FIFTH FIVE-YEAR REVIEW REPORT FOR
W.R. GRACE & CO., INC. (ACTON PLANT) SUPERFUND SITE
MIDDLESEX COUNTY, MASSACHUSETTS

Prepared by

U.S. Environmental Protection Agency
Region 1, New England
Boston, Massachusetts

Bryan Olson, Director
Superfund and Emergency Management Division

6/17/19

Date

Table of Contents

LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ARS	Aquifer Restoration System
AUL	Activity and Use Limitation
AWD	Acton Water District
BERA	Baseline Ecological Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
COPCs	Contaminants of Potential Concern
EPA	United States Environmental Protection Agency
EPC	Exposure Point Concentration
FYR	Five-Year Review
HHRA	Human Health Risk Assessment
ICs	Institutional Controls
IGCL	Interim Groundwater Cleanup Level
LATS	Landfill Area Treatment System
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mg/kg	milligrams per kilogram
MNA	Monitored Natural Attenuation
NAUL	Notice of Activity and Use Limitation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGVD 29	National Geodetic Vertical Datum of 1929
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
O&M	Operation and Maintenance
ORSG	MassDEP Office of Research and Standards Guidelines
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PEC	Probable Effects Concentration
PCE	Tetrachloroethylene
PFAS	Per- and Polyfluoroalkyl Substances
ppm	parts per million
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
SEL	Severe Effects Level
SELF	Southeast Landfill
SLERA	Screening-level Ecological Risk Assessment
TBC	To be considered
TCA	Trichloroethane

TCE	Trichloroethylene
UCL	Upper Confidence Limit
µg/L	micrograms per liter
VISL	Vapor Intrusion Screening Level
VC	Vinyl Chloride
VDC	Vinylidene Chloride, also known as 1,1-Dichloroethene
VOCs	Volatile Organic Compounds

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the fifth FYR for the W.R. Grace & Co., Inc. (Acton Plant) Superfund Site. The triggering action for this **statutory** review is the completion date (9/23/14) of the previous FYR. The FYR (the "Report") has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of three OUs, two of which (OU-1 and -3) are addressed in this FYR. The selected remedy for OU-1 included excavation of contaminated material from various source areas, off-site incineration of highly contaminated soil and sludge, and on-site solidification of less contaminated soil, sludge, and sediment after removal of volatile organic compounds (VOCs) by heat. Solidified waste was then disposed on-site in the Industrial Landfill, an unlined landfill that was already in existence at the Site and used by W.R. Grace for disposal of various wastes and sludges. The remedy included capping of the Industrial Landfill following placement of solidified waste within it, landfill gas collection and treatment, and grading of the excavated waste areas. The selected remedy for OU-3 is active treatment of contaminated groundwater by extraction, above-ground treatment, and discharge; monitored natural attenuation of groundwater beyond the active treatment zones; institutional controls to restrict groundwater use until cleanup objectives have been met; and cleanup of contaminated sediments in Sinking Pond and the North Lagoon Wetland.

OU-2 is not addressed in this FYR. The 1989 ROD stated that a remedy for OU-2 would be necessary only if, following completion of the OU-1 remedy, residual contamination in soils under the source areas exceeded soil cleanup goals established for OU-1. Data collected during and after the completion of the OU-1 remedy indicated that the soil cleanup goals were met for each of the source areas, and therefore no remedy for OU-2 was necessary.

The W.R. Grace & Co., Inc. (Acton Plant) Superfund Site Five-Year Review was led by Christopher Smith, EPA Region 1 Remedial Project Manager (RPM). Other EPA participants included: Cindy Lewis, Region 1 Attorney, Richard Sugatt, Region 1 Risk Assessor, and Sarah White, Region 1 Community Involvement Coordinator. EPA's contractor AECOM provided support for aspects of the FYR related to hydrogeology, risk assessments, landfill maintenance, and groundwater treatment. Jennifer McWeeney of the MassDEP assisted in the review as the representative for the support agency. Site representatives for W.R Grace & Co. were notified of the initiation of the FYR, which began on 2/11/19.

Site Background

The bulk of the Site consists of the W.R. Grace property, a former chemical manufacturing facility which had occupied approximately 260 acres in Acton and Concord, Massachusetts. The property owned by W.R. Grace in Concord is now owned by the Town of Concord, but the remainder of the property is still owned by Grace (see Figure 1). The remnants of the manufacturing facility are visible on Figure 2 as paved roads, former parking areas, and the concrete slabs of former buildings. The former pits and lagoons are now mostly grass-covered fields, interspersed with wooded areas. Features that are relevant to the ongoing active remediation at the Site include the capped Industrial Landfill, the nearby groundwater treatment plant (GWTP), and Sinking Pond, the

receiving waters for the GWTP effluent (Figure 3). The Massachusetts Bay Transportation Authority (MBTA) Commuter Rail Fitchburg Line crosses the Grace property in an east-west direction.

Except on its west side, the area considered to be within the Site extends beyond the Grace property (see Figure 3), reaching the Assabet River to the south and southeast and Fort Pond Brook to the north and northwest. Beyond that fairly large Site area (see Figure 3), land use is almost exclusively moderate-density residential except for commercial properties and the Nuclear Metals Inc. (NMI) Superfund Site along Route 62 to the south (see Figure 1 in Appendix B). Within the Site but beyond the Grace property, the surrounding land uses (moving counter-clockwise from the east) include a new solar panel array (Town of Concord) and wetlands to the east; residential, industrial (Linde LLC), and public water supply (Acton Water District School Street Well Field) to the north; public water supply (Acton Water District Assabet Well Field) and a strip mall to the south; and a large area of commercial and light industrial development (including the new Town of Concord school bus maintenance facility) to the southeast.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: W.R. Grace & Co., Inc. (Acton Plant)		
EPA ID: MAD001002252		
Region: 1	**State:** MA	**City/County:** Acton & Concord/Middlesex
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Christopher Smith		
Author affiliation: EPA		
Review period: 2/11/2019 - 6/17/2019		
Date of site inspection: 5/7/2019		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/23/2014		
Due date *(five years after triggering action date)*: 9/23/2019		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

A chronology of Site events is included in Appendix C. Two major series of investigations have been conducted at the Site. The first occurred in the 1980s and led to construction of a groundwater extraction and treatment system, development of the 1989 ROD for OU-1, and cleanup of the source areas at the Site. The second set of investigations, conducted mainly between 2000 and 2002, resulted in development of the 2005 ROD for OU-3.

The contaminated media at the Site included soil, sludge, groundwater, and surface water. The primary contaminants identified in the sludges and underlying soils at several former lagoons at the Site were vinylidene chloride (VDC), vinyl chloride (VC), benzene, and ethylbenzene. Less common contaminants in sludges and soils included phthalates, metals, and cyanide, as well as formaldehyde and phenol in one specific area. Benzene, toluene, and ethylbenzene were the prominent contaminants in soils underlying the Industrial Landfill.

Fifteen contaminants were identified as indicator chemicals in groundwater, including VDC, VC, benzene, toluene, ethylbenzene, trichloroethene (TCE), formaldehyde, arsenic, beryllium, cadmium, chromium, copper, lead, nickel, and zinc. VDC and 1,1,1-trichloroethane (TCA) were detected in surface water samples from the Assabet River. VDC, benzene, toluene, xylene, tetrachloroethene (PCE) and chloroform were detected in surface water samples from Fort Pond Brook.

The primary resource affected by the Site is the underlying aquifer, from which groundwater is withdrawn at two well fields: one (Assabet Well Field, Wells #1 and #2) at the southern end of the Site near the Assabet River, and another (School Street Wellfield) at the northeastern end of the Site along Fort Pond Brook. Soils and sediment in the North Lagoon Wetland and in Sinking Pond were contaminated with arsenic and manganese, with iron and copper also of concern in Sinking Pond.

OU-1 and OU-2

A risk assessment was performed in 1989 (Alliance, 1989) that evaluated future human health risks associated with site-wide exposure to surface materials and groundwater, and specific source area exposures assuming residential use of the property. The risk assessment concluded that the W. R. Grace property was likely to pose significant carcinogenic and non-carcinogenic risk to human health in the event the property was developed and used for residential purposes, in the absence of remediation. Significant groundwater risk contributors included VDC, VC, arsenic, lead, and zinc. Risks associated with exposure to surface material were primarily attributed to VDC, VC, and arsenic. These conclusions formed the basis of the selected remedy for OU-1 and OU-2, which addressed surface materials (soil and sludge) only.

OU-3

The objectives for the investigations associated with OU-3 were to define the extent of groundwater contamination and its impacts, if any, on surface water, sediments, and air at the Site. Human health and ecological risk assessments were completed in 2005. The primary chemicals that were identified as groundwater contaminants at the Site include VDC, VC, benzene, 1,2-dichloropropane, 1,2-dichloroethane, methylene chloride, bis (2-ethylhexyl) phthalate, arsenic, and manganese.

The Human Health Risk Assessment identified future risks to receptors from exposure to sediments in North Lagoon Wetland and in Sinking Pond. Unacceptable risks to potential future recreational receptors (waders) were identified in Sinking Pond and in North Lagoon Wetland due to elevated arsenic in sediments. Unacceptable risks to the environment were also identified and attributed to arsenic in portions of Sinking Pond (above the thermocline) in water less than 12 feet deep, and to exposure to elevated concentrations of other metals in sediments of Sinking Pond including manganese, iron, and copper. The band of shallow water around the pond posing a risk to ecological receptors overlapped with areas of potential human exposure and risk to human

receptors from swimming/wading. Risks to ecological receptors in sediments of the North Lagoon Wetland were attributed to arsenic and manganese.

These conclusions formed the basis of the selected remedy for OU-3 of the Site.

Response Actions

When investigations in 1978 indicated that two municipal wells (Assabet #1 and #2) were contaminated with VDC, VC, ethylbenzene, and benzene, W. R. Grace and EPA entered into a Consent Decree requiring cleanup of the Site in October 1980 (1980 Consent Decree) under the Resource Conservation and Recovery Act. A similar settlement was reached between W.R. Grace and the state of Massachusetts. In September 1983, the Site was added to the National Priorities List (NPL).

The 1980 Consent Decree required cleanup and restoration of the drinking water in the aquifer, the source of water for Assabet Wells #1 and #2. In response, Grace developed a plan for a recovery well network to capture contaminated groundwater and pump it to a central facility for treatment. Following EPA and State approval of this cleanup plan, the Aquifer Restoration System (ARS) was constructed between December 1983 and March 1985. Parts of the ARS extraction well network were subsequently deactivated in 2002 and in 2008, while other parts were integrated into the new groundwater remedy required by the 2005 ROD.

This section describes the selected remedies for the three operable units (OU-1, OU-2, and OU-3) that comprise the Site.

OU-1

The ROD for OU-1 was signed on September 29, 1989. This ROD addressed the first of three operable units planned for the Site. The remedial action objectives as presented in the ROD for the Site were to:

- *Protect exposure points, where humans or wildlife may be exposed to contaminants in soil, groundwater, surface water, and sediments, during and after site remediation.*
- *Prevent the migration of contaminants in groundwater from sources on-site to public drinking water supplies.*
- *Protect on- and off-site groundwater from contamination by site contaminants in excess of drinking water quality.*
- *Eliminate the potential for contact in the future with waste materials by the public and the environment.*
- *Protect on- and off-site surface water from contamination by site contaminants.*
- *Prevent the migration of contaminated run-off from the waste sites.*
- *Protect against direct contact with site contaminants and minimize environmental exposure during remedial activities.*
- *Reduce to the maximum extent practicable the number of source areas to eliminate long-term management and permit unrestricted use.*

The selected remedy for OU-1 (source control), as identified in the ROD, consisted of the following components:

- *Excavation and transportation off-site for incineration of highly contaminated material from the Blowdown Pit;*
- *Excavation and stabilization of the remaining contents of the Blowdown Pit, as well as the contaminated sludges and soils of the Primary Lagoon, Secondary Lagoon, North Lagoon, and Emergency Lagoon;*
- *Excavation of contaminated soils from the Battery Separator Lagoons, Boiler Lagoon, and Tank Car Area;*
- *Placing both the stabilized and the non-stabilized materials excavated from the Site on the existing Industrial Landfill, and covering these materials with an impermeable cap;*

- *Post-excavation sampling and analysis;*
- *Capping the Battery Separator Chip Pile;*
- *Covering any disposal area which attains the soil cleanup goals;*
- *Modifying the ARS to address air stripper emission controls; and*
- *Establishing long-term environmental monitoring at each disposal area designed to monitor the effectiveness of the proposed remedy.*

The goals of the selected remedy were to protect the drinking water aquifer by minimizing further contamination of the groundwater and surface water, and to eliminate the threats posed by direct contact with or ingestion of contaminants in soil and waste sludges at the Site. The cleanup goals are presented in Table B-1 in Appendix B.

OU-2

The ROD for OU-1 stated that a remedy for OU-2 would be necessary only if, following completion of the OU-1 remedy, residual contamination in soils under the source areas exceeded soil cleanup goals established for OU-1. Data collected during and after the completion of the OU-1 remedy indicated that the soil cleanup goals were met for each of the source areas; therefore, no remedy for OU-2 was necessary (EPA, 1999).

OU-3

The ROD for OU-3 was signed on September 30, 2005. This ROD addresses the third and final operable unit for the Site. The selected remedy for OU-3, as identified in the ROD, consists of the following components:

- *Cleanup of contaminated sediments and soils posing an unacceptable risk to human health and/or the environment in Sinking Pond and the North Lagoon Wetlands;*
- *Extraction and treatment of groundwater contamination in the Southeast and Southwest Industrial Landfill Areas on the Grace property and at targeted areas in the Northeast Area;*
- *A redesigned and/or modified Aquifer Restoration System that will treat extracted groundwater for both metals and organic contaminants. Treatment processes for extracted groundwater would include air-stripping, activated carbon (air treatment), and metals precipitation prior to surface water discharge to Sinking Pond;*
- *Monitored Natural Attenuation of areas of groundwater contamination not captured by the extraction system;*
- *Institutional Controls such as deed restrictions and/or local ordinances to prevent unacceptable exposures to contaminated groundwater until cleanup levels are met and to protect against unacceptable future exposures to any wastes left in place on-Site;*
- *Long-term groundwater, surface water, and sediment monitoring, and periodic Five-Year Reviews of the remedy.*

The goals of the selected remedy are to restore the drinking water aquifer and to eliminate the threats posed by direct contact with or ingestion of contaminants in sediment in the North Lagoon Wetland and Sinking Pond. The Interim Groundwater Cleanup Levels (IGCLs) are presented in Table B-2. At the time that IGCLs identified in the ROD (and all newly promulgated or modified ARARs) have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment will be performed on all residual groundwater contamination to determine whether the remedial action is protective. The risk assessment will follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by all COCs (including but not limited to the COCs identified in the ROD) via ingestion, dermal contact, and inhalation of volatile chemicals from domestic water use. The sediment cleanup goals for protection of human health and protection of ecological receptors are presented in Table B-3 and Table B-4, respectively.

Status of Implementation

OU-1

The remedial design/remedial action activities for OU-1 were performed by W. R. Grace under the 1980 Consent Decree. Consistent with the 1989 ROD the following work has been conducted at the Site (additional details can be found in the 2014 FYR):

- The contents of the Battery Separator Lagoons, Boiler Lagoon, and the Tank Car Area were excavated to a depth of at least five feet and deeper if necessary to reach soil cleanup goals. These materials were then placed on the Industrial Landfill; if unexpected levels of contaminants were detected that could present implementation problems or impact the effectiveness of the landfill remedy, then those materials were stabilized prior to placement on the landfill or were disposed of off-site. Post-excavation sampling and analysis were conducted to ensure that soil cleanup goals were attained.

- Sludges and at least two feet of soil in each of the Primary, Secondary, and Emergency Lagoons were excavated, stabilized, and placed on the Industrial Landfill. Additional excavation greater than two feet in depth was performed until the soil cleanup goals were met. Sediments from the North Lagoon were removed to a depth equivalent to the low groundwater level, stabilized, and placed on the Industrial Landfill. Materials in the Blowdown Pit containing greater than 100 parts per million (ppm) of VDC were excavated and shipped to an off-site disposal facility. Remaining sludge and other contaminated materials and at least two feet of underlying soil were excavated, stabilized and placed on the Industrial Landfill. Post-excavation sampling was then conducted to ensure that soil cleanup goals were attained.

  The Industrial Landfill was covered with excavated soils and then with stabilized materials from the lagoons and Blowdown Pit and then graded using excavated materials from the other waste disposal areas. The landfill was then sealed/closed with an impermeable cap designed and constructed in accordance with Massachusetts Hazardous Waste Regulations for landfills. The impermeable cap included a synthetic cover to prevent infiltration of surface water into the waste materials beneath the cap. The cap was also constructed with vents to allow gases generated from the existing and new material to vent to the surface outside the landfill. Emissions from the Industrial Landfill were initially controlled utilizing a thermal oxidation unit, but, after proper evaluation, have since been allowed to vent passively to the atmosphere (EPA, 2002). Additionally, a groundwater monitoring and recovery system was designed and installed at the Industrial Landfill to supplement the existing ARS recovery wells.

- Originally, the Battery Separator Chip Pile was to be capped in place, but the need to remove the underlying soils made in-place capping not feasible. Therefore, the battery separator chips were excavated and placed in the Industrial Landfill and were covered with non-solidified material excavated from the source areas.

- Prior to implementation of the remediation work provided for in the ROD for OU-1, W.R. Grace constructed an ARS. This system began treating contaminated groundwater that was extracted from bedrock and overburden wells through an air stripping tower. The ARS began operation in March 1985 and continued, with modifications, to treat groundwater until the OU-3 remedy was constructed. The air stripping tower component of the ARS required upgrading by installing carbon filters to control vapors and odors; these upgrades were completed in September 1992.

OU-3

The remedial design/remedial action activities for OU-3 were performed by W. R. Grace under the 2006 Remedial Design/Remedial Action Statement of Work. Consistent with the 2005 ROD, the following work has been performed at the Site (additional details can be found in the 2014 FYR):

- The Landfill Area groundwater extraction and treatment system began operating in May 2011. Groundwater is pumped from five extraction wells to achieve a capture zone defined in the ROD. Beyond that zone, MNA is the remedy. The Landfill Area treatment system initially consisted of a metals microfiltration unit to reduce concentrations of arsenic, iron, manganese, and phosphorus, and a photocatalytic oxidation system to destroy VOCs and 1,4-dioxane (note: 1,4-dioxane was discovered post-ROD. Originally, the groundwater treatment system was intended to treat VOCs with an air stripper. In an effort to provide treatment for 1,4-dioxane in the influent, too, the photocatalytic oxidation system was installed in place of an air stripper). After a shakedown period of about one year, a liquid phase carbon unit was added to the system in May 2012 to remove residual chlorine from the effluent.

- A temporary groundwater extraction and treatment system operated from April 2010 through September 2013 in the Northeast Area. Its goal, which was accomplished, was to achieve mass removal from the most highly contaminated portion of the residual VDC plume that migrates through the bedrock aquifer to Fort Pond Brook and the School Street public water supply wells.

- The progress of the MNA component of the groundwater remedy has continued to be monitored. Sampling has shown that the MNA remedy has been largely successful in reducing the contaminant concentrations in the VOC plumes.

- Sediment removal actions were performed in the North Lagoon Wetland and in Sinking Pond between June and November 2011. Excavated areas in North Lagoon Wetland were backfilled with a minimum of 12 inches of topsoil to pre-construction grades, seeded, and planted, to achieve the goal of the upper one foot of sediment having concentrations of arsenic and manganese at or below the target cleanup levels. Remedial activities in Sinking Pond included excavation of sediments in the Inlet, and between elevations 144.5 feet and 128 feet around the border of the pond. A minimum of 6 inches of clean topsoil was then placed in the excavated portions of the pond between the water line and the historical high-water elevation (144.5 feet). Disturbed portions of the pond bank from the edge of water to 144.5 feet were seeded and planted. As documented in the Final Sediment Remedial Design Report (ARCADIS, 2011), W.R. Grace developed a remedial design that was intended to achieve the long-term goal of 42 mg/kg arsenic throughout the applicable portion of the pond such that subsequent monitoring for a reducing trend toward 42 mg/kg would not be necessary. Sediment remedial activities were determined to be complete and the final site inspection occurred on November 17, 2011.

Table 1 summarizes the status of the institutional controls for the Site. A draft Institutional Controls Plan for OU-3 (groundwater) was submitted by the PRP on May 12, 2011 (Tetra Tech GEO, 2011). The Town of Acton expressed concerns about their role in the plan in a letter dated June 6, 2011, and EPA and MassDEP issued a letter in response to those concerns on July 11, 2011. There is currently no resolution regarding the ultimate form of the IC that will be used to restrict installation of private wells in the vicinity of the plume, but the existing IC (an administrative hold on the installation of private irrigation wells by the Acton Board of Health) remains in effect. See Section V (Technical Assessment) below for additional discussion of institutional controls that may be required for the Grace property and for other properties in the towns of Acton and Concord.

Table 1: Summary of Planned and/or Implemented Institutional Controls					
Media, engineered controls, and areas that do not support UU/UE based on current conditions	**ICs Needed**	**ICs Called for in the Decision Documents**	**Impacted Parcel(s)**	**IC Objective**	**Title of IC Instrument Implemented and Date (or planned)**
OU-1: Capped Industrial Landfill	Yes	Yes	Industrial Landfill and surrounding groundwater (landfill area plume)	Ensure continued maintenance and prevent disturbance of the Industrial Landfill cap.	Deed Notice is on file with the Registry of Deeds.
OU-3: Groundwater	Yes	Yes	Properties within 500 feet of the mapped groundwater contaminant plume	Prevent installation of private wells near or within contaminant plume boundaries	The Acton Board of Health has an administrative hold on private irrigation well installations in effect, but additional ICs may also be needed. Agreement on the form of additional ICs to be used is not yet agreed between EPA, MassDEP, and the Town.

Systems Operations/Operation & Maintenance

The Landfill Area extraction and treatment system is maintained and monitored in accordance with the O&M Plan (Tetra Tech GEO and O&M, Inc., 2012a). Following a startup period during which many system operations were monitored daily or weekly, the frequency was decreased to monthly or quarterly for most monitoring activities, including individual extraction well and treatment system effluent sampling, and monitoring of extraction well flow performance. Treatment system performance reports are included in the annual Monitoring Program Reports.

The 1,4-dioxane destruction component of the treatment system has operated poorly since its inception. The system was designed to treat 1,4-dioxane to approximately 3 µg/L, which at the time of system design and construction was the MassDEP Office of Research and Standards Guideline for the compound. As influent concentrations of 1,4-dioxane have decreased over time (influent is now generally in the range of 3 µg/L) due to low yield wells (see paragraph below) and reductions in contaminant mass, the performance of the system has continued to decline, and generally destruction rates are less than 50 percent. Because the system does not have a discharge limit for 1,4-dioxane, the poor removal of the compound has not prompted corrective action.

The two extraction wells in the Southeast Landfill (SELF) Area, SELF-1 and -2, are screened in silty fine sand deposits and were installed to extract groundwater with relatively high concentrations of benzene from those poorly-permeable materials. The wells have always been low-yielding (1.5 gpm or less) and have high concentrations of inorganics, which create a need for frequent redevelopment, pump maintenance, and pigging of pipelines to maintain the modest pumping rates. In order to reduce the frequency of maintenance, the operator installed transducer-based level control systems in these wells in 2016, to optimize pump cycling and reduce inorganic fouling.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the 2014 five-year review as well as the recommendations from the 2014 five-year review and the current status of those recommendations.

Table 2: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy for OU-1 is protective of human health and the environment. Soil in excess of cleanup levels has been excavated, stabilized, and either placed in the Industrial Landfill or shipped off-site for treatment and disposal. The Industrial Landfill was then closed with an impermeable cap to prevent potential exposure. The PRP has filed a deed notice with the Registry of Deeds to regulate land use of the Industrial Landfill, and the PRP maintains ownership of the landfill and maintains the cap, and there is a perimeter fence enclosing the landfill.
3	Short-term Protective	The remedy at OU-3 is protective in the short-term, because there is no current exposure to contamination in groundwater or sediment. Groundwater in the vicinity of the Industrial Landfill is currently being extracted and treated by a new system that was constructed in 2011 (the Landfill Area). A separate groundwater extraction and treatment system was installed in the Northeast Area of the Site and operated from April 2010 to September 2013, at which time it was determined that it had met the ROD objective of reducing contaminant mass in this area. The Acton Water District provides treatment of groundwater from the five public water supply wells in the vicinity of the Site, and the Acton Board of Health has established an administrative hold on the installation of private wells within 500 feet of the current groundwater contaminant plume. Areas of contaminated sediment in the North Lagoon Wetland and in Sinking Pond were excavated for off-site disposal during the summer and fall of 2011 and the cleanup levels established in the ROD were achieved. The wetlands have been restored and monitoring of the effectiveness of restoration efforts continues. However, in order for the remedy to be protective in the long-term, additional institutional controls for groundwater may be needed to supplement the town's administrative hold on installing wells near the plume to prevent groundwater use until cleanup levels are reached.
Sitewide	Short-term Protective	The remedial actions taken are protective of human health and the environment in the short-term because there is no current exposure to contamination. Soil and sediment have been remediated and contaminated soil left on site in the Industrial Landfill was capped. The

Table 2: Protectiveness Determinations/Statements from the 2014 FYR		
OU #	**Protectiveness Determination**	**Protectiveness Statement**
		Landfill Area groundwater remedy is operating and will reduce contaminant concentrations to cleanup levels over time through a combination of active extraction and treatment combined with monitored natural attenuation. To be protective in the long-term, additional institutional controls may be needed for groundwater within the vicinity of the contaminant plume to supplement the existing controls (the Town's administrative hold) already in place.

Table 3: Status of Recommendations from the 2014 FYR					
OU #	**Issue**	**Recommendations**	**Current Status**	**Current Implementation Status Description**	**Completion Date (if applicable)**
3	The Acton Board of Health has established an administrative hold on the installation of private irrigation wells within 500 feet of the mapped region of contaminated groundwater that lies within the town. It may be necessary to establish additional institutional controls to prevent groundwater use within the contaminated plume area until cleanup goals are met. An Institutional Controls Plan was prepared in 2011 but action on it has stalled due to concerns raised by the Town of Acton.	Continue efforts with the Town to establish additional institutional controls if needed.	Ongoing	No change from last FYR. Town continues to implement the administrative hold but efforts for a more robust IC have not been pursued. The Town has requested supporting information (updated map of plume and addresses for the area of concern) to help ensure compliance.	

In addition, the following were recommendations from the 2014 FYR that did not affect protectiveness, but could improve the effectiveness of the remedies and/or support future FYRs in drawing conclusions regarding protectiveness:

- ***OU-1: Industrial Landfill Maintenance:*** Monitoring of vegetative growth in the perimeter swale should continue. Sediment and mowing clippings should be removed from the perimeter swale to promote positive drainage and eliminate standing water on the south, southeast and northwest sides of the landfill. Checking swale grades should also be considered, and if necessary the swale bottom should be re-graded to provide positive drainage to the outlet.

- ***OU-3: Sinking Pond Monitoring:*** In order to confirm the effectiveness of the remedy, it is recommended that additional temperature profile data and surface water elevations be collected in fall of 2015 and 2016, to confirm the location of the existing thermocline. Based on those data, it can be determined if reevaluation of exposure assumptions or additional sampling will be needed prior to the next five year review.

The temperature profile data for Sinking Pond was collected in 2015 and 2016 and is discussed under Question B, subsection "Ecological Risk Review."

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

A public notice was made available by a press release (https://www.epa.gov/newsreleases/epa-begins-14-reviews-massachusetts-superfund-site-cleanups-year) issued by EPA on 2/21/2019, in which the initiation of 14 FYRs in Region 1 was announced. The release announcing the five-year reviews also invited the public to submit any comments to the U.S. EPA community involvement coordinators for each site. The results of the review at the W.R. Grace & Co. (Acton Plant) Site and the report will be made available at the Site information repositories located at the Acton Public Library and at the US EPA Region 1 OSRR Records and Information Center, 5 Post Office Square, Boston, MA.

During the FYR process, interviews were conducted with Town of Acton Health Department and Acton Water District (AWD) officials, members of the community group Green Acton (the organization formerly known as Acton Citizens for Environmental Safety has been folded into Green Acton), the MassDEP project manager, and a representative of Grace. The purpose of the interviews was to document any perceived problems or successes with the remedy implementation to date.

Green Acton representatives said that more public communication from EPA regarding the site would be welcome, particularly with respect to two issues they note are causing confusion: 1) the site cleanup status (some folks think the cleanup is "done", unaware that O&M will be ongoing for many years), and 2) the fact that the neighboring Superfund site has a cleanup goal for 1,4-dioxane when the Grace site does not. They noted other concerns regarding what will happen as Grace re-develops their property (could new development affect the remedy?), and the status of institutional controls such as the Acton Board of Health administrative hold on irrigation wells. This latter concern was also raised by a Town representative who felt that clearer direction and assistance was needed from EPA for the Board of Health to be able to maintain the administrative hold (e.g., an updated map to show recommended boundaries of the hold and addresses of the properties to which it applies).

The overarching concern of all community representatives was the potential for VOCs and 1,4-dioxane to continue to impact the AWD water supply wells (both the School Street well field and the Assabet well field). The community representatives all felt that it was important that Grace continue to monitor groundwater and that there should be a cleanup goal for 1,4-dioxane that is specific to the Grace site. There is also a sense that the AWD has had to provide treatment of groundwater with their own treatment systems to remove contaminants that Grace should be responsible for actively removing (rather than relying on monitored natural attenuation). The AWD representative said that the AWD is supportive of the Superfund process but expressed concern that AWD was not being kept as well-informed as they had been in the past. He noted that AWD gets regular inquiries about the Site (1 or 2 per month), with questions/concerns similar to those Green Acton noted (1, 4-dioxane and

redevelopment of the Grace property). He noted that AWD would like to receive monitoring data more quickly so they can adjust their operations as needed, and that AWD has concerns that the extent of 1,4-dioxane contamination is not sufficiently understood. Similarly, the MassDEP project manager stated her view that an evaluation should be conducted to determine if further action is warranted to address residual 1,4-dioxane contamination in both the Southwest Area and Northeast Area of the site.

The Grace representative stated that the OU-3 remedy is progressing well, with VOC concentrations declining by operation of the Landfill Area Treatment System (LATS) in some areas and by natural attenuation in other areas, as envisioned in the ROD. He noted that the LATS experiences operational difficulties mostly because of the high naturally occurring iron concentrations in the groundwater. Two extraction wells require significant maintenance but contribute little flow, and Grace would like to discontinue operation of these wells, as Grace's view is that these wells do not contribute significantly to the protectiveness of the remedy. Similarly, Grace would like to discontinue operation of the photocatalytic oxidation portion of the LATS because it is energy-intensive and no longer improves the overall ability of the treatment system to remove VOCs and 1,4-dioxane. He stated that Grace continues to own all of the original Site property (excepting the parcel the Town of Concord took by eminent domain in 2015) and that Grace has no established plans for the future use of their property at this time.

Data Review

Groundwater Monitoring

Five rounds (2014 through 2018) of annual groundwater monitoring have been performed since the last FYR. In each round, samples were collected from a varying number of wells and analyzed for one or more of the following: VOCs, inorganics, geochemical parameters, and 1,4-dioxane. VDC, VC, and benzene continue to be the most frequently detected compounds at concentrations greater than their IGCLs, and 1,4-dioxane remains a compound of interest due to its presence at concentrations greater than 0.3 µg/L (the MassDEP drinking water guideline and Method 1 GW-1 standard, used to regulate cleanup of MassDEP sites). Neither is considered an enforceable standard, nor does a federal MCL exist.

Figures 4 through 7 illustrate the extent of each of these compounds in the groundwater at the Site in 2018. For comparison purposes, a depiction of the extent of VDC in the groundwater in 2001/2002 (Figure 8) is also included. Since VDC is widespread at the Site, a comparison of Figure 5 to Figure 8 gives a good visual summary of the extent of the improvement in groundwater quality since the feasibility study (FS) and the ROD were completed.

For evaluation of groundwater conditions, the Site has historically been divided into six areas: the Former Lagoon Area, the Northeast Area, the Southwest Area, the Assabet River Area, the Southwest Landfill Area, and the Southeast Landfill Area. These areas are shown on Figure 4.

Former Lagoon Area. The remedy selected for this area in the 2005 ROD was Monitored Natural Attenuation (MNA), since most wells had contaminant concentrations <100 ug/L after years of operation of the ARS system. However, shortly after shutdown of the ARS system extraction wells in 2009, the concentrations of VDC and VC in monitoring well OSA-13B began to increase, reaching peaks of 7,900 µg/L (VDC) and 280 µg/L (VC) in 2018. In response to the increasing concentrations of contamination at OSA-13B, nearby existing wells were added to the annual sampling program, and the frequency of sample collection was temporarily increased in select wells. The expanded monitoring has shown that the concentrations of contamination are also rising in the shallow groundwater (VDC as high as 22 µg/L at OSA-13A) and the deep groundwater (VDC and VC as high as 780 µg/L and 37 µg/L, respectively, at OSA-13C) at the OSA-13 cluster. Other than minor exceedances of the IGCL for VDC at OSA-14A and OSA-3BR (7.8 µg/L at both wells), no horizontal expansion of the contamination at the OSA-13 cluster has been detected, although the existing monitoring wells may not be at optimal locations or depths to detect such movement.

In other parts of the FL Area, data from 2018 showed that of the three primary groundwater contaminants at the Site, only VDC was found to exceed its IGCL (at OSA-6BR).

Only well OSA-13B was sampled for 1,4-dioxane in the FL Area in 2018. In five samples collected since 2011, the concentrations of 1,4-dioxane have decreased steadily from 2.07 µg/L to 0.36 µg/L.

Northeast Area. The contamination in the Northeast (NE) Area represents the residual of the plume that flowed northeast from the FL Area toward Fort Pond Brook and the School Street wellfield when the lagoons at the Site were in operation. When the ROD was written, the primary known contaminants in the northeast plume were VDC and VC. The concentrations of VDC and VC at the individual supply wells in the well field have been below IGCLs since 2008, except for one annual sample from the Scribner station in 2015 which had 10.8 µg/L of VDC.

By 2018, only one well (AR-31D) still had a VDC concentration (36 µg/L) above 30 µg/L (see Figure 5), and while VDC concentrations throughout the plume were generally in the range of about 4 to 20 µg/L, many of the wells show statistically-significant downward trends for VDC and VC. VC was not detected above its IGCL of 2 µg/L at any well in this area in 2018.

Sampling of monitoring wells in 2018 indicated that 1,4-dioxane remains widespread in the NE Area at concentrations up to about 2 µg/L. The concentration was highest (3.1 µg/L) at AR-30D. Samples from two of the water supply wells/wellfields had concentrations of 1,4-dioxane of 0.18J µg/L; it was not detected (<0.20 µg/L) at the third.

Southwest Area. The three primary VOC contaminants have been almost completely flushed from the bedrock and overburden aquifers in the Southwest (SW) Area. VDC, VC, and benzene concentrations were well below IGCLs in the few monitoring wells that were still being sampled in this area between 2014 and 2018.

Five bedrock and two overburden monitoring wells in the SW Area are included in annual monitoring rounds for 1,4-dioxane analysis. The southernmost well, PT-03B1, is actually in the plume from the Nuclear Metals Inc. (NMI) Superfund Site, which flows northwest beneath the Assabet River and into the SW Area in response to pumping from the Assabet water supply wells. The 1,4-dioxane results at PT-03B1 between 2014 and 2018 ranged from 2.6 µg/L to 9.2 µg/L. In the other monitoring wells in the SW Area, the concentrations of 1,4-dioxane generally fell within the range of 0.34 µg/L to 1.7 µg/L, with one result of 2.7 µg/L in 2016. In the Assabet 1A supply well, which partially captures both the NMI and the W.R. Grace plumes, 1,4-dioxane concentrations were between 0.15J µg/L and 0.47 µg/L, with one result of 1 µg/L as a possible outlier. In the nearby Assabet 2A water supply well, which is more affected by the W.R. Grace plume, concentrations of 1,4-dioxane were between 0.14 µg/L and 0.27 µg/L, with one result of 0.41 µg/L. The results generally show that while 1,4-dioxane is widespread in the bedrock aquifer in this area at concentrations up to about 2 µg/L, concentrations do not appear to be increasing over time (excluding the results from well PT-03B1, which is impacted by the NMI plume rather than the Grace plume).

Assabet River Area. Similar to the NE Area, the groundwater contamination in the Assabet River (AR) Area is the cut-off portion of a plume that flowed through in this area when the Site was an active facility. Two overburden monitoring wells in the downgradient part of this area, close to the Assabet River, were sampled annually between 2014 and 2018. The VDC (27 to 34 µg/L) and VC (9.7 to 14 µg/L) concentrations in well LF-18D, the more easterly of the two wells and closer to the Industrial Landfill plume, exceeded the IGCLs. At LF-20D, only one VDC result (7.2 µg/L) since 2014 exceeded the IGCL, and the VC results (0.98J to 4.2 µg/L) were below the IGCL in 2017 and 2018. Both compounds exhibit statistically significant downward trends at both wells. Concentrations of 1,4-dioxane in these two wells were 2.9 (LF-20D) and 5.7 (LF-18D) µg/L in 2018. The remediation of this area will be by MNA, as the end of the cut-off plume discharges to the Assabet River.

Southwest and Southeast Landfill Areas. The contaminated groundwater beneath and downgradient of the Industrial Landfill is generally divided into two areas. The Southwest Landfill (SWLF) Area is characterized by high concentrations of VDC and VC, with lower concentrations of benzene. In the Southeast Landfill (SELF) Area, benzene and arsenic have been the primary contaminants, although VC is present at high concentrations in the eastern monitoring wells. The OU-3 ROD requires that groundwater with the highest levels of these contaminants be captured and treated for discharge to Sinking Pond. Lower levels of contamination beyond the required capture zone will be remediated by MNA.

In 2018, the plume in the SWLF Area was characterized by VDC concentrations up to 92 µg/L and VC concentrations up to 68 µg/L. Benzene concentrations in the SWLF Area were lower, with a maximum of 23 µg/L in the bedrock. The groundwater with these high concentrations of contaminants is all within the capture zone of the extraction wells.

In the SELF Area, groundwater is extracted from wells SELF-1 and SELF-2 in the overburden, where the highly-contaminated part of the plume is present. In 2018, the overburden aquifer exhibited benzene concentrations up to 110 µg/L (in extraction well SELF-2). VDC and VC concentrations in the SELF Area in 2018 were lower, with maximum levels of 30 and 54 µg/L, respectively; however, these concentrations were outside the capture zone and will attenuate via MNA.

In the SWLF Area in 2018, the concentrations of 1,4-dioxane in three samples from each of the three extraction wells ranged from 0.99 µg/L to 4.6 µg/L (except for one outlier result of 12 ug/L). Annual samples from two monitoring wells had 1,4-dioxane concentrations of 0.87 µg/L (overburden) and 3.1 µg/L (bedrock).

In the SELF Area in 2018, concentrations were in the range of 11 µg/L to 25 µg/L in the two overburden extraction wells, and in the range of 2.7 µg/L to 16 µg/L in three monitoring wells. The levels of 1,4-dioxane in the SE Landfill Area are the highest at the Site.

Summary of Groundwater Monitoring Results. Except for the area within the capture zone of the SELF and SWLF extraction wells, the selected remedy for groundwater throughout the site is MNA. In the SW Area, except for two samples from a bedrock well (AR-03B1) on the southeast edge of Sinking Pond that had mildly elevated concentrations (9.9 and 15 µg/L) of VDC, no exceedances of IGCLs were detected in the last five years. In the NE and AR Areas, residual concentrations of VDC and VC from the original highly-contaminated plumes are being attenuated, so the most contaminated groundwater is now close to the leading edges and discharge points. The portion of the NE plume in which the IGCL for VDC is still exceeded remains much larger than in the AR Area.

In the SWLF and SELF Areas, concentrations of VOCs and inorganics are highest within the capture zone of the extraction system, which is being sustained as required by the ROD. Beyond the capture zone, where MNA is the remedy, the concentrations of most VOCs and inorganics show declining trends, although exceedances of IGCLs remain significant in some areas (VC >50 µg/L to the southeast of the ROD-required capture zone).

VOCs are mostly below IGCLs in the FL Area, although in a limited area near well cluster OSA-13, the long-term viability of the MNA remedy is currently being brought into question by increasing concentrations of VDC and VC. The source of these increasing concentrations should be investigated to determine if MNA will be successful in the long-term.

The highest concentrations of 1,4-dioxane are detected in the Landfill Areas, where concentrations up to 25 µg/L occurred in 2018 in the SELF area. There is no MCL for 1,4-dioxane, and a cleanup level was not established by EPA in the ROD; however, concentrations of 1,4-dioxane continue to be monitored, in response to stakeholder concerns and to ensure the remedy remains protective. Risks associated with 1,4-dioxane are further discussed under Question B, subsection “Changes in Toxicity and Other Contaminant Characteristics.”

Of the seven inorganic COCs at the Site, only arsenic (4 out of 16 samples) and manganese (9 out of 16 samples) were detected at concentrations exceeding the IGCLs in 2018. The four wells in which arsenic exceeded its IGCL are all in the FL, SWLF, and SELF Areas. Dissolved oxygen concentrations are increasing at all four of those wells, and arsenic concentrations are decreasing at three of them and may eventually fall below the IGCL as geochemical conditions become less reducing. Manganese concentrations at the nine wells where the IGCL is exceeded show mixed trends and may be slower to remediate. The IGCL for manganese may be raised in the future based on background concentrations.

North Lagoon Wetland and Sinking Pond Vegetation Monitoring

Monitoring of the restored wetland areas of North Lagoon Wetland (NLW) and Sinking Pond was conducted from 2012 through 2016 (the five years after completion of sediment removal activities), as specified in the Demonstration of Compliance and Maintenance Plan (ARCADIS, 2012). The purpose of the monitoring was to assess the establishment, quality, and survival of seeded and planted vegetation in wetland areas that were affected by the sediment remedial activities and subsequently restored.

At the time of the last FYR (2014), the monitoring had indicated that the restoration of the wetland habitats had been largely successful. Since then, two additional years of monitoring have occurred (2015 and 2016). The monitoring in 2015 and 2016 demonstrated vegetative cover in the restored habitat areas generally remained high and met the goal of 80% ground cover. The 2016 data indicated the wooded plant communities throughout both Sinking Pond and NLW restoration areas showed recruitment of large numbers of native species, with less success with survival of the planted trees and shrubs. With the recruitment of native species including cottonwood, birch and willow, the average cover of woody species dramatically increased in 2016. No major concerns were identified, and observations throughout the wetland and upland restorations around Sinking Pond and the NLW indicate these communities continue to develop and mature.

Sinking Pond Temperature Measurements

As recommended in the 2014 FYR, temperature profile data and surface water elevations were collected in the fall of 2015 and fall of 2016 to monitor the location of the existing thermocline. This work was done because an assumption of the ecological exposures for the remedy included removal of sediment from the most biologically active area of the pond encompassing the sediments above an elevation of 128 feet. The intent of the remedy was to remove contaminated sediments at elevations above 128 feet in order to limit exposures of aquatic organisms to sediment contaminants in the most ecologically sensitive areas of the pond.

The measurements collected in 2015 and 2016 are compared to pre-existing measurements in Table B-5. Based on these results, the approximate thermocline elevation has been as much as 10 feet lower than the elevation to which cleanup occurred. This is further discussed under Question B, subsection “Ecological Risk Review.”

Site Inspection

The inspection of the Site was conducted on May 7, 2019. In attendance were Christopher Smith, U.S. EPA; Jennifer McWeeney, MassDEP; Thor Helgason (*de maximis* - site manager for the PRP); and Warren Diesl and Deborah Roberts (AECOM – oversight contractor for EPA). The purpose of the inspection was to assess the protectiveness of the remedy. The Site Inspection Checklist and selected photographs taken during the inspection are included in Appendix D. The inspection included the following items: 1) Industrial Landfill inspection, 2) inspection of Landfill Area groundwater treatment system; and 3) inspection of restored areas (North Lagoon Wetland and Sinking Pond).

Landfill Area Inspection

The chain link fence that surrounds the Industrial Landfill is intact and in reasonably good condition. The grass on the landfill cap appears to be in good condition, with no stressed areas noted. As noted during the site inspection in 2014, the perimeter drain around the toe of the landfill has some areas (south, southeast, northeast) in which the growth of vegetation in the rip rap may slightly impede drainage. However, water was observed flowing out of the channel into a drainage culvert on the north side of the landfill, so although the flow is slowed in the channel, it is not blocked.

Most of the infrastructure associated with the extraction wells and pipelines is below ground and not conducive to inspection. The flow monitoring equipment in the treatment plant indicated a flow of 47 gpm, which is close to the target rate of 50 gpm. The monitoring wells and extraction wells that were inspected appeared to be secure and in good condition. The treatment plant was neat and well organized, with components and pipes conspicuously labeled and hazards well marked.

Wetland Restoration Inspection

The site visit included an inspection of the wetlands restoration at Sinking Pond and the North Lagoon Wetland. Areas of the Site impacted by excavation of sediments and subsequently restored had been seeded and planted in 2011 following the removal actions. In general, both restoration locations are well-vegetated. The vegetation on the bank of Sinking Pond is fairly sparse and patchy; however, there is no evidence that there has been any serious erosion or gully formation on the bank. The water levels at Sinking Pond were higher than previous years. There has been mortality of shrubs and trees around the bank of Sinking Pond since data was collected for the final vegetation monitoring report (ARCADIS, 2017). The monitoring report documented many small seedlings of native trees and shrubs that were not visible during the site inspection.

The area of the sedge marsh within North Lagoon Wetland has developed a good density of wetland vegetation, dominated by sedges along the edges of the marsh, with cattails and sedges prominent in the center of the marsh. The remainder of the North Lagoon Wetland, located in the wooded marsh and along Fort Pond Brook, has become covered with suitable wetland vegetation. Very few surviving trees and shrubs were observed in the wooded area of North Lagoon Wetland. A large area of the invasive common reed (Phragmites sp.) was observed in the wooded swamp and a small area in the sedge marsh; otherwise, invasive species were not prevalent.

Changes in Land Use and Ownership Since the Last Five-Year Review

In 2015, the Town of Concord took ownership of the parcel of the Grace property in Concord by eminent domain. The parcel consists of approximately 68-acres and is located between the Assabet River to the east and the Concord/Acton Town border to the west. Concord constructed a solar array in the northern portion of this property and a bus maintenance facility in the southern portion (see Figure 3). At the time Concord took ownership of this parcel of the Grace property, no ICs were in place restricting land use or development on this parcel, or any other parcels within the Grace property except for the Industrial Landfill, and for the Industrial Landfill the IC was (and remains) limited to a deed notice.

The lack of ICs to control the development of the Concord parcel caused problems for EPA, WR Grace, and the Town of Concord. Despite warnings from EPA and MassDEP, construction of the solar arrays resulted in thousands of dollars of damage to monitoring wells operated by Grace in that area of the Site. Without consultation with either EPA or MassDEP, the Town also installed a groundwater extraction well intended to provide non-potable water to clean busses at the bus maintenance facility. This eight-inch diameter well was advanced to a depth of approximately 500 feet in bedrock. EPA was not notified of the installation of this well, and only became aware it was installed after it was discovered by personnel repairing the monitoring wells damaged during construction of the solar array. Subsequently, EPA issued a letter restricting the use of this well out of concern that it may draw contaminated groundwater from the Grace Site, with potential to pose a risk to human health and to adversely affect the groundwater remedy.

These issues, which arose because of the acquisition of a parcel of the Grace property, demonstrate that the current ICs on the property are not sufficient to ensure the protectiveness of the remedy over the long term. The current ICs include a deed notice for the Industrial Landfill area only and the administrative hold on groundwater extraction wells which applies to Acton only (see Table 1 above). The issues which arose during development of the Concord parcel show that these ICs are insufficient to prevent use of groundwater and damage to remedy infrastructure. A comparison of the current ICs on the Grace property to others implemented in Region 1 also identified other deficiencies, including that they do not provide for an evaluation of vapor intrusion and mitigation in the event of future development and they lack enforcement under state law (e.g., the landfill is controlled only through a deed notice, rather than a Notice of Activity and Use Limitation (NAUL), which is an enforceable standard). In summary, a review of the ICs and changes in land use demonstrates that the current ICs are not effective and require re-evaluation.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Yes. The review of documents, ARARs, and risk assumptions indicates that the OU-1 remedy was implemented in accordance with the ROD for OU-1 and is functioning as intended. The Industrial Landfill is owned and maintained by W.R. Grace, wastes were solidified and capped, access is restricted by a fence, and a deed notice has been filed with the Registry of Deeds that puts parties on notice that the landfill cannot be disturbed except by written permission of MassDEP; hence, there is no current potential for exposure to waste left in place. The fence surrounding the landfill is intact and kept in good repair. The passive venting of landfill gas does not pose an unacceptable health risk or hazard, as substantiated in previous FYRs. W.R. Grace has stated that it intends to maintain ownership of the land surrounding the Industrial Landfill and control access to it. However, to ensure long term protectiveness, more formal restrictions on future use of the W.R. Grace property may be required.

Notices of Activity and Use Limitations (NAULs) should be considered across the Site, including for the land still owned by Grace within the Town of Acton as well as for the parcel located within Concord. These NAULs would function to protect against unacceptable future exposures to any wastes left in place on-Site and prevent exposure to contaminated groundwater until cleanup levels are met. Specifically, a NAUL for the Industrial Landfill would prevent construction on the landfill and potential exposure to the wastes contained in it. NAULs for groundwater would ensure that as the property is developed, the remedy is not adversely affected, remedy infrastructure (e.g., extraction wells and piping) is protected, and that there is no exposure to unacceptable levels of contamination in groundwater (e.g., through installation of wells or vapor intrusion).

The OU-3 groundwater remedial action is performing as expected across most of the Site, and it is anticipated that for the most part, cleanup levels will be achieved in a reasonable time frame. The Landfill Area groundwater extraction system is containing the plume within the ROD-required capture zone. Operation procedures are adequate to maintain extraction well yields. Beyond the capture zone, contaminant concentrations are decreasing through MNA. The Landfill Area groundwater treatment system is removing VOCs and inorganics from the influent and meeting the standards for discharge of the effluent to Sinking Pond. Operation and maintenance procedures are adequate to maintain the functionality of the treatment system at the required level of performance. However, as discussed above, the parcels that make up the Grace property (those still owned by Grace, as well as the Concord-owned parcel) lack formal restrictions to prevent the use of contaminated groundwater. NAULs should be considered that will formalize this restriction as the Site proceeds towards redevelopment in order to ensure protectiveness in the future.

The Acton Board of Health's administrative hold on installation of private irrigation wells within 500 feet of the contaminant plume prevents residential exposure to contaminated groundwater; however, it may be necessary to establish more formal and enforceable institutional controls to prevent groundwater use within the contaminated plume area until cleanup goals are met. An Institutional Controls plan to prevent unacceptable exposures to contaminated groundwater was prepared in 2011 but action on it has stalled due to concerns raised by the Town of

Acton. Additionally, since the 2014 Five-Year Review, the property owned by W.R. Grace in Concord has transferred ownership and is now owned by the town of Concord as noted above. Concord has constructed solar panels and installed a bus maintenance facility in this area (see Figure 3). ICs should be considered for this area of the property now owned by the town of Concord.

The part of the site where the efficacy of the groundwater MNA remedy is uncertain is a limited area near the former Primary Lagoon, where concentrations of VDC and VC have increased significantly since 2014. Concentrations had risen modestly in 2010 following shutdown of the FL Area ARS extraction wells (in 2009), but the more recent data show a more rapid rise and some vertical spreading to shallower and deeper monitoring wells at the most affected cluster. Additional investigation is needed to define the source area and to determine if any supplemental remediation is necessary.

Treated water is supplied to Town residents and there is an administrative hold on private irrigation well installation within 500 feet of the plume areas. Ongoing monitoring and evaluation of groundwater contaminant concentrations Site-wide will continue, as planned, until cleanup goals are attained.

Under OU-3 actions, contaminated sediments were removed from Sinking Pond and the North Lagoon Wetland between June and November 2011 and disposed off-site. Confirmatory samples were collected, and additional excavation was performed as needed to attain cleanup levels. Both areas were restored in late 2011. Monitoring of restored wetland habitats is ongoing and indicates the restoration has been largely successful.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Question B Summary

No. There have been changes to the toxicity values, exposure assumptions, exposure pathways and methods of evaluating risk since the OU-1 and OU-3 RODs. However, the RAOs selected for the Site remain valid.

Groundwater

Changes in toxicity values for most groundwater compounds (e.g., arsenic, VDC, and TCE) would not affect remedy protectiveness since IGCLs are based on MCLs or MCLGs. Toxicity values have not changed since the 2005 OU-3 risk assessment was completed for those groundwater compounds with risk-based cleanup levels (nickel, manganese, and MTBE). In addition, the drinking water pathway is currently incomplete because the Acton Water District provides treatment of groundwater from the five public water supply wells in the vicinity of the Site (i.e., concentrations of Site related contaminants are all reduced below Federal and State or risk-based standards), and the Acton Board of Health has established an administrative hold on the installation of private wells within 500 feet of the current groundwater contaminant plume. However, as discussed in Question A above, NAULs should be considered across the Grace property to ensure the use of contaminated groundwater is restricted with respect to future potential uses/pathways. Additionally, NAULs to address groundwater should be considered on the portion of the former Grace property that is now owned by the town of Concord.

Soil and Sediment

Soil and sediment in excess of cleanup levels has been excavated and either placed in the Industrial Landfill or shipped off-site for disposal. The Industrial Landfill has been closed with an impermeable cap to prevent potential exposure. The protectiveness of the soil and sediment cleanup levels was fully evaluated in the 2014 FYR which concluded that the ROD soil and sediment cleanup levels continue to be protective. Since 2014, toxicity values have not changed for any of the soil or sediment COCs. Changes in toxicity for other contaminants (e.g., lead) do not affect remedy protectiveness.

Vapor Intrusion

The remedy continues to be protective of the vapor intrusion (VI) pathway. Although there were select exceedances of groundwater vapor intrusion screening levels (VISLs) (see subsection "Changes in Exposure Pathways" below), the cumulative risk associated with the VI pathway is expected to be within EPA's risk management range. However, a vapor intrusion evaluation should be performed before new buildings are constructed in on-property, Grace-owned areas where groundwater VISLs are exceeded or where appropriate groundwater data are not currently available. NAULs that are also designed to ensure mitigation of VI risk should be considered to address the potential for future redevelopment of the Site.

Changes in Standards and TBCs

A review of Applicable or Relevant and Appropriate Requirements was performed to check the impact on the remedy protectiveness due to any changes in standards, new promulgated standards, and/or changes in TBCs (to be considered). Tables documenting the review of each ARAR, using the regulations and requirements synopses listed in the RODs for OU-1 and OU-3 as a basis, are included as Appendix E. The evaluation included a determination of whether the requirement is currently ARAR or TBC and whether the requirements have been met. In general, any changes in standards since the RODs for OU-1 and OU-3 do not change the protectiveness of the remedy.

Most of the regulations and requirements remain ARARs for the Site and all are being complied with. Some regulations/requirements that were originally identified as ARARs are now either applicable requirements that apply to off-site activities or other regulations that must be met at the Site (e.g., OSHA).

The Massachusetts Sanitary Landfill Regulations are no longer considered ARAR. They would have been applicable to capping in place of the Battery Separator Area chip piles, which was part of the ROD-specified remedy for OU-1. However, the chip piles were excavated and placed in the Industrial Landfill instead of being capped in place.

Floodplains Protection Executive Order 11988; Clean Water Act (40 CFR 6.302(b), Appendix A was withdrawn. The current provision is a FEMA regulation codified at 44 CFR 9, which provides a similar level of regulatory protectiveness for wetlands and floodplains.

Changes in Toxicity and Other Contaminant Characteristics

Since the time of the 1988 OU-1 Endangerment Assessment and 2005 OU-3 Risk Assessment, EPA has re-examined and updated toxicity factors for some of the contaminants evaluated. Changes in these toxicity factors do not affect the groundwater remedy because of its reliance on the use of treated municipal water as drinking water. ROD groundwater cleanup levels are based on MCLs or MCLGs which have not changed since 2005. The soil and sediment cleanup levels were re-evaluated for protectiveness in the 2014 FYR and determined to be protective. Because no changes to COCs have occurred over the last five years, the ROD soil cleanup levels for future residential use and sediment cleanup levels for recreational use continue to be protective. Since the 2014 FYR, updated toxicity values and new information has become available on the following contaminants.

- ***2016 Lead in Soil Cleanups***

  EPA's 2016 OLEM memorandum "Updated Scientific Considerations for Lead in Soil Cleanups" (OLEM Directive 9200.2-167) indicates that adverse health effects are associated with blood lead levels (BLLs) at less than 10 micrograms per deciliter (µg/dL). The memo mentioned that several studies have observed "clear evidence of cognitive function decrements in young children with mean or group BLLs between 2 and 8

µg/dL." Any soil screening, action or cleanup level developed based on the previous target BLL of 10 µg/dL may not be protective.

EPA's approach to evaluate potential lead risks is to limit exposure to residential and commercial soil lead levels such that a typical (or hypothetical) child or group of similarly exposed children would have an estimated risk of no more than 5% of the population exceeding a 5 µg/dL BLL. This is based on evidence indicating cognitive impacts at BLLs below 10 µg/dL. Additionally, this approach aligns with the Lead Technical Review Workgroup's current support for using a BLL of 5 µg/dL as the level of concern in the Integrated Exposure Uptake Biokinetic Model (IEUBK) and Adult Lead Methodology (ALM). A target BLL of 5 µg/dL reflects current scientific literature on lead toxicology and epidemiology that provides evidence that the adverse health effects of lead exposure do not have a threshold.

EPA's 2017 OLEM memorandum "Transmittal of Update to the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters" (OLEM Directive 9285.6-56) provides updates on the default baseline blood lead concentration and default geometric standard deviation input parameters for the Adult Lead Methodology. These updates are based on the analysis of the NHANES 2009-2014 data, with recommended updated values for baseline blood lead concentration being 0.6 µg/dL and geometric standard deviation being 1.8.

Using updated default IEUBK and ALM parameters at a target BLL of 5 µg/dL, site-specific lead soil SLs of 200 mg/kg and 1,000 mg/kg are developed for residential and commercial/industrial exposures, respectively.

Lead was not identified as a soil or sediment COC at the Site. Sediment lead concentrations identified in the 2005 OU-3 Risk Assessment are less than 200 mg/kg. The 1988 OU-1 Endangerment Assessment evaluated lead in solid material (soil, sediment and surficial sludges combined) for three source areas (Primary Lagoon, Landfill, and Battery Separator Area), believed to be representative of contaminants across the Site. An average lead concentration was calculated for each source area. The highest average lead concentration from the three areas was 22.4 mg/kg, significantly less than the 200 mg/kg residential screening value. Therefore, no further investigation or action for lead is necessary.

- ***2013 1,4-Dioxane cancer and non-cancer toxicity values***

In 2013, EPA revised the toxicity values for 1,4-dioxane. The oral slope factor increased, while the value for inhalation unit risk decreased, which indicates that 1,4-dioxane is more toxic from cancer health effects via the oral pathway, but less toxic from inhalation. Additionally, the non-cancer values for oral reference dose and inhalation reference concentration both decreased, which indicates that 1,4-dioxane is more toxic from non-cancer hazards.

This compound was commonly used as a chlorinated solvent stabilizer to prevent product degradation. Although it was not identified as a COC in the OU-3 Risk Assessment, groundwater sampling for 1,4-dioxane has been occurring at the Site since 2006. The maximum 1,4-dioxane concentration ever detected in Site groundwater (downgradient of the industrial landfill) is 36 µg/L. The current tapwater Regional Screening Level (RSL), which utilizes updated default exposure assumptions, is 0.46 µg/L (equating to a cancer risk of 1E-06). Using the RSL value as a baseline for comparison, the maximum 1,4-dioxane concentration ever detected in Site groundwater equates to a cancer risk of 7.8E-05, which is within EPA's acceptable risk range (1E-04 to 1E-06). In 2018, the highest level of 1,4-dioxane detected in groundwater was 26 µg/L. This equates to a lower cancer risk of 5.7E-05. Finally, it should be noted that no groundwater from this more highly contaminated on-property area is being consumed. In the town of Acton Assabet supply wells, 2018 monitoring showed that concentrations of 1,4-dioxane generally ranged between 0.14 µg/L and 0.47 µg/L; in the School Street wellfield, concentrations were between ND and 0.18 µg/L (see "Data Review" section above). The presence of 1,4-dioxane in groundwater does not pose a threat to human health due to the town of Acton's hold on the installation of private extraction wells in the area of the plume and the current use of treated municipal water as the source of drinking water. Monitoring for 1,4-dioxane should continue.

- ***2016 PFOA/PFOS non-cancer toxicity values***

In May 2016, EPA issued final lifetime drinking water health advisories for PFOA and PFOS, which identified a chronic oral reference dose (RfD) of $2x10^{-5}$ mg/kg-day for PFOA and PFOS (EPA, 2016a and EPA, 2016b). These RfD values should be used when evaluating potential risks from ingestion of contaminated groundwater at Superfund sites where PFOA and PFOS might be present based on site history. Potential estimated health risks from PFOA and PFOS, if identified, would likely increase total site risks due to groundwater exposure. Further evaluation of potential risks from exposure to PFOA and PFOS in other media at the site might be needed based on site conditions and may also affect total site risks.

PFOA and PFOS belong to a group of compounds known as PFAS, which are used in a variety of industrial applications and are commonly associated with disposal areas containing industrial and chemical waste. A wide variety of chemicals were historically used, produced, and/or disposed at the Site, including explosives, container sealing compounds, latex products, plasticizers, and resins. Sampling for PFAS in groundwater has not yet been done at the Site but is being recommended for the next FYR period. There is no current exposure to Site-impacted groundwater and institutional controls will prevent future exposures once they are fully implemented, until cleanup levels have been achieved. In the short-term, the protectiveness of the remedy is not affected by this change to the toxicity values for these compounds.

- ***2014 PFBS non-cancer toxicity value***

Perfluorobutanesulfonic acid (PFBS) has a chronic oral RfD of $2x10^{-2}$ mg/kg-day based on an EPA Provisional Peer Reviewed Toxicity Value (PPRTV) (EPA, 2014b). This RfD value should be used when evaluating potential risks from ingestion of contaminated groundwater at Superfund sites where PFBS might be present based on site history. Potential estimated health risks from PFBS, if identified, would likely increase total site risks due to groundwater exposure. Further evaluation of potential risks from exposure to PFBS in other media at the site might be needed based on site conditions and may also affect total site risks.

PFBS belongs to a group of compounds known as PFAS, which, as described above, are used in a variety of industrial applications and are commonly associated with disposal areas containing industrial and chemical waste. Sampling for PFAS in groundwater has not yet been done at the Site but is being recommended for the next FYR period. There is no current exposure to Site-impacted groundwater and institutional controls will prevent future exposures once they are fully implemented, until cleanup levels have been achieved. In the short-term, the protectiveness of the remedy is not affected by this change to the toxicity value for this compound.

The Acton Water District was required to collect PFAS samples in treated groundwater under the Unregulated Contaminant Monitoring Rule (UCMR) in 2013-2014. Samples were collected from the Assabet and School Street Treatment plants (note: these two treatment plants have now been consolidated in to the new South Acton Water Treatment Plant). While the methodology and guidelines for PFAS sampling have changed from 2013-2014, PFAS were not detected in any of the samples, suggesting that even if PFAS are detected in groundwater on the Grace site, the water supply wells were not being significantly impacted in 2013-2014. It is highly unlikely that any PFAS impacts to the water supply wells from the Grace site have changed significantly in the past five years. Thus, any risk of exposure to possible PFAS impacts from the Grace Site in the treated water supply is expected to be extremely minimal.

Changes in Risk Assessment Methods

The following guidance documents were released by EPA since the last FYR. Although these guidance documents represent a change in risk assessment methodology, the change does not affect remedy protectiveness.

- ***2014 OSWER Directive Determining Groundwater Exposure Point Concentrations, Supplemental Guidance***

In 2014, EPA finalized a Directive to determine groundwater exposure point concentrations (EPCs) (https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236917). This Directive provides recommendations to develop groundwater EPCs. The recommendations to calculate the 95% UCL of the arithmetic mean concentration for each contaminant from wells within the core/center of the plume, using the statistical software ProUCL, could result in lower groundwater EPCs than the maximum concentrations routinely used for EPCs as past practice in risk assessment, leading to changes in groundwater risk screening and evaluation. In general, this approach could result in slightly lower risk or higher screening levels. This change does not affect the protectiveness of the remedy for the Grace Site.

- ***2014 OSWER Directive on the Update of Standard Default Exposure Factors***

In 2014, EPA finalized a Directive to update standard default exposure factors and frequently asked questions associated with these updates. https://www.epa.gov/risk/superfund-risk-assessment-human-health-topics (items # 22 and #23 of this web link under exposure assessment; EPA, 2014d). Many of these exposure factors differ from those used in the risk assessment supporting the 1989 ROD. These changes in general would result in a slight decrease in the risk estimates for most chemicals. This change does not affect the protectiveness of the remedy for the Grace Site.

Changes in Exposure Pathways

Exposure pathways considered in the OU-1 and OU-3 risk assessments include: (1) ingestion, dermal contact and/or inhalation exposures associated with groundwater used as household water, irrigation water, or encountered by excavation workers; (2) soil ingestion and dermal contact by future residents; (3) sediment and surface water ingestion and dermal contact by recreational visitors; and (4) the vapor intrusion (VI) pathway associated with groundwater. Portions of the Site have undergone redevelopment over the last five years (e.g., construction of a solar park and bus garage). However, because the Site was remediated to residential cleanup levels and the vapor intrusion pathway is not of concern (see below bullet 2018 EPA VISL Calculator), the changes in land use do not affect remedy protectiveness.

The following guidance was released by EPA since the last FYR. Although this guidance represents a change in the method of evaluating a specific exposure pathway, the changes do not affect remedy protectiveness.

- ***2018 EPA VISL Calculator***

In February 2018, EPA launched an online VISL calculator which can be used to obtain risk-based screening level concentrations for groundwater, sub-slab soil gas, and indoor air. The VISL calculator uses the same database as the Regional Screening Values (RSLs) for toxicity values and physiochemical parameters and is automatically updated during the semi-annual RSL updates. Please see the User's Guide for further details on how to use the VISL calculator. (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator). EPA updates RSL tables twice a year and the most current ones are available at the EPA Regional Screening Levels web page (https://www.epa.gov/risk/regional-screening-levels-rsls).

Consistent with the 2014 FYR, groundwater VISLs set at a cancer risk of 10^{-6} and a noncancer hazard of 1 for residential land use have been used to evaluate current groundwater concentrations within the Site plume. To be consistent with past VI evaluations, the same subset of wells used in the 2005 BHHRA and the 2014 FYR (see Table B-6) were considered, although only wells in that subset with VOC sampling results from the last five years were used. The exception to this is that one overburden well (OSA-14A), which had not been sampled since 1998 but was added back to the monitoring program in 2017, has been added to the VI screening for the Former Lagoon Area.

One ongoing impediment to evaluation of VI issues at this Site is that the plumes are mostly found in the deep overburden and bedrock; as a result, many of the shallow wells have been deleted from the annual monitoring program, since contaminant concentrations above cleanup levels were no longer detected in the shallow aquifer. For the VI screening in this review (as done in 2014), mostly data from deeper wells were used, which represents a more conservative approach, since shallower groundwater is almost always less contaminated at this Site. Consistent with the 2014 VISL screening, groundwater concentrations are generally less than the VISLs. Ethylbenzene and vinyl chloride in the Former Lagoon Area (in wells OSA-13A and OSA-14A, which are screened at the water table), and trichloroethene in the Northeast Area in deeper overburden groundwater exceed their cancer-based VISLs by less than 5-fold, 30-fold and 2-fold, respectively, indicating that the cancer risk associated with these exceedances is less than 4×10^{-5}. Therefore, the vapor intrusion pathway would not be associated with a risk above EPA's risk management criteria, confirming the conclusions of the 2005 risk assessment and 2014 VI evaluation and indicating that the remedy continues to be protective of VI.

In the area of the Site where construction occurred since the last FYR (the bus garage that was recently constructed in the Assabet River Area), no shallow wells have been sampled recently since the plume is known to be deep in that area. In the two (Southeast and Southwest) Landfill Areas, none of the wells that were used in 2014 have been sampled in the last five years, nor have any other shallow wells been sampled. VOCs are known to occur in this area in deep overburden groundwater, but those results are not relevant to VI because, in all likelihood, the groundwater does not rise to the surface until it reaches the Assabet River or bordering wetlands, where no occupied buildings exist or are likely to be constructed.

This pathway may require further study as methods used to VI evolve. Even though it is expected that the potential for VI should decrease as groundwater cleanup progresses and concentrations of VOCs in groundwater continue to decrease over time, a VI evaluation should be performed before new buildings are constructed on Site properties where groundwater VISLs are exceeded or where appropriate groundwater data are not currently available. NAULs that are designed to mitigate the potential for VI exposure should be developed and implemented to address this future Site use concern.

Ecological Risk Review

The ecological risk assessment, including a Screening-Level Ecological Risk Assessment and a Baseline Ecological Risk Assessment (SLERA and BERA) was conducted using methodology that would generally comply with current EPA risk assessment guidance. A BERA was completed for OU-3 in 2005 (Menzie-Cura, 2005b) and concluded there were unacceptable ecological risks from exposure of semi-aquatic wildlife and benthic invertebrates to sediment from the North Lagoon Wetland and Sinking Pond and additionally to fish in Sinking Pond. The 2005 BERA concluded that there was risk from exposure, primarily to sediment, but no unacceptable ecological risks from exposure to surface water.

The primary discrepancies between current guidance and previous guidance exist in the areas of benchmarks and toxicity values utilized. There are also minor differences in the recommended toxicity testing approaches and in the factors used in wildlife modeling. There are no newly promulgated standards, relevant to the Site BERA, which bear on the protectiveness of the remedy.

Cleanup levels were set in the ROD for ecological receptors in the North Lagoon Wetland and in Sinking Pond to address exposure to sediments. The ROD identified the short-term goal for the most biologically active areas of Sinking Pond (the inlet and areas where the ground slope is shallow) as remediation of the areas with arsenic greater than 730 mg/kg or where any of the four COCs (arsenic, copper, iron and manganese) exceeds an effects-based benchmark [Probable Effects Concentration (PEC) or Severe Effects Level (SEL)]. As documented in the Final Sediment Remedial Design Report (ARCADIS, 2011), W.R. Grace developed a remedial design that was intended to achieve the long-term goal of 42 mg/kg arsenic throughout the applicable portion of the pond. The

remedy included excavation of sediment from North Lagoon Wetland and Sinking Pond and included restoration of the excavated areas.

As discussed in the previous FYR (2014), an assumption of the ecological exposures for the remedy included removal of sediment from the most biologically active area of the pond encompassing the sediments above an elevation of 128 feet. This was the elevation selected to represent the location of the thermocline based on pre-design data. Since the implementation of the remedy in 2011, the pond surface water elevation has been observed to be several feet lower than pre-design conditions (formerly about elevation 140 feet to 145 feet). These results are presented in Table B-5. This may be due to the fact that less water is being discharged to Sinking Pond compared to when the ARS system was operational. The additional monitoring data in 2015-2016 confirmed that post-remedy, the thermocline is approximately 118-119 ft NGVD 29, as compared to the approximately 128 ft elevation that was established for the target elevation of the sediment removal. A study should be conducted to re-evaluate the ecological protectiveness of the remedy in Sinking Pond given the changes in the water level and depth of the thermocline. If unacceptable environmental risks are found, options to address the problem should be proposed.

Standards Review

Since the last FYR there have not been any significant changes in recommended ecological benchmarks utilized for sediment or soil, and only a limited number of changes in National Recommended Water Quality Criteria (NRWQC) values for surface water. The NRWQC changes include new standards for aluminum, cadmium, selenium, and ammonia. However, a review of surface water data collected in 2001-2003 for the risk assessments indicated none of these constituents would have been selected as COPCs in surface water in Sinking Pond. Consequently, a review of the standards and the current surface water, sediment and soil data indicate there are no newly promulgated standards, relevant to the Site, which bear on the protectiveness of the remedy.

Changes in Exposure Pathways

Ecological routes of exposure have been changed by implementation of the remedy. Excavation of contaminated sediments above area-specific cleanup levels from Sinking Pond and North Lagoon Wetland have reduced the exposure of ecological receptors to Site COCs. The removal of contaminants from these areas has contributed to the reduction in exposure and increased effectiveness of the remedy.

Expected Progress Towards Meeting RAOs

According to the ROD, the RAOs for OU-3 included cleanup of contaminated sediments and soils posing an unacceptable risk to human health and/or the environment in Sinking Pond and the North Lagoon Wetlands. After the dredging, arsenic results for all Sinking Pond samples had 95% UCL values below the corresponding clean-up target values. The measured values in Sinking Pond were below the target clean-up level for sediments of 42 mg/kg. Similarly, the 95% UCLs for sediment in the North Lagoon Wetland were also below the target clean-up levels for this area, indicating significant progress toward RAOs. Post-construction vegetation monitoring for NLW and Sinking Pond was conducted by Grace for five years following remediation (2012 through 2016) to evaluate the progress of the habitat restoration. Habitat monitoring conducted as part of the site inspection held on May 7, 2019 confirmed adequate progress toward re-vegetation of the NLW and the banks of Sinking Pond; however, efforts to re-establish trees and shrubs on the bank of Sinking Pond do not appear successful.

There is uncertainty in the exposure of aquatic organisms to sediments in the biologically active zone above the deeper thermocline that has developed (elevations of 128 to 118 ft NVGD). The average concentration of the arsenic and other metals in these sediments is not well characterized. Additional studies to determine the ecological risk posed by the changes in the depth of the thermocline, and thereby the biologically active zone, are needed.

QUESTION C: Has any **other** information come to light that could call into question the

protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations				
Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 1	**Issue Category: Institutional Controls**			
	Issue: The Industrial Landfill contains solidified and capped wastes. The landfill is well maintained. A deed notice has been filed with the Registry of Deeds which alerts parties the landfill cannot be disturbed except by written permission of MassDEP. However, there is not a more formal restriction on the landfill such as a NAUL which would ensure the remedy remains protective in the long-term.			
	Recommendation: Enact a NAUL on the former Industrial Landfill that prevents disturbance of the landfill.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2020

OU(s): 3	**Issue Category: Institutional Controls**			
	Issue: The Acton Board of Health has established an administrative hold on the installation of private irrigation wells within 500 feet of the mapped region of contaminated groundwater that lies within the town. It may be necessary to establish additional institutional controls to prevent groundwater use within the contaminated plume area until cleanup goals are met. An Institutional Controls Plan was prepared in 2011 but action on it has stalled due to concerns raised by the Town of Acton. Additionally, since the time of the 2014 FYR, the town of Concord became the owner of a Site parcel of land formerly owned by W.R. Grace. While Concord has been made aware of the contaminated groundwater and the presence of remedy infrastructure on the parcel, the parcel does not include any ICs. The Site property still owned by Grace, within Acton, also lacks ICs to prevent use of groundwater or to ensure evaluation and mitigation of potential VI exposure associated with any future redevelopment of Site property.			
	Recommendation: Make a determination as to whether additional institutional controls are needed in Acton, or if the administrative hold is sufficient to maintain protectiveness. If additional institutional controls are determined to be needed, work with the Town to establish them. Evaluate the need for institutional controls, such as NAULs across the Grace property and on the Site parcel owned by Concord, that are designed to restrict the use of contaminated groundwater, protect against future vapor intrusion risk, and ensure the remedy is not adversely affected.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2020

OU(s): 3	Issue Category: Monitoring			
	Issue: PFAS are an emerging class of compounds commonly found in groundwater near former industrial sites. The W.R. Grace Site has never been sampled for PFAS.			
	Recommendation: Sample a subset of Site wells for PFAS to determine if the compounds are contaminants of potential concern associated with the Site.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2020

OU(s): 3	Issue Category: Changed Site Conditions			
	Issue: The elevation of the thermocline in Sinking Pond has changed since the time of the 2014 FYR. The elevation of the thermocline controlled the scope of sediment excavation in Sinking Pond; now that the thermocline is at a lower elevation than it was at the time the remedy was designed, it is uncertain if an unacceptable ecological risk is posed by remaining contaminated sediments.			
	Recommendation: Conduct a study to re-evaluate the ecological protectiveness of the remedy in Sinking Pond. If unacceptable environmental risks are found, propose and enact solutions to mitigate the risks.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2020

OTHER FINDINGS

In addition, the following are recommendations that were identified during the FYR that may improve performance of the remedy, but do not necessarily affect current and/or future protectiveness:

- ***OU-3: Institutional Controls:*** During the interview process for this FYR, a Town of Acton representative requested an updated site map and list of properties for which the administrative hold should apply. It is recommended that EPA discuss this request further with the Town and coordinate the response with Grace.

- ***OU-3: 1,4-Dioxane In Groundwater:*** The presence of 1,4-dioxane in groundwater continues to be a challenging problem to address. While the compound does not pose an unacceptable human health risk at the Site, representatives from MassDEP and the Town of Acton have expressed concerns that the nature and extent of the contaminant in groundwater is not well understood. Grace representatives have expressed concern that the energy intensive operation used to treat 1,4-dioxane is no longer effective or necessary. It is recommended that EPA work with all of the stakeholders to address these concerns and optimize how the presence of the contaminant is handled at the Site.

- ***OU-3: Former Lagoon Area:*** VOCs are mostly below IGCLs in the FL Area, although in a limited area near well cluster OSA-13, the long-term viability of the MNA remedy is currently being brought into question by increasing concentrations of VDC and VC. The source of these increasing concentrations should be investigated, to determine if MNA will be successful in the long-term or if supplemental remediation is warranted.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: 1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy for OU-1 is protective of human health and the environment in the short-term. Soil in excess of cleanup levels has been excavated, stabilized, and either placed in the Industrial Landfill or shipped off-site for treatment and disposal. The Industrial Landfill was then closed with an impermeable cap to prevent potential exposure. The PRP maintains ownership of the landfill and has filed a deed notice with the Registry of Deeds to regulate land use on the landfill area. However, there is not a more formal restriction on this area of the property such as a NAUL. To be protective in the long-term, a NAUL should be implemented on the landfill.	

Protectiveness Statement(s)	
Operable Unit: 3	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU-3 is protective in the short-term, because there is no current exposure to contamination in groundwater or sediment. Groundwater in the vicinity of the Industrial Landfill is currently being extracted and treated. The Acton Water District provides treatment of groundwater from the five public water supply wells in the vicinity of the Site and a network of wells is regularly monitored for Site contaminants. The Acton Board of Health has established an administrative hold on the installation of private wells within 500 feet of the current groundwater contaminant plume. For the groundwater remedy to be protective in the long-term, institutional controls may be required which (1) supplement the Town of Acton's administrative hold on the installation of private wells, (2) limit the use of contaminated groundwater on the Grace property in Acton and Concord, (3) protect against future vapor intrusion risk for development on the Grace property, and (4) ensure the remedy is not adversely effected by future land use. Areas of contaminated sediment in the North Lagoon Wetland and in Sinking Pond were excavated and the cleanup levels established in the ROD were achieved; however, changes in the exposure assumptions in Sinking Pond call in to question whether the remedy remains ecologically protective in the long-term, and additional evaluation is needed.	

Sitewide Protectiveness Statement
Protectiveness Determination: Short-term Protective
Protectiveness Statement: The remedial actions taken are protective of human health and the environment in the short-term because there is no current exposure to contamination. Soil and sediment have been remediated and contaminated soil left on site in the Industrial Landfill was capped. The Landfill Area groundwater remedy is operating and will reduce contaminant concentrations to cleanup levels over time through a combination of active extraction and treatment combined with monitored natural attenuation. Groundwater in the vicinity of town water supply wells is regularly monitored and the water district provides additional treatment. To be protective in the long-term, additional institutional controls may be needed across the property so that any potential exposure risks associated with redevelopment are managed and mitigated. Additional institutional controls may also be needed for groundwater within the vicinity of the contaminant plume to supplement the existing controls (the Town of Acton's administrative hold) already in place.

VIII. NEXT REVIEW

The next five-year review report for the W.R. Grace & Co., Inc. (Acton Plant) Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Alliance Technologies Corporation, 1989. Risk Analysis of the W.R. Grace Site, Acton, Massachusetts. Prepared for U.S. Environmental Protection Agency, Office of Waste Programs Enforcement, Washington, DC, Contract No. 68-W9-0003. June 30, 1989.

ARCADIS. 2011. W.R. Grace Superfund Site Final Sediment Remedial Design Report. March 2011.

ARCADIS, 2012. W.R. Grace Superfund Site Final Sediment Demonstration of Compliance and Maintenance Plan. April 2012.

ARCADIS, 2017. 2016 Freshwater Wetlands Monitoring Report. W.R. Grace Superfund Site - Operable Unit 3, Acton-Concord, Massachusetts. January 2017.

Camp Dresser & McKee. 1988. Appendix D Risk Assessment for W.R. Grace Site, Acton, Massachusetts. August 31, 1988.

EPA, 1989. *Record of Decision*, W.R. Grace (Acton Plant) Superfund Site, Acton, Massachusetts. September 29, 1989.

EPA, 1999. Five Year Review, W.R. Grace (Acton Plant) Superfund Site, Acton, Massachusetts. September 1999.

EPA, 2001. Comprehensive Five-Year Review Guidance. EPA 540-R-01-007, OSWER No. 9355.-7-03B-P. June 2001.

EPA, 2002. Letter from Derrick S. Golden, EPA Remedial Project Manager, to Maryellen Johns, Remedium Group, Inc., Re: The Thermal Oxidation Unit on the Industrial Landfill at the W.R. Grace Superfund Site - Acton, Massachusetts. October 31, 2002.

EPA, 2005. *Record of Decision,* W.R. Grace & Co. (Acton Plant) Superfund Site, Operable Unit Three, September 2005.

EPA, 2009. Five-Year Review Frequently Asked Questions (FAQs) and Answers. OSWER 93557-21. September 2009.

EPA, 2011. Recommended Evaluation of Institutional Controls: Supplement to the Comprehensive Five-Year Review Guidance. September 2011.

EPA, 2012a. Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation and Liability Act Five-Year Reviews. OSWER 9200.2-111. September 13, 2012.

EPA, 2012b. Assessing Protectiveness at Site for Vapor Intrusion, Supplement to the Comprehensive Five-Year Review Guidance. OSWER Directive 9200.2-84. November 2012.

EPA, 2014a. Five Year Review Report for W.R. Grace & Co., Inc. (Acton Plant) Superfund Site. Middlesex County, Massachusetts. September 23, 2014.

EPA, 2014b. Provisional Peer-Reviewed Toxicity Values for Perfluorobutane Sulfonate. Superfund Health Risk Technical Support Center. National Center for Environmental Assessment. Office of Research and Development. EPA/690/R-14/012F. July 17, 2014.

EPA, 2016a. Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). Office of Water. EPA-822-R-16-005. May 2016.

EPA, 2016b. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS). Office of Water. EPA-822-R-16-004. May 2016.

Tetra Tech, 2019. *Operable Unit Three Monitoring Program Report, 2018, W.R. Grace Superfund Site, Acton, Massachusetts,* January 11, 2019.

Tetra Tech GEO, 2011. *Institutional Controls Plan,* May 12, 2011.

Tetra Tech GEO and O&M, Inc. 2012a. *Landfill Area Groundwater Operation and Maintenance Plan*, July 10, 2012.

APPENDIX B – TABLES AND FIGURES

Table B-1: OU-1 ROD Soil Cleanup Levels		
Compound	Low Range of Soil Cleanup Level (µg/kg)	High Range of Cleanup Level (µg/kg)
Ethylbenzene	619	4914
Vinyl chloride (VC)	9	75
Benzene	1	7
Bis(2-ethylhexyl)phthalate	61	491
1,1-Dichloroethene (VDC)	8	65

Table B-2: OU-3 ROD Interim Groundwater Cleanup Levels			
Contaminant	Interim Cleanup Level (µg/L)	Contaminant	Interim Cleanup Level (µg/L)
Benzene	5	Antimony	6
bis(2-chloroethyl)ether	5	Arsenic	10
bis(2-ethylhexyl)phthalate	6	Beryllium	4
1,1-Dichloroethene (VDC)	7	Chromium (Total)	100
1,2-Dichloroethane	5	Lead	15
1,2-Dichloropropane	5	Manganese	300[1]
Methylene chloride	5	Nickel	100
Methyl-tert-butyl-ether (MTBE)	16		
Trichloroethene (TCE)	5		
Vinyl chloride (VC)	2		

1. May be adjusted to a background value in the future

Table B-3: OU-3 ROD Cleanup Levels for Sediment for Protection of Human Health		
Contaminant	North Lagoon Wetland Cleanup Level (mg/kg)	Sinking Pond Cleanup Level (mg/kg)
Arsenic	28	42

Table B-4: OU-3 ROD Cleanup Levels for Sediment for Protection of Ecological Receptors		
Contaminant	Area	Cleanup Level (mg/kg)
Sinking Pond		
Arsenic	Sediment with elevated arsenic, copper, iron, and manganese concentrations in the inlet and within the pond where the ground slope is relatively shallow and that is consistently covered by less than twelve-feet of water[1, 2].	42[a]
Arsenic	Sediment with elevated arsenic, copper, iron, and manganese concentrations within the pond but outside the areas specified above that is consistently covered by less than twelve-feet of water[1, 3].	42[a]
North Lagoon Wetland		
Arsenic	Sediment 0-12 inches in depth with elevated arsenic concentrations	28
Manganese	Sediment 0-12 inches in depth with elevated arsenic concentrations	2,030

Notes:

(1) Sediment located between an elevation of 144.5 feet NGVD (maximum surface water elevation observed in the pond) and 128 feet NGVD (twelve feet below the minimum surface water elevation) will be evaluated.

(2) Short-term goal is to remediate areas with arsenic greater than 730 mg/kg or where the four COCs (arsenic, copper, iron, and manganese) exceed their PEC or SEL within the areas defined. Arsenic PEC = 33 mg/kg, copper PEC = 149 mg/kg, iron SEL = 43,766 mg/kg, and manganese SEL = 1,100 mg/kg.

(3) Short-term goal is to identify areas with arsenic greater than 730 mg/kg and the following three metals, copper, iron, and manganese, exceed their PEC or SEL, and then to evaluate the need to remediate such areas based on risks, feasibility, and implementability. Copper PEC = 149 mg/kg, iron SEL = 43,766 mg/kg, and manganese SEL = 1,100 mg/kg.

(a) Long-term goal is to achieve sediment concentrations at or below the maximum background concentration of 42 mg/kg for sediment arsenic within the top two inches of sediment.

Table B-5: Pond Surface Elevations and Approximate Thermocline Depths/Elevations			
Measurement	Pond Surface Elevation (NGVD 29)	Approximate Thermocline Depth (ft)	Approximate Thermocline Elevation (NGVD 29)
September 2009	Not measured	15	--
June 2014	134.87	8	126.87
September 2015	133.87	15	118.87
September 2016	133.17	15	118.17
Average values, per ROD	140.00 (historical low)	12	128

Table B-6: Wells Considered to be Used for Groundwater Vapor Intrusion Screening (Wells Used in 2005 BHHRA and 2014 FYR) [1]		
Area	**Well Identifier**	**Dates of Most Recent Sampling**
Assabet Wellfield Public Water Supply	ASSABET 1A	2018
	ASSABET 2A	2018
Assabet River Area	AR-04P	2000
	AR-14B1	2017
	AR-15P	2001
	CLF-2B	2001
Former Lagoon Area	NLBR-R	2017
	NLGP	2010
	NMGP	2012
	OSA-01A	2018
	OSA-02A	2015
	OSA-06B	2006
	OSA-09B	2006
	OSA-11A	2006
	OSA-13A	2018
	OSA-14A[2]	2018
	SLGP-R	2018
Northeast Area	AR-31S	2018
	PS-22B	2018
	RE-1OBS	2011
	RE-2OBS	2012
	RE-1	2009
	RE-2	2009
Powder Mill Plaza Irrigation Well	POWDERMILL	2002
Southeast Landfill Area	AR-22	2006
	B-08D	2006
	ELF	2009
	LF-06S	2006
	LF-15	2006
	RLF	2009
School Street Wellfield Public Water Supply	CHRISTOFFERSON	2018
	LAWSBROOK	2018
	SCRIBNER	2018
Southwest Area	B-05B2	2006
	RP-1	2005
	WRG-1	2011
Southwest Landfill Area	AR-20A	2010
	LF-12A	2006
	LF-21D	2006

Notes:

(1) Only wells that have been sampled between 2014 and 2018 were used for this screening.

(2) OSA-14A was not used for VI screening in the 2005 BHHRA or in the 2014 FYR because it had not been sampled since 1998. It is used in this FYR because it was added back into the monitoring program in 2017, and it is a water-table well that exhibits VOC contamination.

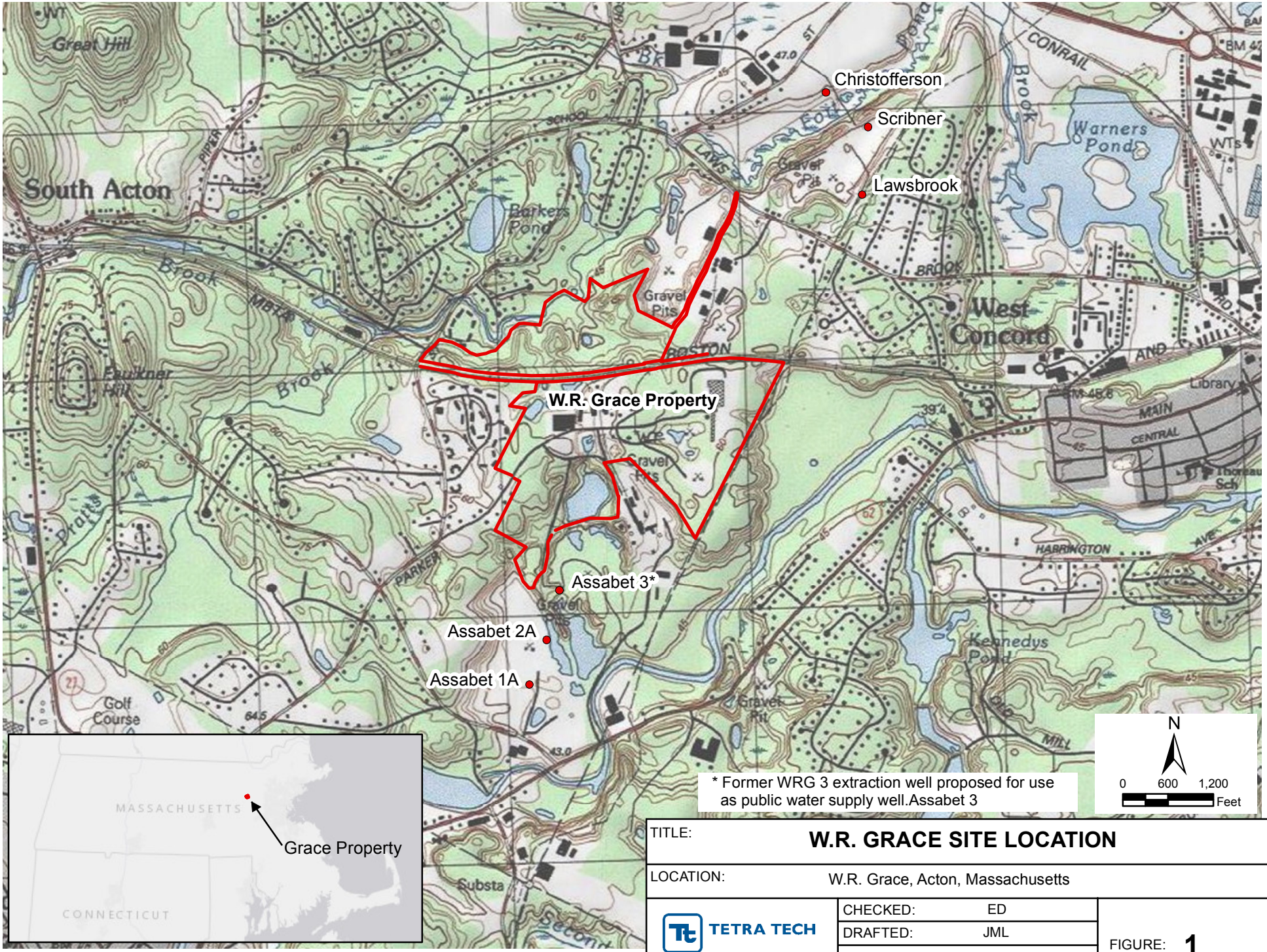
Table B-7: Comparison of Maximum Detected Groundwater Concentrations to 2019 Vapor Intrusion Screening Levels for Wells Used in 2005 BHHRA and 2014 FYR		
VOC	Maximum Groundwater Concentration (µg/L)	Vapor Intrusion Screening Level (µg/L) [(1)]
Assabet Wellfield Public Water Supply		
1,1-Dichloroethene	0.53	195
1,4-Dioxane	1.0	2,860
Chloroform	0.66	0.8
Methyl tert-butyl ether	0.62	450
Assabet River Area[(2)]		
1,4-Dioxane	1.4	2,860
Former Lagoon Area[(3)]		
Acetone	16	22,500,000
Carbon disulfide	2.8	1,240
1,1-Dichloroethene	22	195
Ethylbenzene	15	3.5
Styrene	4.7	9,280
Toluene	0.52	19,200
Vinyl chloride	4.2	0.15
Xylene	0.91	385
Northeast Area[(4)]		
Acetone	5.8	22,000,000
1.1-Dichloroethene	20	195
Methyl tert-butyl ether	0.74	450
Trichloroethene	1.6	1.2
1,4-Dioxane	1.4	2,860
School Street Wellfield Public Water Supply		
1,1-Dichloroethene	10.8	195
Methylene chloride	0.47	763
1,4-Dioxane	0.46	2,860

Notes:

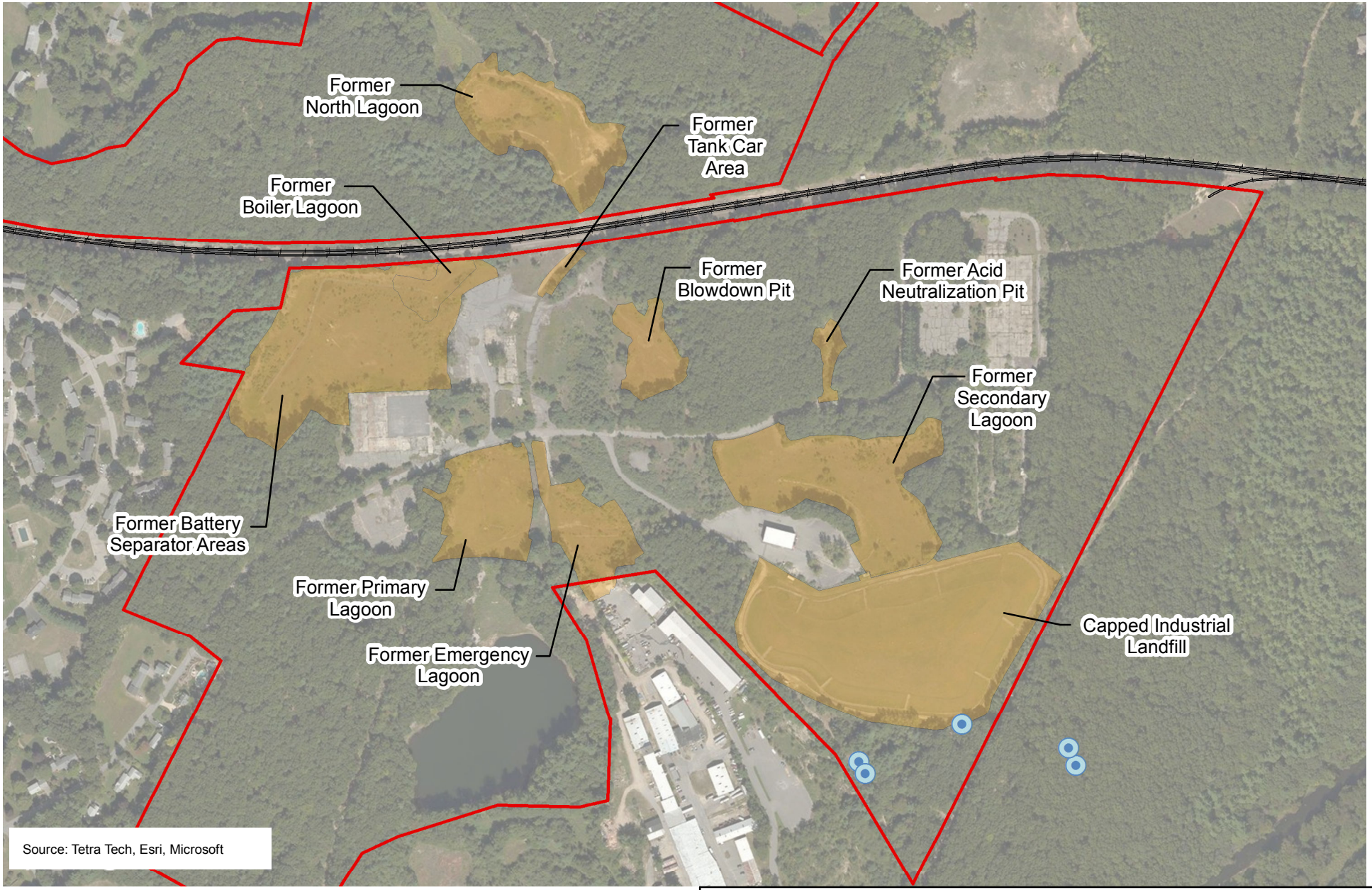
(1) The screening concentrations correspond to a cancer risk of 10^{-6} and noncancer hazard of 1. Vapor Intrusion Screening Levels from: https://epa-visl.ornl.gov/cgi-bin/visl_search (April 2, 2019). Red values exceed their screening level.

(2) Since the plume is only in the deep overburden in this area, shallow wells are not sampled. The 1,4-dioxane value shown is from well AR-14B1, the only well recently sampled for VOCs.

(3) These maximum values are from well OSA-13A except the vinyl chloride result which is from OSA-14A and the acetone result which is from NLBR-R.
(4) All of these maximum values are from well PS-22B. No shallow wells in this area are sampled for VOCs, so results from a deeper overburden well were used as a surrogate for a conservative screening.



TITLE:	**W.R. GRACE SITE LOCATION**
LOCATION:	W.R. Grace, Acton, Massachusetts
TETRA TECH	CHECKED: ED
	DRAFTED: JML
	DATE: 03/19/19
FIGURE:	**1**



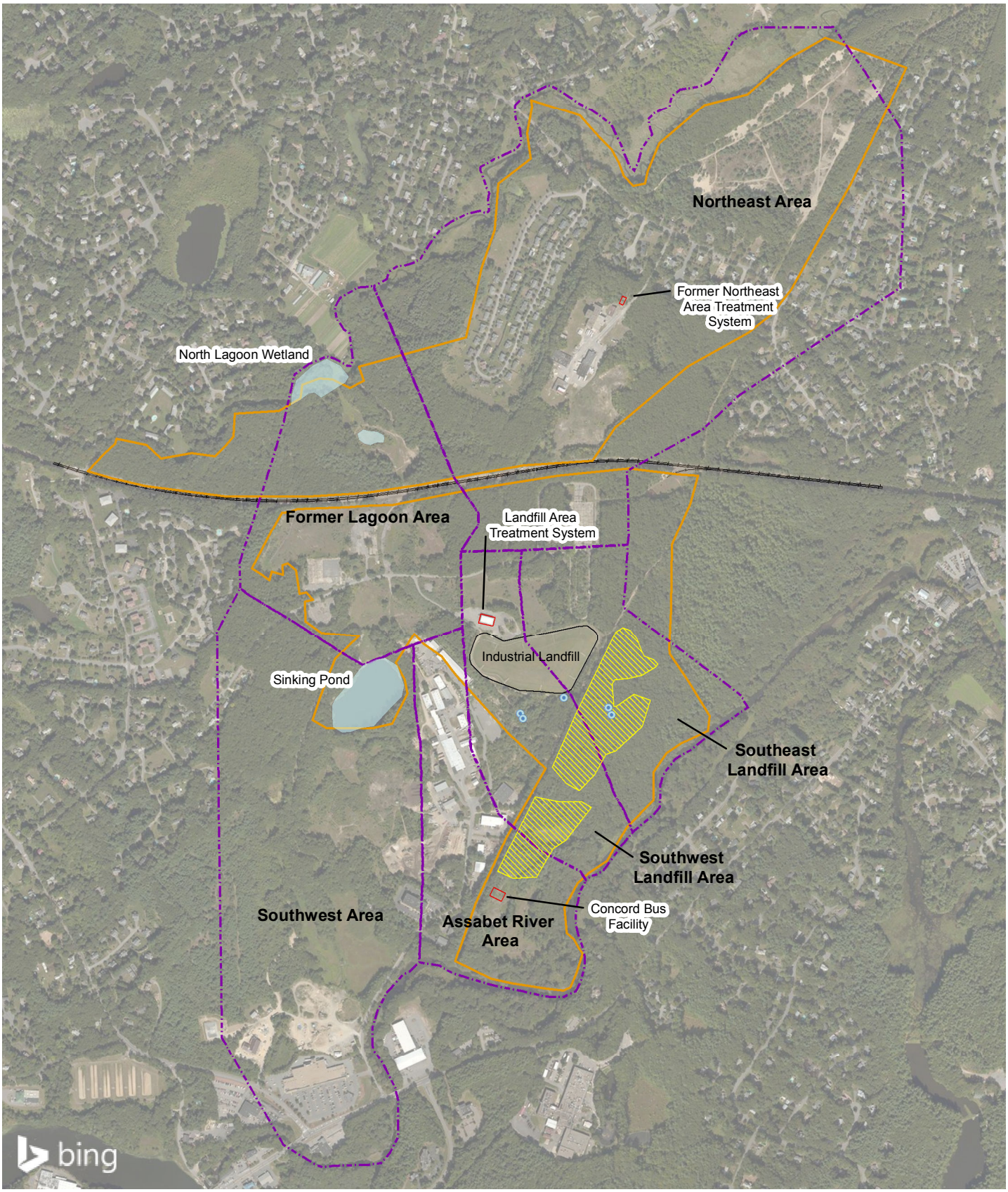
Legend

- Grace Property Boundary (Approximate)
- Source Area
- Grace Extraction Well

N

0 300 600 Feet

TITLE:	**Potential Source Areas**
LOCATION:	W.R. Grace, Acton, Massachusetts
TETRA TECH	
CHECKED:	ED
DRAFTED:	JML
DATE:	03/20/19
FIGURE:	**2**



Source: Tetra Tech, Esri, Microsoft, MassGIS, AECOM

0 600 1,200 Feet

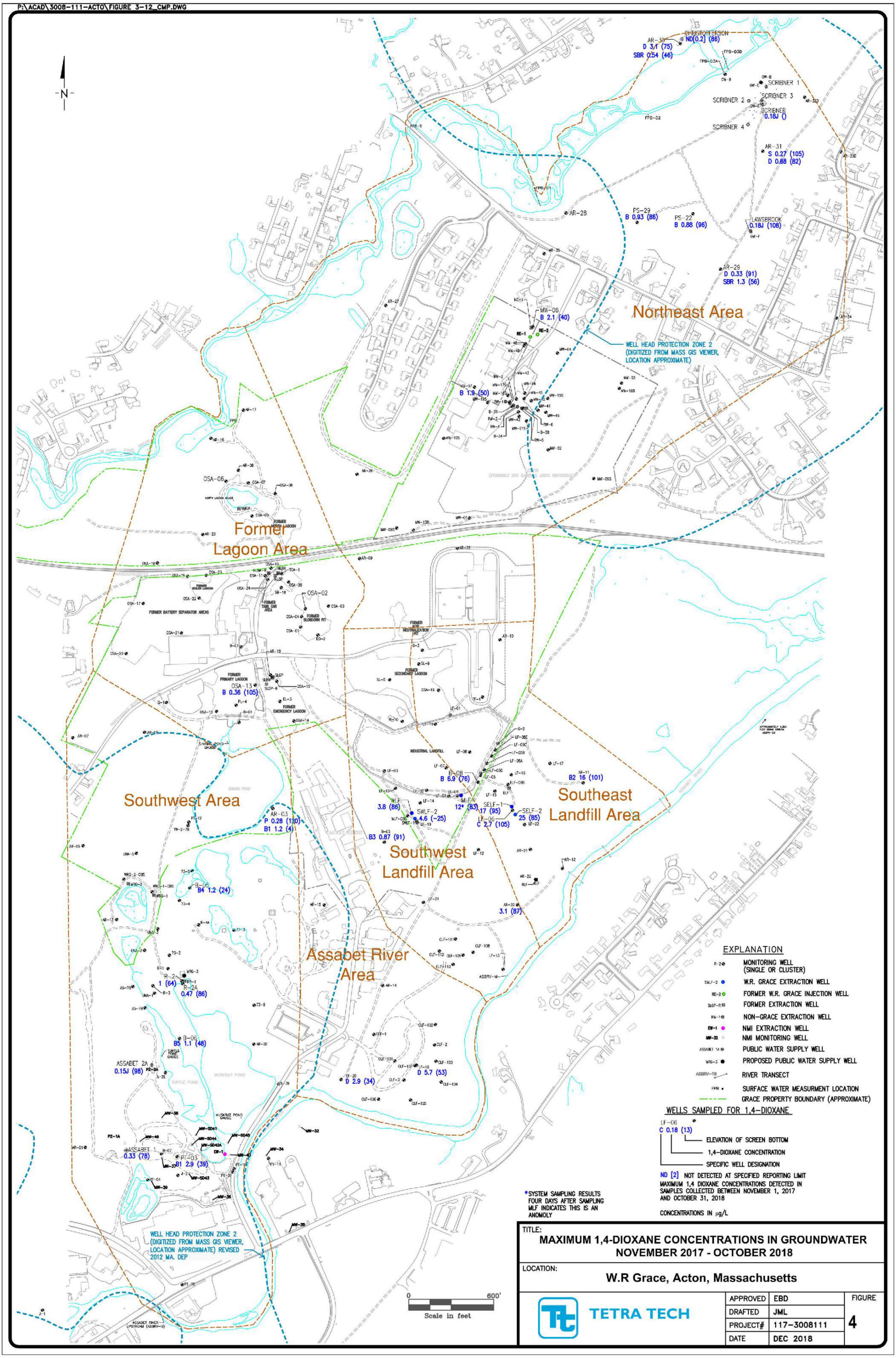
Legend

- Site Boundary
- Site Area Boundary
- Solar Panel Area
- MBTA Railroad
- Grace Extraction Well

N

TITLE:	**Remediation Areas**
LOCATION:	W.R. Grace, Acton, Massachusetts
TETRA TECH	
CHECKED:	ED
DRAFTED:	JML
DATE:	03/20/19
FIGURE:	3

P:\ACAD\3008-111-ACTO\FIGURE_3-12_CMP.DWG



G:\WRG-ACT_2018\ANNUAL\FROMCP-CADFILES_UPDATED\FIGURE_5_5YRREVIEW_VDC.DWG

NOTE: BASE MAP BY COL-EAST 1998. WELL LOCATIONS, W.R. GRACE PROPERTY LINE & MISC. SITE FEATURES COMPILED FROM INFORMATION PROVIDED BY CAMP DRESSER & McKEE. SURROUNDING PROPERTY LINE LOCATIONS ARE FROM THE TOWN OF ACTON AND CONCORD ASSESSORS MAPS.

N

Northeast Area

WELL HEAD PROTECTION ZONE 2
(DIGITIZED FROM MASS GIS VIEWER, LOCATION APPROXIMATE)

Former Lagoon Area

Southwest Area

Southeast Landfill Area

Southwest Landfill Area

Assabet River Area

LINDE
(FORMERLY BOC GASES & AIRCO INDUSTRIAL)

EXPLANATION

- W.R. GRACE PROPERTY BOUNDARY (APPROXIMATE)
- MONITORING WELL (SINGLE OR CLUSTER)
- WR GRACE EXTRACTION WELL
- FORMER INJECTION WELL
- FORMER EXTRACTION WELL
- NON-GRACE RECOVERY WELL
- PUBLIC WATER SUPPLY WELL
- PROPOSED PUBLIC WATER SUPPLY WELL
- RIVER TRANSECT

VDC CONCENTRATION 2018

- >200-7900 ug/L VDC
- >100-200 ug/L VDC
- >60-100 ug/L VDC
- >30-60 ug/L VDC
- >7-30 ug/L VDC

ROD CAPTURE BOUNDARY

COMPOSITE CAPTURE BOUNDARY

0 600
Scale in feet

VDC CONCENTRATIONS SHOWN ARE MAXIMUM REGARDLESS OF DEPTH. CONCENTRATION BOUNDARIES ARE APPROXIMATE.

VDC = VINYLIDENE CHLORIDE = 1,1-DICHLOROETHENE

TITLE:

DISTRIBUTION OF VDC IN GROUNDWATER, 2018

LOCATION:

W.R. Grace, Acton, MA.

TETRA TECH

APPROVED	EBD
DRAFTED	JML
PROJECT#	117-3008111
DATE	DEC 2018

FIGURE 5

G:\WRG-ACT_2018\ANNUAL\FROMCP-CADFILES_UPDATED\FIGURE_6_5YRREVIEW_VC.DWG

NOTE: BASE MAP BY COL-EAST 1998. WELL LOCATIONS, W.R. GRACE PROPERTY LINE & MISC. SITE FEATURES COMPILED FROM INFORMATION PROVIDED BY CAMP DRESSER & McKEE. SURROUNDING PROPERTY LINE LOCATIONS ARE FROM THE TOWN OF ACTON AND CONCORD ASSESSORS MAPS.

Northeast Area

Former Lagoon Area

Southwest Area

Southwest Landfill Area

Southeast Landfill Area

Assabet River Area

WELL HEAD PROTECTION ZONE 2 (DIGITIZED FROM MASS GIS VIEWER, LOCATION APPROXIMATE)

LINDE (FORMERLY BOC GASES & AIRCO INDUSTRIAL)

EXPLANATION

- W.R. GRACE PROPERTY BOUNDARY (APPROXIMATE)
- MONITORING WELL (SINGLE OR CLUSTER)
- WR GRACE EXTRACTION WELL
- FORMER WR GRACE INJECTION WELL
- FORMER EXTRACTION WELL
- NON-GRACE RECOVERY WELL
- PUBLIC WATER SUPPLY WELL
- PROPOSED PUBLIC WATER SUPPLY WELL
- RIVER TRANSECT

VINYL CHLORIDE CONCENTRATION 2018

- >30-68 ug/L VINYL CHLORIDE
- >2-30 ug/L VINYL CHLORIDE
- ROD CAPTURE BOUNDARY
- COMPOSITE CAPTURE BOUNDARY

SAMPLES COLLECTED BETWEEN AUG. 27 TO SEPT. 17, 2018

VINYL CHLORIDE CONCENTRATIONS SHOWN ARE MAXIMUM REGARDLESS OF DEPTH. CONCENTRATION BOUNDARIES ARE APPROXIMATE.

0 600

Scale in feet

TITLE:

DISTRIBUTION OF VINYL CHLORIDE IN GROUNDWATER, 2018

LOCATION:

W.R. Grace, Acton, MA.

TETRA TECH

APPROVED	EBD
DRAFTED	JML
PROJECT#	117-3008111
DATE	DEC 2018

FIGURE 6

G:\WRG-ACT_2018\ANNUAL\FROMCP-CADFILES_UPDATED\FIGURE_7_5YRREVIEW_BENZENE.DWG

NOTE: BASE MAP BY COL-EAST 1998. WELL LOCATIONS, W.R. GRACE PROPERTY LINE & MISC. SITE FEATURES COMPILED FROM INFORMATION PROVIDED BY CAMP DRESSER & McKEE. SURROUNDING PROPERTY LINE LOCATIONS ARE FROM THE TOWN OF ACTON AND CONCORD ASSESSORS MAPS.

N

Northeast Area

Former Lagoon Area

Southwest Area

Southeast Landfill Area

Southwest Landfill Area

Assabet River Area

WELL HEAD PROTECTION ZONE 2 (DIGITIZED FROM MASS GIS VIEWER, LOCATION APPROXIMATE)

LINDE (FORMERLY BOC GASES & AIRCO INDUSTRIAL)

FORT POND BROOK

MASSACHUSETTS TRANSPORTATION AUTHORITY

ACTON

CONCORD

ASSABET RIVER

MUSKRAT POND

TURTLE POND

SINKING POND

NORTH LAGOON GAUGE

SINKING POND 3B GAUGE

SINKING POND 3A GAUGE

TURTLE POND GAUGE

MUSKRAT POND GAUGE

INDEPENDENCE ROAD

AGWAY KRAUS

INDUSTRIAL LANDFILL

FORMER BATTERY SEPARATOR AREAS

FORMER BOILER LAGOON

FORMER TANK CAR AREA

FORMER BLOWDOWN PIT

FORMER ACID NEUTRALIZATION PIT

FORMER SECONDARY LAGOON

FORMER PRIMARY LAGOON

FORMER EMERGENCY LAGOON

FORMER NORTH LAGOON

CHRISTOFFERSON

SCRIBNER

LAWSBROOK

EXPLANATION

- W.R. GRACE PROPERTY BOUNDARY (APPROXIMATE)
- MONITORING WELL (SINGLE OR CLUSTER)
- WR GRACE EXTRACTION WELL
- FORMER WR GRACE INJECTION WELL
- FORMER EXTRACTION WELL
- NON-GRACE RECOVERY WELL
- PUBLIC WATER SUPPLY WELL
- PROPOSED PUBLIC WATER SUPPLY WELL
- RIVER TRANSECT

BENZENE CONCENTRATION 2018

- >100-110 ug/L BENZENE
- >30-100 ug/L BENZENE
- >5-30 ug/L BENZENE

ROD CAPTURE BOUNDARY

COMPOSITE CAPTURE BOUNDARY

SAMPLES COLLECTED BETWEEN AUG. 27 TO SEPT 17, 2018

BENZENE CONCENTRATIONS SHOWN ARE MAXIMUM REGARDLESS OF DEPTH. CONCENTRATION BOUNDARIES ARE APPROXIMATE.

0 600

Scale in feet

TITLE:

DISTRIBUTION OF BENZENE IN GROUNDWATER, 2018

LOCATION:

W.R. Grace, Acton, MA.

TETRA TECH

APPROVED	EBD
DRAFTED	JML
PROJECT#	117-3008111
DATE	DEC 2018

FIGURE 7

G:\WRG-ACT_2002\06-02RI_Rpt\2002-VDC-B.dwg
Aug 30 , 2002 - 10:46am

NOTE: BASE MAP BY COL-EAST 1998. WELL LOCATIONS, W.R. GRACE PROPERTY LINE & MISC. SITE FEATURES COMPILED FROM INFORMATION PROVIDED BY CAMP DRESSER & McKEE. SURROUNDING PROPERTY LINE LOCATIONS ARE FROM THE TOWN OF ACTON AND CONCORD ASSESSORS MAPS.

N

CHRISTOFFERSON
AR-30
FPB-T1
OW-8
OW-B
OW-C
FPB-T2
SCRIBNER
AR-32D
OW-E
FPB-T3
FPB-T4
FPB-T9
FPB-T5
AR-31
AR-33D
FPB-T8
FPB-T10
FPB-T6
FPB-T7
AR-28
FPB-T11
PS-29
PS-22
LAWSBROOK
OW-F
FPB-T12
FPB-T13
AR-29
FPB-T14
FPB-T15
AR-27
FPB-T16
FPB-T17
MW-5S
MW-6
AR-34
FPB-T18
MW-4
FPB-T19
MW-7
MW-3
MW-16B
MW-15S
MW-12S
MW-14
FPB-T22
FPB-T21
AR-17
FPB-T20
FPB GAUGE
AR-16
FORT POND BROOK
MW-10S
MW-11
MW-2
AR-8
AR-26
BOC GASES
(FORMERLY AIRCO INDUSTRIAL)
MW-9
OSA-06
OSA-07
OSA-08
NORTH LAGOON GAUGE
NL-1
NL-2
NMGP
NMGP-OBS
OSA-05
FORMER NORTH LAGOON
MW-1
MW-8S
MW-13B
AR-23
AUTHORITY
TRANSPORTATION
AR-25
OSA-18
AR-09
MASSACHUSETTS
BAY
OSA-10
NLBR-R
TCA-1
OSA-11
NLGP
OSA-19
OSA-23
OSA-9
OSA-24
FORMER BOILER LAGOON
BL-1
AR-18
OSA-17
OSA-22
FORMER TANK CAR AREA
OSA-02
BD-1
OSA-03
FORMER BATTERY SEPARATOR AREAS
BSL-1
OSA-04
FORMER CHLORDOWN PIT
BD-3
BD-4
OSA-21
OSA-01
BD-2
B-01
OSA-20
FORMER ACID NEUTRALIZATION PIT
G-3
AR-10
ACTON
CONCORD
SL-9
D-9
D-10
D-6
D-5
D-4
D-1
D-7
D-2
D-12
D-3
D-11
D-8
D-13
TF-2
D-14
TF-1
RW
SL-5
OSA-16
FORMER SECONDARY LAGOON
AR-19
SLBR
OSA-15
FORMER PRIMARY LAGOON
OSA-13
SLGP-R
EL-3
B-1
PL-4
OSA-12
FORMER EMERGENCY LAGOON
OSA-14
B-10
LF-01
LF-11
INDEPENDENCE ROAD
AR-6
AR-7
B-04
B-2
G-2
SINKING POND GAUGE
TW1-78
G-4
SINKING POND 2 GAUGE
INDUSTRIAL LANDFILL
LF-08
LF-05C
LF-05E
LF-17
LF-05B
LF-05D
LF-16
LF-03
LF-07
AR-04
LF-05A
LF-5P
B-08
ELF-OBS
AR-11
LF-10
LF-02
LF-09
ELF
SINKING POND
LF-14
MLF
LF-04
LF-15
ASBRV-T1
ASSABET RIVER
LF-06
AR-03
PT-12
TW2-78
WLF-OBS
WLF
LF-19
AGWAY KRESS
B-03
AR-5
UNA-5
LF-12
AR-21
ASBRV-T2
AR-12
AR-22
ASBRV-T3
RLF
WRG-2-OBS
WRG-2
73-5
WRC-1-OBS
B-05
WRG-1
73-4
AR-15
LF-21
AR-20
ASBRV-T4
AR-13
73-6
R-4
R-4A
77-3
UNA-3
A8-78
UNA-2
73-7
73-3
77-1
A7-78
R-1
WRG-3
78-3
77-2
R-5
78-1
B-09
A6-78
R-3
R-2
R-2A
RP-1
AR-14
UNA-1
LF-13
ASBRV-U
ASBRV-T5
ASBRV-T5.1
ASBRV-T5.3
ASBRV-T5.2
A5-78
73-8
ASBRV-T5.5
A4-78
ASBRV-T5.6
CLF-1
CLF-2
B-06
ASBRV-T5.7
AR-02
ASBRV-T5.8
TURTLE POND GAUGE
LF-18
ASSABET 2A
ASSABET 2
A-2E
ASBRV-T6
ASBRV-T8
CLF-3
LF-20
TURTLE POND
MUSKRAT POND
9-78
ASBRV-T7
PT-1
ASBRV-T14
ASBRV-T13
ASBRV-T8
PT-2
MUSKRAT POND GAUGE
ASBRV-T12
ASBRV-T9
ASBRV-T11
ASBRV-T10
AR-01
A-1N
ASSABET 1
B-7
ASBRV-T15
PT-11
PT-03
PT-10
J-2
PT-09
PT-04
PT-05
J-3
ASBRV-T16
PT-08
ASBRV-U
ASBRV-T18
ASBRV-T17
J1

EXPLANATION

- W.R. GRACE PROPERTY BOUNDARY (APPROXIMATE)
- MONITORING WELL (SINGLE OR CLUSTER)
- EXTRACTION WELL
- PUBLIC WATER SUPPLY WELL
- PROPOSED PUBLIC WATER SUPPLY WELL
- RIVER TRANSECT

VDC CONCENTRATION 2001/2002

- 300 – 660 ug/L VDC
- 100–300 ug/L VDC
- 10–100 ug/L VDC
- 7–10 ug/L VDC

SAMPLES COLLECTED BETWEEN JULY 2001 AND JUNE 2002

VDC CONCENTRATIONS SHOWN ARE MAXIMUM REGARDLESS OF DEPTH. CONCENTRATION BOUNDARIES ARE APPROXIMATE.

VDC = VINYLIDENE CHLORIDE = 1,1-DICHLOROETHENE

0 600
Scale in feet

TITLE: Distribution of VDC in Groundwater, 2001 – 2002

LOCATION: W.R. Grace, Acton, MA.

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	AEB
DRAFTED	RMK
FILE	2002-VDC-B
DATE	8/30/02

FIGURE: 8

APPENDIX C – CHRONOLOGY OF SITE EVENTS

Appendix C: Chronology of Site Events	
Event	**Date**
Dewey & Almy Chemical Company manufactures various products at the Acton site at various times, such as: latex, resins, plasticizers, and paper battery separators	1945 – 1954
W.R. Grace acquires Dewey & Almy and continues various chemical manufacturing processes at the Acton site	1954 – 1991
Organic contaminants (vinylidene chloride, vinyl chloride, ethylbenzene, and benzene) detected in municipal wells, Assabet #1 and #2	1978
The United States sues W.R. Grace to require cleanup of the Site	April 17, 1980
MassDEP issues an Administrative Order to W.R. Grace, specifying procedures and requirements for evaluating and correcting Site contamination	July 14, 1980
W.R. Grace and EPA enter into a Consent Decree to clean up waste disposal areas and restore groundwater in drinking water aquifers. The provisions of the Consent Decree are similar to the requirements of the July 14, 1980 MassDEP Administrative Order.	October 21, 1980
MassDEP issues an Amended Order to W.R. Grace, amending MassDEP's July 14, 1980 order to conform with the Consent Decree language	April 15, 1981
Site added to the National Priorities List	September 8, 1983
Aquifer Restoration System (ARS) construction completed and operation begins	March 1985
Phase IV Report and Addendum, detailing the OU-1 remedy, was completed by Camp, Dresser & McKee (CDM) for W.R. Grace	June 6, 1989
Risk Analysis Report completed by Alliance Technologies Corporation for EPA	June 30, 1989
Record of Decision for OU-1 signed by Paul G. Keough, Acting Regional Administrator	September 29, 1989
CDM issued Remedial Design/Remedial Action (RD/RA) Work Plan for OU-1	January 1991

Appendix C: Chronology of Site Events	
Event	**Date**
CDM issued report on Field Pilot Programs for upgrading air stripping tower portion of ARS	May 1991
Quarterly well monitoring begins	March 1992
Odor controls for air-stripping tower installed and operational; Site security measures implemented	September 1992
CDM submitted revised 100% design package for OU-1 remedial action	August 1993
GZA issued Final Site Work Plan and Construction Quality Control Plan for OU-1 remedial action	July 1994
OU-1 Remedial Action initiated; Air monitoring system installed	October 17, 1994
Landfill gas treatment system delivered and installed; Permanent fencing around landfill installed	March 1997
Final site inspection performed	June 1997
Remedial Action Report for OU-1 issued by EPA	September 30, 1997
Revised Construction Quality Assurance Closeout Report for OU-1 issued by CDM for W.R. Grace	February 1998
Statement of Work for OU-3 Remedial Investigation/Feasibility Study is signed	March 25, 1998
First 5-year review report issued by EPA for the Site	September 1999
Draft Remedial Investigation Report and Phase 2 Work Plan for OU-3 issued by GeoTrans for W.R. Grace	August 30, 2002
Phase 2 Remedial Investigation Report issued by GeoTrans for W.R. Grace	May 14, 2003
Draft Baseline Ecological Risk Assessment issued by Menzie-Cura for W.R. Grace	July 30, 2004
Draft Public Health Risk Assessment Deliverable 3 issued by Menzie-Cura for W.R. Grace	August 5, 2004
Second 5-year review report issued by EPA for the Site	September 29, 2004
Public Review Remedial Investigation and Feasibility Study Reports for OU-3 issued by GeoTrans for W.R. Grace	July 1, 2005

Appendix C: Chronology of Site Events	
Event	**Date**
Proposed Plan for OU-3 released to public	July 8, 2005
Public Meeting on Proposed Plan for OU-3	July 19, 2005
Public Hearing on Proposed Plan for OU-3	August 4, 2005
OU-3 ROD signed	September 30, 2005
W.R. Grace and EPA come to agreement on a Remedial Design/Remedial Action Statement of Work for OU-3	August 30, 2006
Approval for performing a topographical survey and wetland assessment/delineation is granted by EPA and MassDEP	April 3, 2007
Sediment Pre-Design Work Plan is Conditionally Approved by EPA	July 24, 2007
Landfill Area and Northeast Area Groundwater Pre-Design Work Plans are Conditionally Approved by EPA	August 30, 2007
Request to Discontinue Pumping from Existing Recovery Well RLF is Conditionally Approved by EPA, with Existing Recovery Well ELF to remain operational until new recovery wells (SELF-1 and SWLF-1) are brought on line	January 15, 2008
Northeast Area Groundwater Pre-Design Results Report Conditionally Approved by EPA	November 26, 2008
Petition to discontinue pumping from extraction wells NLBR-R, NLGP, SLBR, and SLGP-R in the Former Lagoon Area is Conditionally Approved by EPA	January 9, 2009
Sediment Pre-Design Results Report Conditionally Approved by EPA	February 26, 2009
Northeast Area Groundwater Concept Design Conditionally Approved by EPA	April 24, 2009
Landfill Area Groundwater Pre-Design Results Report Conditionally Approved by EPA	June 9, 2009
Northeast Area Design Approved by EPA	June 11, 2009
Landfill Area Concept Design Submitted	September 8, 2009
Third 5-year review report issued by EPA for the Site	September 23, 2009

Appendix C: Chronology of Site Events	
Event	**Date**
Landfill Area Concept Design Approved by EPA	January 22, 2010
Startup of Northeast Area Groundwater Extraction and Treatment System	April 5, 2010
Northeast Area Groundwater Extraction and Treatment System determined to be "Operational and Functional" by EPA	May 14, 2010
Sediment Concept Design Report Submitted	June 2010
Sediment 100% Design Submitted	September 2010
Sediment 100% Design Conditionally Approved by EPA	September 30, 2010
Landfill Area Extraction System Capture Zone Conditionally Approved by EPA	October 29, 2010
Landfill Area Final Design Submitted	December 10, 2010
Landfill Area Final Design Approved by EPA	February 14, 2011
Revised Sediment 100% Design Submitted	March 2011
Startup of Landfill Area Treatment System	May 2, 2011
Shake-down of Landfill Area Treatment System	May 2011 – May 2012
Sediment Construction Final Inspection	November 17, 2011
Sediment Construction determined to be "Operational and Functional" by EPA	January 10, 2012
Preliminary Closeout Report for the Site issued by EPA	February 8, 2012
Landfill Area Groundwater Extraction and Treatment System determined to be "Operational and Functional" by EPA	May 25, 2012
Grace submits evaluation of first 2.5 years of NE Area remediation system operations, with petition to shut down in April 2013	February 25, 2013
EPA conditionally approves shutdown of NE Area remediation system	September 20, 2013
NE Area remediation system shut down	September 24, 2013
Fourth 5-year review report issued by EPA for the Site	September 23, 2014
Grace submits final vegetation monitoring report for OU-3	January 12, 2017

Appendix C: Chronology of Site Events	
Event	**Date**
Town of Concord completes construction of a solar array and school bus depot on the Concord Parcel of the Site.	August 2017
Grace enters into Access Easement with Town of Concord following the Town of Concord's taking the Concord parcel of the Site by eminent domain in 2015.	September 25, 2017

APPENDIX D – SITE INSPECTION INFORMATION

D-1 Photographs

PHOTOGRAPHS

Photo #1. Perimeter drain on south side of Industrial Landfill. Note general lack of vegetation in rip rap, open gas vent, and healthy appearance of grass cover on landfill. May 7, 2019

Photo #2. Extraction Well MLF, just outside fence that surrounds Industrial Landfill (gate in fence for access to well is about 40 feet to the left). May 7, 2019.

Photo #3. Perimeter drain on southeast side of Industrial Landfill. Note vegetation and water in rip rap channel, landfill perimeter fence, and open gas vent. May 7, 2019

Photo #4. Water draining (despite vegetation) from perimeter drainage channel into culvert, that conveys water beneath perimeter roadway and fence to low area on north side of landfill. Note protective pipes on monitoring wells (4 wells) of LF-11 cluster. May 7, 2019.

D-2 Inspection Checklist

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: WR Grace & Co., Inc (Acton Plant)	**Date of inspection: 5/7/2019**
Location and Region: Acton, MA – Region 1	**EPA ID: MAD001002252**
Agency, office, or company leading the five-year review: EPA	**Weather/temperature: Partly sunny, 65 deg**

Remedy Includes: (Check all that apply)

- ■ Landfill cover/containment
- ■ Access controls
- ■ Institutional controls
- ■ Groundwater pump and treatment
- □ Surface water collection and treatment
- □ Other_____
  _____
- ■ Monitored natural attenuation
- ■ Groundwater containment
- □ Vertical barrier walls

Attachments: □ Inspection team roster attached □ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Thor Helgason _____ _____ 5/7/19
   Name Title Date
   Interviewed ■ at site □ at office □ by phone Phone no. _____
   Problems, suggestions; □ Report attached _____
   _____

2. **O&M staff** Jim Champa _____ GWTP Operator ___5/7/19_____
   Name Title Date
   Interviewed ■ at site □ at office □ by phone Phone no. _____
   Problems, suggestions; □ Report attached _____
   _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached _____
_____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ■ O&M manual — ■ Readily available — ■ Up to date — □ N/A
   - □ As-built drawings — □ Readily available — □ Up to date — □ N/A
   - ■ Maintenance logs — ■ Readily available — ■ Up to date — □ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ■ Readily available — ■ Up to date — □ N/A
   - □ Contingency plan/emergency response plan — □ Readily available — □ Up to date — □ N/A

   Remarks_____

3. **O&M and OSHA Training Records** — □ Readily available — □ Up to date — ■ N/A

   Remarks On file at O&M HQ, Knoxville, TN

4. **Permits and Service Agreements**
   - □ Air discharge permit — □ Readily available — □ Up to date — ■ N/A
   - ■ Effluent discharge — □ Readily available — □ Up to date — □ N/A
   - □ Waste disposal, POTW — □ Readily available — □ Up to date — ■ N/A
   - □ Other permits_____ — □ Readily available — □ Up to date — ■ N/A

   Remarks_____

5. **Gas Generation Records** — □ Readily available — □ Up to date — ■ N/A

   Remarks_____

6. **Settlement Monument Records** — □ Readily available — □ Up to date — ■ N/A

   Remarks_____

7. **Groundwater Monitoring Records** — ■ Readily available — ■ Up to date — □ N/A

   Remarks_____

8. **Leachate Extraction Records** — □ Readily available — □ Up to date — ■ N/A

   Remarks_____

9. **Discharge Compliance Records**
   - □ Air — □ Readily available — □ Up to date — ■ N/A
   - ■ Water (effluent) — ■ Readily available — ■ Up to date — □ N/A

   Remarks_____

10. **Daily Access/Security Logs** — ■ Readily available — ■ Up to date — □ N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization**
   - ☐ State in-house
   - ☐ Contractor for State
   - ☐ PRP in-house
   - ■ Contractor for PRP
   - ☐ Federal Facility in-house
   - ☐ Contractor for Federal Facility
   - ☐ Other_____

2. **O&M Cost Records**
   - ☐ Readily available
   - ☐ Up to date
   - ☐ Funding mechanism/agreement in place
   - Original O&M cost estimate_____ ☐ Breakdown attached

   Total annual cost by year for review period if available

   From_____ To_____ _____ ☐ Breakdown attached
   Date Date Total cost

   From_____ To_____ _____ ☐ Breakdown attached
   Date Date Total cost

   From_____ To_____ _____ ☐ Breakdown attached
   Date Date Total cost

   From_____ To_____ _____ ☐ Breakdown attached
   Date Date Total cost

   From_____ To_____ _____ ☐ Breakdown attached
   Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**
   Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ■ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ■ Gates secured ☐ N/A
   Remarks Landfill is surrounded by chain link fence

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
   Remarks Landfill fence has warning signs. Gates in landfill fence as well as gate at Independence Road are closed when GWTP operator is not on site.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ■ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ■ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
Violations have been reported ☐ Yes ☐ No ☐ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ■ No vandalism evident
Remarks_____
_____

2. **Land use changes on site** ☐ N/A
Remarks None on Grace property, but parcel within Site in Concord was taken by town for solar panel field and school bus maintenance and storage facility_____
_____

3. **Land use changes off site** ■ N/A
Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ■ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ■ Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks _____
_____
_____
_____
_____
_____

VII. LANDFILL COVERS ■ Applicable □ N/A

A. Landfill Surface

1. **Settlement** (Low spots) □ Location shown on site map □ Settlement not evident
Areal extent_____ Depth_____
Remarks Landfill surface shows minor differential settlement but overall slopes/grades not affected
_____

2. **Cracks** □ Location shown on site map ■ Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____
_____

3. **Erosion** □ Location shown on site map ■ Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

4. **Holes** □ Location shown on site map ■ Holes not evident
Areal extent_____ Depth_____
Remarks_____
_____

5. **Vegetative Cover** ■ Grass ■ Cover properly established ■ No signs of stress
□ Trees/Shrubs (indicate size and locations on a diagram)
Remarks Grass appears healthy and is cut generally two times per year (June, September)
_____

6. **Alternative Cover (armored rock, concrete, etc.)** ■ N/A
Remarks_____
_____

7. **Bulges** □ Location shown on site map ■ Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

8. **Wet Areas/Water Damage** ■ Wet areas/water damage not evident
□ Wet areas □ Location shown on site map Areal extent_____
□ Ponding □ Location shown on site map Areal extent_____
□ Seeps □ Location shown on site map Areal extent_____
□ Soft subgrade □ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** □ Slides □ Location shown on site map ■ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ■ Applicable □ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** □ Location shown on site map ■ N/A or okay
Remarks_____
_____

2. **Bench Breached** □ Location shown on site map ■ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** □ Location shown on site map ■ N/A or okay
Remarks_____
_____

C. Letdown Channels ■ Applicable □ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** □ Location shown on site map ■ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** □ Location shown on site map ■ No evidence of degradation
Material type Rip Rap_____ Areal extent_____
Remarks_____
_____

3. **Erosion** □ Location shown on site map ■ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. **Undercutting** ☐ Location shown on site map ■ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ■ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
■ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks Minor vegetation near bottom of several letdown channels – no effect on drainage
_____

D. Cover Penetrations ■ Applicable ☐ N/A

1. **Gas Vents** ☐ Active☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks Gas vents are open to atmosphere, since the need to collect and burn gas ended about a decade ago_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ■ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ■ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ■ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ■ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ■ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.,* gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ■ Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ■ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ■ Functioning ☐ N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ■ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls □ Applicable ■ N/A

1. **Deformations** □ Location shown on site map □ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** □ Location shown on site map □ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ■ Applicable □ N/A

1. **Siltation** □ Location shown on site map ■ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** □ Location shown on site map □ N/A
   ■ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks Vegetation is present in the rip rap channel that surrounds the base of the landfill. It appears that the vegetation may slow, but does not prevent, flow in the channel, since flow was observed in the channel toward and into a drainage culvert on the north side of the landfill_____
   _____

3. **Erosion** □ Location shown on site map ■ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ■ Functioning □ N/A
   Remarks On north side of landfill, water in perimeter channel discharges to culvert which crosses beneath perimeter road and fence and discharges to low area._____
   _____

VIII. VERTICAL BARRIER WALLS □ Applicable ■ N/A

1. **Settlement** □ Location shown on site map □ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   □ Performance not monitored
   Frequency_____ □ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ■ Applicable □ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ■ Applicable □ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
■ Good condition■ All required wells properly operating □ Needs Maintenance □ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
■ Good condition□ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
■ Readily available □ Good condition□ Requires upgrade □ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines □ Applicable ■ N/A

1. **Collection Structures, Pumps, and Electrical**
□ Good condition□ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
□ Good condition□ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
□ Readily available □ Good condition□ Requires upgrade □ Needs to be provided
Remarks_____
_____

C. Treatment System ■ Applicable □ N/A

1. **Treatment Train** (Check components that apply)
■ Metals removal □ Oil/water separation □ Bioremediation
□ Air stripping ■ Carbon adsorbers
□ Filters_____
□ Additive (*e.g.*, chelation agent, flocculent)_____
■ Others Purifics photo-oxidation system for organics removal followed by liquid phase carbon__
■ Good condition □ Needs Maintenance
■ Sampling ports properly marked and functional
□ Sampling/maintenance log displayed and up to date
■ Equipment properly identified
■ Quantity of groundwater treated annually 45 to 50 gpm (47 gpm at time of inspection)
□ Quantity of surface water treated annually_____
Remarks_____
_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
□ N/A ■ Good condition□ Needs Maintenance
Remarks_____
_____

3. **Tanks, Vaults, Storage Vessels**
□ N/A ■ Good condition■ Proper secondary containment □ Needs Maintenance
Remarks_____
_____

4. **Discharge Structure and Appurtenances**
□ N/A ■ Good condition□ Needs Maintenance
Remarks_____
_____

5. **Treatment Building(s)**
□ N/A ■ Good condition (esp. roof and doorways) □ Needs repair
□ Chemicals and equipment properly stored
Remarks_____
_____

6. **Monitoring Wells** (pump and treatment remedy)
■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition
□ All required wells located □ Needs Maintenance □ N/A
Remarks_____
_____

D. Monitoring Data

1. Monitoring Data
■ Is routinely submitted on time ■ Is of acceptable quality

2. Monitoring data suggests:
■ Groundwater plume is effectively contained ■ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
■ Properly secured/locked ■ Functioning ■ Routinely sampled ■ Good condition
□ All required wells located □ Needs Maintenance □ N/A
Remarks_____
_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

_____
_____
_____
_____
_____
_____
_____
_____
_____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

D-3 Habitat Restoration Inspection Memo

OVERSIGHT REPORT
W.R. Grace Superfund Site
Acton, Massachusetts

DATE PREPARED:	May 8, 2019	**REPORT NO:**	WRGRACE070519
DATE ON SITE :	May 7, 2019		
HOURS AT SITE:	09:40 - 11:55	**PREPARED BY:**	D. Roberts
WEATHER CONDITIONS:	63°, Sunny		

I. SUMMARY OF WORK PERFORMED:

The purpose of the visit was to conduct an inspection of the habitat restoration at Sinking Pond and the North Lagoon Wetland (NLW) and observe the conditions during for the 2019 Five Year Review. The group (see list, Section III, below) met at the parking area, near the gate. We first walked to Sinking Pond, then NLW.

II. GENERAL COMMENTS AND OBSERVATIONS:

Sinking Pond

1. The water level was much higher in the pond, likely due to high spring water levels and recent rainfall.

2. The vegetation on the bank is fairly sparse and patchy. There is no evidence that there has been any serious erosion or gully formation on the bank. There were few surviving planted trees and shrubs located on the pond bank. Although the final monitoring report documented many small seedlings of native trees including cottonwood, birch, beaked hazelnut and willow, a brief survey of the bank at the northern end of the did not result in finding any of these tree species.

3. The top of the bank at the northern end of the pond had been mowed. Several small white pines were cut in the mowing.

4. Cattails were the dominant plants visible this time of year in the Inlet area. Some pond weeds were starting to grow. A few larger (6-10ft) shrubs, were found along the bank of the Inlet area.

5. Frogs were observed in shallow water of the pond.

North Lagoon Wetland

1. The area of the sedge marsh in the NLW showed good cover of wetland plants. The wetland area was saturated with water, with standing water in the center, which is the desired spring condition. As reported during monitoring, the deeper area of the marsh

has become covered by cattails. Intermixed with the cattails are a variety of sedge species, and the outer fringe of the sedge marsh is dominated by sedges, as is the channel toward the NLW along Fort Pond Brook. The presence of the cattails is not ideal habitat, but the growth and diversity of the sedges is generally acceptable. There is an area of *Phragmites* on the western edge of the sedge marsh.

2. In the area of the wooded marsh, fairly good cover was observed with wetland species including jewelweed, bulrushes, and a few sedges, with skunk cabbage around the perimeter. Very few surviving trees and shrubs were observed in the wooded area of NLW.
3. Survivorship of saplings and shrubs is slightly better in the cattail marsh area of the NLW to the north. However, most of the protective tubes still standing in the wetland were empty, indicating that many of the planted trees had not survived.
4. Several piles of the empty tubes are present around the site, and should be removed.
5. There is a large area of *Phragmites* in the wooded swamp.
6. The wetland area adjacent to the bank of Fort Pond Brook appears to be well-vegetated.

III. SUMMARY OF CONTRACTORS AND PERSONNEL:

Contractor	Site Activity/Role	Personnel
EPA	Oversight/TOPO	Chistopher Smith
DEP	Oversight/Project manager	Jennifer McWeeney
AECOM	Oversight/Project Hydrogeologist	Warren Diesl
AECOM	Oversight/Ecological Risk-Wetlands	Deborah Roberts
DeMaximus	Construction Management	Thor Helgason

PHOTO LOG
WR Grace Superfund Site
Acton, Massachusetts

DATE PREPARED:	May 8, 2019	**PHOTO LOG NO:**	WRGR06May2019
DATE ON SITE :	May 7, 2019	**PREPARED BY:**	D. Roberts

Photo File Name	Description
P5070001	Sinking Pond. Northeast shore. Some bare patches. No trees or shrubs visible.
P5070002	Sinking Pond. Looking south.
P5070003	Sinking Pond. West shore.
P5070004	Sinking Pond. Bank along east shore. Poor vegetation cover.
P5070005	Sinking Pond. From northeast, looking back at north bank.
P5070006	Sinking Pond. North shoreline, showing emergent vegetation, including pine seedling under water.
P5070007	Sinking Pond. West shore near berm. Note water level at base of berm.
P5070007b	Sinking Pond. This photo is from May 21, 2014 for comparison. Note wide bench at the base of the berm.
P5070008	Sinking Pond. Inlet, dominated by cattails.
P5070009	Sinking Pond. Inlet, south end. Some pond weeds, not yet to the surface in early season.
P507010	Sinking Pond. Inlet. East bank. A few shrubs along bank.
P507011	Sinking Pond. From the Inlet's rock berm along the north shore. Note the green stake in the water near the center of the photo.
P0507011B	Sinking Pond. This photo is from September 14, 2015 for comparison. Note the location of the stake close to shore, showing the typical lower water levels later in the summer/fall.
P50700012	Sinking Pond. West shore. Partial vegetation (early in season). No surviving shrubs.
P50700014	North Lagoon Wetland. Sedge marsh, south end. Good cover of sedges.
P50700015	North Lagoon Wetland. Center of wetland. Good water levels, sedges along the outer perimeter, cattails in center. A stand of Phragmites on the

P50700016	North Lagoon Wetland. North end.
P50700017	North Lagoon Wetland. Sedge marsh outlet stream, with good development of sedges.
P50700018	North Lagoon Wetland. Sedge marsh outlet stream, looking north.
P50700019	North Lagoon Wetland. Wooded swamp. Good vegetation cover. No surviving trees or shrubs.
P50700020	North Lagoon Wetland. Wooded swamp, north end. Some sedges. Dominated by Phragmites (standing dead stalks).
P50700021	North Lagoon Wetland. Similar view. One surviving dogwood at edge of swamp.
P50700022	North Lagoon Wetland. Looking west.
P50700023	North Lagoon Wetland. Looking east
P50700024	North Lagoon Wetland. Tree protection tubes remaining in the woods near the wooded swamp and elsewhere.
P50700025	North Lagoon Wetland. Dominated by cattails, some sedges, and a few surviving shrubs.
P50700026	North Lagoon Wetland. Connection to Fort Pond Brook. Water levels high, fairly good vegetation cover along brook.
P50700027	North Lagoon Wetland. Connection to Fort Pond Brook.

Site Photographs
WR Grace Superfund Site
May 7, 2019

P5070001

P5070002

P5070003

P5070004

P5070005

P5070006

P5070007

P5070007b

P5070008

P5070009

P5070010

P5070011

P5070011b - 09/14/2015

P5070012

P5070014

P5070015

P5070016

P5070017

P5070018

P5070019

P5070020

P5070021

P5070022

P5070023

P5070024

P5070025

P5070026

P5070027

APPENDIX E – ARARS TABLES

TABLE E-1. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Regulatory Requirements	SDWA - Maximum Contaminant Levels (MCLs) (40 CFR 141.11 - 141.16)	MCLs have been promulgated for a number of organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water. MCLs for indicator compounds were used as target cleanup levels for groundwater under each waste area. Attaining soil cleanup goals was expected to ensure that any future migration of residual contaminants in the soil will not cause exceedances of MCLs in groundwater under each waste area.	Soil cleanup goals were met during the OU-1 source control remedy. Soil cleanup goals were selected so that these standards can be met in the future.
State Regulatory Requirements	Massachusetts Drinking Water Regulations (310 CMR 22.00)	Establishes MCLs for drinking water supplies, as the federal MCLs. State drinking water standards are the same as the federal MCLs that were used.	See above.

TABLE E-1. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements (continued)	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Establishes minimum groundwater quality criteria. Similar to MCLs, groundwater quality criteria were expected to be attained by reducing residual soil contaminants to the Soil Cleanup Goals. *This regulation was rescinded in March 2009 because revisions to 314 CMR 5.00 (Groundwater Discharge Permits) promulgated in March 2009 eliminated the need for this regulation.*	Soil cleanup goals were met during the OU-1 source control remedy. Soil cleanup goals were selected so that these standards could be met in the future. Groundwater quality criteria attainment is being evaluated as part of OU-3.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Regulatory Requirements	Clean Air Act - National Air Quality Standards for Total Suspended Particulates (40 CFR 50.6)	Applicable	This regulation specifies maximum primary and secondary 24-hour concentrations for particulate matter.	These requirements are not ARARs per se, but are implemented through the State implementation requirements.
	OSHA - Worker Safety Regulations (29 CFR 1926)	Applicable	This regulation specifies the type of safety equipment, training and procedures to be followed during construction of the remedy. These regulations were applicable during construction of the selected remedy.	The OSHA rules are not ARARs per se, but they are worker safety rules that must always be complied with during operations, maintenance, and monitoring activities at the site.
	Protection of Archaeological Resources (32 CFR 229.4)	Applicable	This provides procedures for the protection of archaeological resources. If any of these resources are found during soil excavation, work would stop until the area has been reviewed by federal and state archaeologists. Research performed prior to remedy construction suggested that none would be found at this site.	No archaeological resources were found during remedy implementation.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	DOT Rules for the Transportation of Hazardous Materials (49 CFR 107, 171.1 - 171.500)	Applicable	This regulation outlines procedures for the packaging, labeling, manifesting, and transport of hazardous materials. Any shipments to and from the site during the remedy are to comply with these rules.	DOT rules are not ARARs because they regulate off-site activities. DOT rules were complied with for off-site shipments.
State Regulatory Requirements	Massachusetts Standards for All (Permitted Hazardous Waste) Facilities (310 CMR 30.510-516)	Relevant and Appropriate	This regulation provides general facility requirements for waste analysis, security measures, inspections, and training requirements.	The Industrial Landfill was constructed and is operated in accordance with these requirements. These requirements remain relevant and appropriate and are being complied with.
	Contingency Plan, Emergency Procedures, Preparedness and Prevention (310 CMR 30.520-524)	Relevant and Appropriate	This regulation outlines the requirements for emergency procedures to be used following explosions and fires, as well as safety equipment and spill-control requirements. This regulation also requires that threats to public health and the environment be minimized.	These requirements remain relevant and appropriate and are being complied with.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements (continued)	Massachusetts Manifest System, Recordkeeping, and Reporting (310 CMR 30.530-544)	Relevant and Appropriate	Requires manifesting hazardous waste shipped off-site for disposal. Any off-site shipments of waste materials were to be manifested.	These requirements are not ARARs, as they are considered off-site requirements.
	Massachusetts Closure and Post-closure (310 CMR 30.580-596)	Relevant and Appropriate	This requirement details the specific requirements for closure and post-closure of hazardous waste facilities.	The landfill cap was constructed in accordance with these requirements. These requirements remain relevant and appropriate. Post-closure operations, maintenance and monitoring are currently being performed in accordance with the Post Closure Operations and Maintenance Plan. The landfill closure was designed to meet RCRA requirements for landfill closure.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements (continued)	Massachusetts - Landfills (310 CMR 30.620-633)	Relevant and Appropriate	Establishes requirements for construction, operation, monitoring, and maintenance of hazardous waste landfills.	The landfill cap was constructed in accordance with these requirements. Operations and maintenance have also been performed in accordance with these requirements. These requirements remain relevant and appropriate. The landfill closure was designed to meet the requirements for landfill closure. Post-closure operations, maintenance and monitoring are currently being performed in accordance with the Post Closure Operations and Maintenance Plan.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements (continued)	Massachusetts Groundwater Protection (310 CMR 30.660-675)	Relevant and Appropriate	Provides performance requirements for a groundwater monitoring network, and standards for a monitoring program and sample analysis.	Groundwater at each disposal area is monitored to determine the effectiveness of the remedial measures. An annual groundwater monitoring program has been ongoing for the Landfill Area as well as other portions of the plume, and is reviewed each year and adjusted as necessary. These regulations are still relevant and appropriate.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements (continued)	Massachusetts Ambient Air Quality Standards (310 CMR 6.00) and Air Pollution Control Regulations (310 CMR 7.00)	Applicable	Establishes primary and secondary standards for emissions of dust and odor from construction and remedial activities.	These requirements remain applicable. The Northeast Area treatment system air stripper (which has been shut down) included vapor-phase carbon for odor control. The Landfill Area treatment system currently does not require emissions control because it does not employ an air stripper. Particulate emissions during excavation and solidification activities were controlled to meet the requirements. Odor emissions from the previous groundwater treatment air stripper (the ARS) were controlled with Best Available Control Technology (BACT). A gas control system utilizing BACT was installed during landfill cap construction to control emissions.

TABLE E-2. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 1 - ACTON AND CONCORD, MASSACHUSETTS

ARARs	REQUIREMENTS	ORIGINAL STATUS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements (continued)	Massachusetts Solid Waste Management Facility Regulations (310 CMR 19.000)	Applicable	This regulation outlines the requirements for closure of solid waste landfills. The Battery Separator Area chip piles were to be closed as a solid waste landfill with, among other things, an intermediate cover consisting of impervious material or flexible membrane which prevents the percolation of surface or rain water.	These requirements are no longer applicable. They would have applied to the capping of the Battery Separator Area chip piles, which was part of the OU-1 ROD-specified remedy. However, the chips were instead excavated and placed in the Industrial Landfill.

TABLE E-3. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Criteria, Advisories, and Guidance	Safe Drinking Water Act ("SDWA") National Primary Drinking Water Regulations Maximum Contaminant Levels ("MCLs"), 40 C.F.R. §§ 141.11-141.16, 141.60-141.62 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	Maximum Contaminant Levels (MCLs) have been promulgated for several common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies. MCLs are applicable only at the tap, but are relevant and appropriate because the groundwater underneath parts of the Site may be or is being used as a drinking water source.	MCLs are exceeded in groundwater at some Site locations. However, the groundwater remedy is expected to attain MCLs in the future. Groundwater is being extracted and treated or is attenuating naturally as part of the remedy and is monitored annually to evaluate progression towards cleanup goals. Institutional controls currently prevent the use of affected groundwater.

TABLE E-3. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Non-zero SDWA Maximum Contaminant Level Goals ("MCLGs"), 40 C.F.R. § 141.50-141.51. **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	MCLGs, defined by SDWA regulations as the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety, are non-enforceable health goals under the SDWA. Because MCLGs are not enforceable regulatory standards, they are not applicable. However, they are relevant and appropriate because groundwater aquifers beneath parts of the Site may be or is being used as a source for drinking water.	MCLGs are exceeded in groundwater at some site locations. However, the remedy is expected to attain non-zero MCLGs in the future. Groundwater is being extracted and treated or is attenuating naturally as part of the remedy and is monitored annually to evaluate progression towards cleanup goals. Institutional controls currently prevent the use of affected groundwater.
Federal Criteria, Advisories, and Guidance (continued)	Human health Reference Doses (RfDs) and Cancer Slope Factors (CSFs) found in USEPA's IRIS database. **ROD Status: TBC** **5-Year Review Status: TBC**	USEPA requires the use of these values in the assessment of human health risk.	These values were used in the risk assessment and calculation of numerical remediation goals. Any future evaluation of residual risk is expected to also use these values.

TABLE E-3. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Criteria, Advisories, and Guidance	Office of Research and Standards Guidelines ("ORSGs"), as found in Massachusetts Drinking Water Standards and Guidelines for Chemicals in Massachusetts Drinking Waters (last updated in the spring of 2014) **ROD Status: TBC** **5-Year Review Status: TBC**	The ORS has identified risk-based guidelines applicable to drinking water. Because the ORSGs are not regulations, they are TBCs, rather than ARARs.	ORSGs are exceeded in groundwater at some Site locations. However, the remedy is expected to attain ORSGs in the future. Institutional controls currently prevent the use of affected groundwater in the interim.

TABLE E-3. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Criteria, Advisories, and Guidance (continued)	Massachusetts Drinking Water Regulations, 310 CMR 22.06, 22.06B, 22.07A, 22.07B **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	These regulations set forth Massachusetts MCLs ("MMCLs"), based on health and technical practicality, for public water systems. The aquifer on site is not a public water system, but the requirements are relevant and appropriate for those areas of the Site that are “GW-1” areas under the MCP, because the groundwater in those areas of the Site may be potentially used as a source for drinking water. When MMCLs are more stringent than federal levels, the state levels must be met. The MMCLs for 1,4-Dichlorobenzene (also known as para-Dichlorobenzene in 310 CMR 22.07B) and ethylene dibromide are more stringent than the MCLs, but these are not contaminants of concern at the Site.	MMCLs are exceeded in groundwater at some Site locations. However, the remedy is expected to attain MMCLs in the future. Institutional controls currently prevent the use of affected groundwater in the interim.

TABLE E-3. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Massachusetts Ground Water Quality Standards ("GWQS"), 314 CMR 6.01-6.10 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Not ARAR – regulation was rescinded in March 2009**	The GWQSs were numeric limits for certain contaminants (e.g., arsenic, cadmium, copper, lead, manganese, mercury and non-numeric health-based standards for others (e.g., pathogenic organisms), as well as a pH range. This regulation was rescinded in March 2009 because revisions to 314 CMR 5.00 (Groundwater Discharge Permits) that were promulgated in March 2009 eliminated the need for this regulation.	Not ARAR – regulation was rescinded in March 2009

TABLE E-4. LOCATION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, M.G.L. c. 131, § 40; 310 CMR 10.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Wetlands Protection Act (WPA) imposes requirements and limitations for alteration of wetlands and establishes performance standards for projects that affect wetlands. Because there are lands under water bodies on the Site that are being remediated, these regulations are applicable.	The discharge of treated groundwater to Sinking Pond was designed to comply with applicable provisions of the WPA and regulations.
	Massachusetts Groundwater Supply Protection Regulations, 310 CMR 22.21 **ROD Status: Applicable** **5-Year Review Status: Applicable**	310 CMR 22 requires that protective zones around a wellhead be established that limit activities and land uses (such as storage of chemicals and removal of soil) in the zones. Because the Assabet and School Street wellfields are within the Site, and because the Assabet 1,2 and 3 wells and the Christofferson, Scribner, and Lawsbrook wells have DEP-approved Zone II wellhead protection areas which overlap with the site, these requirements are applicable.	The groundwater treatment remedy was designed to comply with 310 CMR 22.21.

TABLE E-5. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Regulatory Requirements	Clean Water Act (CWA) § 402 (33 U.S.C. §1342) **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	Section 402 of the CWA requires issuance of an NPDES permit prior to discharge of any pollutant to a water of the United States. Permits can only be issued in compliance with applicable technology standards.	The discharge for the groundwater remedy was designed to meet applicable substantive standards under NPDES regulations.
	Clean Water Act (CWA) § 304(a) (33 U.S.C. §1314(a)) **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	Federal National Recommended Water Quality Criteria (NRWQC) include (1) human health-based criteria and (2) other water quality parameters protective of fish and aquatic life. NRWQC for the protection of human health provide levels for exposure from drinking water and consuming aquatic organisms, and from consuming fish alone. Discharges subject to NPDES permitting requirements must not result in exceedances of NRWQCs.	The discharge to Sinking Pond will not cause or contribute to an exceedance of NRWQC.
	Resource Conservation and Recovery Act (RCRA, 42 USC 6901-6992) - Groundwater Protection; 40 CFR Part 264, Subpart F. **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	These regulations establish acceptable concentrations of hazardous constituents in the groundwater at licensed RCRA hazardous waste facilities. The point of compliance is set at the edge of the waste management unit(s). The regulations also establish groundwater monitoring requirements.	The groundwater monitoring provisions of Subpart F are considered when developing the long-term monitoring plan for the Site. The monitoring plan for groundwater is re-evaluated annually by Grace, EPA, and MassDEP.

TABLE E-5. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	RCRA - Identification and Listing of Hazardous Wastes; 40 CFR Part 261 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Not ARAR**	Part 261 establishes requirements for determining whether wastes are hazardous.	These regulations were used to assess whether any wastewater treatment residuals are hazardous waste which, according to these regulations, they are not.
	RCRA Generator Requirements; 40 CFR Part 262 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Not ARAR**	RCRA establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	No wastewater treatment residuals have been determined to be hazardous waste.
	Safe Drinking Water Act, Underground Injection Control Requirements, 40 CFR Part 144 **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Underground Injection Control program regulations promulgated under Part C of the Safe Drinking Water Act (SDWA) establish requirements for underground injection of treated groundwater.	These requirements were met when treated water was re-injected as part of the groundwater remedy. Re-injection of treated groundwater was practiced for the Northeast Area treatment system when it was in operation.

TABLE E-5. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Policy on Control of Air Emissions Superfund Sites OSWER Directive 9355.0-28 **ROD Status: TBC** **5-Year Review Status: TBC**	Provides EPA Policy regarding control of emissions from air strippers used during cleanup at Superfund Sites	This policy was considered in the design of the air stripper used in the Northeast Area treatment system. Emissions were found to not pose a risk but were treated with carbon as a means of controlling the potential for odors.
	USEPA Region 1 Memo Lois Gitto to Merrill Hohman, July 12, 1989 **ROD Status: TBC** **5-Year Review Status: TBC**	Lays out Regional policy on emissions from air strippers at Superfund Sites	See above.
State Regulatory Requirements	Massachusetts Air Pollution Control Regulations, 310 CMR 7.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	These regulations set requirements on the control of fugitive emissions and dust.	These requirements were met during construction activities.
	Massachusetts Clean Water Act; G.L. ch. 21, § 26-53; 314 CMR 3.00 Surface Water Discharge Permit Program **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Massachusetts Clean Water Act and regulations impose requirements for permits prior to discharges to waters of the Commonwealth.	The groundwater remedy was designed and is being operated in compliance with the substantive requirements of MCWA and 314 CMR 3.00.

TABLE E-5. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Massachusetts Clean Water Act, G.L. ch. 21, § 26-51; 314 CMR 4.00 Surface Water Quality Standards. **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Massachusetts regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of Massachusetts Surface Water Quality Standards. These standards are the same as the NRWQCs for the compounds analyzed for at the Site.	The discharge to Sinking Pond was designed and is operated so that it will not cause or contribute to an exceedance of the MSWQS.
	Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Waste; 310 CMR 30.100. **ROD Status: Applicable** **5-Year Review Status: Not ARAR**	310 CMR 30.100 establishes requirements for determining whether wastes are hazardous.	These regulations were used to assess whether any wastewater treatment residuals are hazardous waste which, according to these regulations, they are not.
	Massachusetts Hazardous Waste Rules for Generators of Hazardous Waste; 310 CMR 30.300. **ROD Status: Applicable** **5-Year Review Status: Not ARAR**	310 CMR 30.300 establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	No wastewater treatment residuals have been determined to be hazardous waste.

TABLE E-5. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
GROUNDWATER REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Massachusetts Rules for Remedial Air Emissions, 310 CMR 40.0049 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	The Massachusetts rules set forth standards for emissions from remedial activities, including a general requirement for 95% control over emissions from the remedial system, unless it is not feasible or necessary based upon an evaluation of conventional treatment technologies and risks to surrounding human or ecological populations.	The Northeast Area groundwater remedy was designed and operated in compliance with these requirements. Emissions control was employed as a means of odor control only, as the emissions did not pose a significant human health risk.
	Massachusetts Threshold Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air **ROD Status: TBC** **5-Year Review Status: TBC**	DEP has issued guidance setting out permissible concentrations of air toxics in ambient air. The TELs and AALs are used to guide permitting decisions for sources of air toxics.	The groundwater remedy was designed and is operated so that remedial air emissions do not cause any exceedances of TELs or AALs.
	Massachusetts Wetlands Protection Act and Regulations, M.G.L. c. 131, § 40; 310 CMR 10.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Wetlands Protection Act imposes requirements and limitations for alteration of wetlands. It establishes performance standards for projects that affect wetlands. Because there are wetlands on the Site, these regulations are applicable.	The discharge of treated groundwater to Sinking Pond was designed to comply with applicable provisions of the WPA and regulations.
	Massachusetts Well Decommissioning Requirements, 313 CMR 3.03 **ROD Status: Applicable** **5-Year Review Status: Applicable**	Massachusetts regulations provide for certain notification requirements upon well abandonment.	The Massachusetts regulations will be followed to the extent that the remedy involves decommissioning any wells.

TABLE E-6. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
SINKING POND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Criteria, Advisories, and Guidance	Consensus-Based Sediment Quality Guidelines; MassDEP, 2002. Technical Update, Freshwater Sediment Screening Benchmarks for Use Under the Massachusetts Contingency Plan. **ROD Status: TBC** **5-Year Review Status: TBC**	MassDEP recommends using the MacDonald et al. (2000) screening values for evaluating freshwater sediment and risks to benthic organisms. 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.	These guidelines were considered in the risk assessments and in developing risk-based remedial goals for sediment. Any future evaluation of residual risk is expected to also use these values.

TABLE E-6. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
SINKING POND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Other Criteria, Advisories, and Guidance	Ontario Provincial Sediment Quality Guideline **ROD Status: TBC** **5-Year Review Status: TBC**	The Ontario Provincial Lowest Effect Levels (LEL) are used to identify sediment at which most benthic organisms are unaffected. (Ontario Ministry of the Environment, 1993a and b, 1994). Ontario Ministry of the Environment and Energy, 1993a. *Development of the Ontario Provincial Sediment Quality Guidelines for PCBs and the Organochlorine Pesticides*, Water Resources Branch. Ontario Ministry of the Environment and Energy, 1993b. *Development of the Ontario Provincial Sediment Quality Guidelines for Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, and Zinc*, Water Resources Branch. Ontario Ministry of the Environment and Energy, 1994. *Development of the Ontario Provincial Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbons (PAH)*, Water Resources Branch.	These guidelines were considered in the risk assessments and in developing risk-based remedial goals for sediment. Any future evaluation of residual risk is expected to also use these values.

TABLE E-7. LOCATION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
SINKING POND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, M.G.L. c. 131, □§ 40; 310 CMR 10.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Wetlands Protection Act (WPA) imposes requirements and limitations for alteration of areas subject to protection under the WPA, including land under water bodies and establishes performance standards for projects that affect land under water bodies. Because Sinking Pond contains areas subject to jurisdiction under the WPA, these regulations are applicable.	The remedial action was designed to be consistent with the performance standards in the Wetlands Protection Act Regulations.
	Bordering Vegetated Wetland Delineation Criteria and Methodology, Issued: March 1, 1995 **ROD Status: TBC** **5-Year Review Status: TBC**	This policy defines which plant species or other plants are wetland indicator plants as specified in the wetland regulations (310 CMR 10.55(2)(c)). This policy also identifies a standard methodology for determining the boundary of Bordering Vegetated Wetlands (BVWs) in accordance with 310 CMR 10.55(2)(c)(1-3).	The remedy was implemented in compliance with this Policy.

TABLE E-8. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
SINKING POND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Regulatory Requirements	RCRA - Identification and Listing of Hazardous Wastes; 40 CFR Part 261 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	Part 261 establishes requirements for determining whether wastes are hazardous.	The remedy was implemented to comply with the Part 261 regulations in determining whether any excavated sediments were hazardous waste which, based upon the regulations, they were not.
	RCRA Generator Requirements; 40 CFR Part 262 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Not ARAR**	RCRA establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	No excavated sediments were determined to be hazardous waste.
State Regulatory Requirements	Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Waste; 310 CMR 30.100. **ROD Status: Applicable** **5-Year Review Status: Applicable**	310 CMR 30.100 establishes requirements for determining whether wastes are hazardous.	The remedy was implemented to comply with 310 CMR 30.100 in determining whether any excavated sediments were hazardous waste. No sediments were determined to be hazardous waste.
	Massachusetts Hazardous Waste Rules for Generators of Hazardous Waste; 310 CMR 30.300. **ROD Status: Applicable** **5-Year Review Status: Not ARAR**	310 CMR 30.300 establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	No excavated sediments were determined to be hazardous waste.

TABLE E-8. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
SINKING POND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Massachusetts Wetlands Protection Act and Regulations, M.G.L. c. 131, □§ 40; 310 CMR 10.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Wetlands Protection Act (WPA) imposes requirements and limitations for alteration of areas subject to protection under the WPA, including land under water bodies and establishes performance standards for projects that affect land under water bodies. Because Sinking Pond contains areas subject to jurisdiction under the WPA, these regulations are applicable.	The remedial action was designed to be consistent with the performance standards in the Wetlands Protection Act Regulations.
	Massachusetts Solid Waste Management Regulations (310 CMR 19.000) **ROD Status: Applicable** **5-Year Review Status: Not ARAR**	These regulations address non-hazardous waste and closure, post closure and maintenance of solid waste landfills. If non-hazardous wastes are left on site as part of this remedy, the disposal Closure/Post Closure Standards would be met.	No non-hazardous wastes were left on site as part of this remedy.

TABLE E-9. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
State Criteria, Advisories, and Guidance	Consensus-Based Sediment Quality Guidelines; MassDEP, 2002. Technical Update, Freshwater Sediment Screening Benchmarks for Use Under the Massachusetts Contingency Plan. **ROD Status: TBC** **5-Year Review Status: TBC**	MassDEP recommends using the MacDonald et al. (2000) screening values for evaluating freshwater sediment and risks to benthic organisms. 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.	These guidelines were considered in the risk assessments and in developing risk-based remedial goals for sediment. Any future evaluation of residual risk is expected to also use these values.

TABLE E-9. CHEMICAL-SPECIFIC ARARS AND CRITERIA, ADVISORIES, AND GUIDANCE
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Other Criteria, Advisories, and Guidance	Ontario Provincial Sediment Quality Guideline **ROD Status: TBC** **5-Year Review Status: TBC**	The Ontario Provincial Lowest Effect Levels (LEL) are used to identify sediment at which most benthic organisms are unaffected. (Ontario Ministry of the Environment, 1993a and b, 1994). Ontario Ministry of the Environment and Energy, 1993a. *Development of the Ontario Provincial Sediment Quality Guidelines for PCBs and the Organochlorine Pesticides*, Water Resources Branch. Ontario Ministry of the Environment and Energy, 1993b. *Development of the Ontario Provincial Sediment Quality Guidelines for Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, and Zinc*, Water Resources Branch. Ontario Ministry of the Environment and Energy, 1994. *Development of the Ontario Provincial Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbons (PAH)*, Water Resources Branch.	These guidelines were considered in the risk assessments and in developing risk-based remedial goals for sediment. Any future evaluation of residual risk is expected to also use these values.

TABLE E-10. LOCATION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Regulatory Requirements	Executive Order, 11990; Wetlands Protection; Clean Water Act (40 CFR 6, Appendix A). **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Executive Order (EO) imposes requirements on federal agencies that oversee projects undertaken in wetlands areas, including natural ponds. It requires federal agencies to avoid construction in wetlands unless there is no practicable alternative to such construction. If there is no practical alternative to conducting work in the wetlands, all practicable measures to minimize harm to wetlands from such construction must be taken. The North Lagoon Wetland is a jurisdictional wetland area. Because there are wetlands on the Site and a federal agency is overseeing the remediation, this requirement is applicable.	40 CFR Part 6, Appendix A was withdrawn and the requirement reverts back to the FEMA regulation addressing wetlands, codified at 44 CFR Part 9. Because the contamination that was remediated is located in wetlands, there was no practical alternative to address this contamination. Measures were taken to minimize impacts and mitigate damage to the extent practicable and the wetland has been restored. Ongoing monitoring is evaluating the success of the restoration effort.

TABLE E-10. LOCATION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Floodplains Protection Executive Order 11988; Clean Water Act (40 CFR 6.302(b), Appendix A) **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Executive Order (EO) imposes requirements on federal agencies that oversee projects undertaken in floodplains. It requires federal agencies to avoid activities in floodplains unless there is no practicable alternative to such activities. If there is no practical alternative to conducting work in the floodplain, all practicable measures to minimize impacts must be taken. Because there is a floodplain on the Site and a federal agency is involved with the remediation, this requirement is applicable	40 CFR Part 6, Appendix A was withdrawn and the requirement reverts back to the FEMA regulation addressing wetlands, codified at 44 CFR 9. Because some of the contamination in the North Lagoon Wetland that presented an unacceptable risk were located in a floodplain, there was no practical alternative to conducting work within the floodplain to address this contamination. Measures were taken to minimize and mitigate impacts.
State Regulatory Requirements	Massachusetts Wetlands Protection Act and Regulations, M.G.L. c. 131, § 40; 310 CMR 10.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Wetlands Protection Act (WPA) imposes requirements and limitations for alteration of wetlands and establishes performance standards for projects that affect wetlands. Because the North Lagoon Wetland contains areas subject to jurisdiction under the WPA, these regulations are applicable.	The remedial action was conducted in accordance with these regulations.

TABLE E-10. LOCATION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Bordering Vegetated Wetland Delineation Criteria and Methodology, Issued: March 1, 1995 **ROD Status: TBC** **5-Year Review Status: TBC**	This policy defines which plant species or other plants are wetland indicator plants as specified in the wetland regulations (310 CMR 10.55(2)(c)). This policy also identifies a standard methodology for determining the boundary of Bordering Vegetated Wetlands (BVWs) in accordance with 310 CMR 10.55(2)(c)(1-3).	This guidance was used to define the boundary of the wetlands for state wetland purposes.

TABLE E-11. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
Federal Regulatory Requirements	RCRA - Identification and Listing of Hazardous Wastes; 40 CFR Part 261 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Relevant and Appropriate**	Part 261 establishes requirements for determining whether wastes are hazardous.	The remedy was implemented to comply with the Part 261 regulations in determining whether any excavated sediments are hazardous waste which, based upon the regulations, they were not.
	RCRA Generator Requirements; 40 CFR Part 262 **ROD Status: Relevant and Appropriate** **5-Year Review Status: Not ARAR**	RCRA establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	No excavated sediments were determined to be hazardous waste.
	Clean Water Act (CWA) § 402 (33 U.S.C. §1342) **ROD Status: Applicable** **5-Year Review Status: Applicable**	Section 402 of the CWA requires issuance of an NPDES permit prior to discharge of any pollutant to a water of the United States. Permits can only be issued in compliance with applicable technology standards.	Impacted water generated during remedial activities resulted primarily from equipment cleaning activities and precipitation that contacted impacted materials in the sediment dewatering and decontamination pads. This water was collected, filtered, and treated in the new Landfill Area groundwater treatment system which discharges into Sinking Pond. Effluent limitations were met.

TABLE E-11. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Clean Water Act (CWA) § 304(a) (33 U.S.C. §1314(a)) **ROD Status: Applicable** **5-Year Review Status: Applicable**	Federal National Recommended Water Quality Criteria (NRWQC) include (1) human health-based criteria and (2) other water quality parameters protective of fish and aquatic life. NRWQC for the protection of human health provide levels for exposure from drinking water and consuming aquatic organisms, and from consuming fish alone. Discharges subject to NPDES permitting requirements must not result in exceedances of NRWQCs.	The discharge from the dewatering operations was treated and discharged to Sinking Pond. Collection and treatment of the discharge was designed and operated so that it would not cause or contribute to an exceedance of the NRWQC.
State Regulatory Requirements	Massachusetts Clean Water Act, G.L. ch. 21, § 26-51; 314 CMR 3.00. **ROD Status: Applicable** **5-Year Review Status: Applicable**	The Massachusetts regulations provide that discharges to waters of the Commonwealth shall not result in exceedances of Massachusetts Surface Water Quality Standards. These standards are the same as the NRWQCs for the compounds analyzed for at the Site.	The discharge from the dewatering operations was treated and discharged to Sinking Pond. Collection and treatment of the discharge was designed and operated so that it would not cause or contribute to an exceedance of the MSWQS.
	Massachusetts Hazardous Waste Rules for Identification and Listing of Hazardous Waste; 310 CMR 30.100. **ROD Status: Applicable** **5-Year Review Status: Applicable**	310 CMR 30.100 establishes requirements for determining whether wastes are hazardous.	The remedy was implemented to comply with 310 CMR 30.100 in determining whether any excavated sediments are hazardous waste which, based upon the regulations, they were not.

TABLE E-11. ACTION-SPECIFIC ARARS
W.R. GRACE SUPERFUND SITE – OPERABLE UNIT 3 - ACTON AND CONCORD, MASSACHUSETTS
NORTH LAGOON WETLAND SEDIMENT REMEDIATION

ARARs	REQUIREMENTS	REQUIREMENT SYNOPSIS	FIVE YEAR REVIEW
	Massachusetts Hazardous Waste Rules for Generators of Hazardous Waste; 310 CMR 30.300. **ROD Status: Applicable** **5-Year Review Status: Not ARAR**	310 CMR 30.300 establishes requirements applicable to generators of hazardous waste. Those requirements include provisions addressing hazardous waste determinations, manifesting, pre-transport requirements, and recordkeeping.	No excavated sediments were determined to be hazardous waste.
	Massachusetts Air Pollution Control Regulations, 310 CMR 7.00 **ROD Status: Applicable** **5-Year Review Status: Applicable**	These regulations set requirements on the control of fugitive emissions and dust.	These requirements were met during construction activities.
	Massachusetts Solid Waste Management Regulations (310 CMR 19.00) **ROD Status: Applicable** **5-Year Review Status: Not ARAR**	These regulations address non-hazardous waste and closure, post closure and maintenance of solid waste landfills. If non-hazardous wastes are left on site as part of this remedy, the disposal Closure/Post Closure Standards would be met.	No non-hazardous wastes were left on site as part of this remedy.