0.11	U	0.08	U	
Inorganic Constituents (mg/kg)								
Chloride	mg/kg	130		210		130		
Sulfate	mg/kg	830		75	U	59	U	
Nitrogen, as Ammonia	mg/kg	170	J	130	J	32	J	

Notes
U - Analytes not detected, reporting limit shown
J - Estimated concentration