REMEDIAL ACTION WORK PLAN

RARITAN BAY SLAG SUPERFUND SITE MARGARET'S CREEK SECTOR

Old Bridge Township, Middlesex County, New Jersey Site ID: A205

Prepared for
USEPA Region 2, Special Programs Branch 290 Broadway 19th Floor
New York, New York, 10007

Prepared by
USEPA Region 2, Removal Action Branch 2890 Woodbridge Avenue
Edison, New Jersey 08837

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1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA) is conducting a remedial action (RA) at the Raritan Bay Slag Superfund site (RBS), Margaret's Creek Sector, located in Old Bridge Township, Middlesex County, New Jersey. This work is being completed in accordance with the Remedial Design (RD) Contract Documents – Technical Specifications and Drawings and applicable portions of Section 9.2 Description of Remedy Components, Alternative 2 – Excavation/Dredging, Off-site Disposal and Monitoring, of the Record of Decision (ROD) for this site, dated May 23, 2013. This area of the site has also been known and identified as Area 9, Margaret's Creek Sector. The following sections outline the work which will be completed under this action. This remedial action work plan (RAWP) will address those areas where slag, battery casings and lead contaminated soil and sediment have been identified during previous remedial and removal program investigations which were completed in November 2010, August 2014, October 2014, March 2015, July 2016 and August 2016.

2.0 SITE HISTORY and DESCRIPTION

The Margaret's Creek Sector of the RBS site (site) is comprised of 47-acres located east of Route 35, between Cliffwood Beach and the Laurence Harbor section of Old Bridge Township, Middlesex County, New Jersey (Figure 1). The site is secured along Route 35 by a six (6) foot high chain-link fence with two vehicle entrance gates. The site is bordered to the east and west by residential properties, to the north by Raritan Bay and to the south by Route 35. Large areas of the property have been filled in with a variety of materials over time and it gradually slopes towards the beach area of the Raritan Bay. Access into the site is via two entrances along Route 35. The south entrance (Gate 1) is the starting location of a stone-covered road which provides access to the beach area for township and county-employed personnel during emergency situations (brush fires, water rescue, etc.). The second entrance (Gate 2) is located further to the north and serves as a maintenance road along a 30-inch sanitary sewer line.

Since being sold in the late 1960's, portions of the site were filled in with soil, demolition debris (concrete, brick, wood, etc.), wastes associated with the recovery of lead such as slag and waste from used automotive batteries (battery casing materials). Based upon analytical results from previous investigations, areas of the site contain slag or soil contaminated with lead associated with the deposition of battery recycling wastes and slag weathering.

As a result of flooding, hurricane-force winds and tidal surge from Superstorm Sandy in October 2012, the upland areas of Margaret's Creek were significantly disturbed, resulting in battery casings being uncovered and redeposited in these areas, and becoming accessible to persons accessing Margaret's Creek trails and roads. In March 2014, EPA initiated removal of surficial battery casings in the Margaret's Creek sector of the site using Federal funding appropriated for Superstorm Sandy response actions, this work was completed in the spring of 2016. In addition, EPA tasked CDM Smith to develop an RD to fully implement the work for the Margaret's Creek Sector identified in the 2013 ROD. CDM Smith used information from the Remedial Investigation/Feasibility Study (RI/FS), along with information collected by EPA's removal program during the aforementioned removal investigations, to develop the design.

This RAWP refers to the final RD for completion of all the prescriptive design elements (e.g., pre-excavation sampling, excavation, site restoration, etc.). The Design will provide the detail on how these activities will be completed, unless otherwise stated herein or unless a deviation is determined to be appropriate during implementation of construction activities. Any changes from the RD will require prior approval by the EPA Remedial Project Manager (RPM) and will be properly documented in the Remedial Action Report.

3.0 SITE OBJECTIVES

Primary site objectives, as identified in the ROD include the following:

- Pre-excavation sampling program to collect soil, sediment, and surface water samples;
- Site preparation, including mobilization, clearing and grubbing, utility identification, construction of a material staging area(s), equipment decontamination area, monitoring well protection; and establishment of site security, soil erosion, storm water and sediment control measures;
- Excavation dewatering, as necessary;
- Installation of temporary water treatment system, testing, and operation and maintenance, if necessary;
- Excavation of contaminated material and post-excavation sampling
- Waste characterization, stock piling of waste, handling, and offsite disposal;
- Backfill and grading; and
- Site restoration, including wetland restoration of impacted areas

Note: The ROD also includes surface water monitoring. A surface water monitoring plan will be implemented as part of the Seawall Sector Remedial Action. The monitoring is to ensure the effectiveness of the remedy by achievement of the remedial goals presented in the ROD.

4.0 SCOPE of WORK

The scope of work consists of the remediation of slag, battery casings, associated wastes, contaminated and highly impacted soil and sediment in the Margaret's Creek Sector. All geochronology/sediment sample locations in open water and sample SB003 contamination on Block 1 Lot 49 exceeding the site cleanup criteria will be delineated and remediated as part of the Seawall sector, as necessary.

The following sections describe the technical approach to meet the site objectives.

5.0 TECHNICAL APPROACH

Pre-Mobilization Activities

The primary pre-mobilization tasks include the submission and approval of project plans; subcontracting services (surveying, security, disposal, trailers, etc.); ordering materials, equipment and supplies; obtaining local permits; site inspections; delineation/disposal sampling; and a pre- construction meeting.

Procurement

In order to accomplish the objectives, it will be necessary to procure select services prior to mobilization to the job site. The remediation work will be conducted by EPA through the removal program contracting vehicles utilizing support from two primary contractors. Environmental Restoration, LLC, Emergency and Rapid Response Services (ERRS) contractor will provide personnel, equipment and services for the construction activities including but not limited to excavation, management and disposal of waste, and site restoration. The EPA Removal Support Team 3 contractor, Weston Solutions, Inc. (RST3) will provide personnel and equipment to support site operations including but not limited to air monitoring/sampling, soil sampling, photo documentation, maintaining a daily log of operations and report generation. The day-to-day field operations will be managed by EPA's removal program on-scene coordinator (OSC) and the EPA RPM will be responsible for management of the overall RA.

Prior to mobilization, the OSC will coordinate with local authorities regarding emergency planning and traffic control. The OSC will arrange to secure any local permits required to implement the work.

Additional services may include but are not limited to: an analytical service subcontractor, vendor(s) to supply clean backfill material for restoring the site, a transportation and disposal subcontractor(s) and a security services company to provide for afterhours oversight of the work area. The site-specific health and safety plan (HASP) has been completed by the contractor and accepted by EPA; it is attached to this document.

Backfill Materials
The OSC will inspect all backfill materials and be present during sample collection from all backfill sources (soil, topsoil, and wetland soil). Samples of each material will be submitted for laboratory analysis in accordance with the RD. The analyses will include the chemical analysis and geotechnical testing requirements contained in the RD. All testing results will be reviewed and approved by the RPM and OSC. After approval, stockpiling of backfill materials will start prior to the initiation of excavation activities.

Surveys
The pre-construction topographic survey was completed on February 24, 2017. The survey encompassed the upland and wetland portions of the Margaret's Creek Sector where field activities and/or actions will be conducted. New Jersey OneCall was contacted by the ERRS contractor and the identification of on-site utilities was completed. The contractor will coordinate with local utilities, including the Old Bridge Municipal Utilities Authority (OBMUA) to determine the best approach for performing the excavation and backfill activities where the sanitary sewer and other utilities may potentially traverse the excavation area.

Site Access
The contractor will maintain all access roads. Construction entrances/exits, and site access roads will be evaluated and stabilized as needed. Locations and construction details are indicated on Figure 2.

Pre-excavation Sampling
Pre-excavation soil and sediment samples are being collected from areas of concern that have not been fully delineated during previous sampling events. The objective of the sampling events is to delineate the horizontal and vertical extent of contamination within each area of concern identified in the RD. Samples are being collected in 6-inch increments and field screened using an X-ray fluorescence (XRF). These samples will be screened to the depth that is anticipated to represent non-contaminated soil. Based upon the XRF results, samples will be selected for fixed laboratory analysis for lead analysis to determine if excavation is warranted. If lead concentrations are above the cleanup criteria of 400 mg/kg, additional samples will be collected to delineate the extent of contamination. Once delineated, these sample locations will be used to direct excavation activities.

During the pre-design investigation sampling, sampling locations A9-PS-77 (Area-C), A9-PS-74 (Area-T), A9-24 (Area D) and A9-34 (Area J) that were previously reported as exceeding the cleanup criteria could not be verified. Additional samples were collected at the sample locations to verify the results. The results of the verification sampling efforts did not identify exceedances to the Site cleanup criteria. Based on the verification sample results, these excavation areas were removed from the areas to be remediated. All data supporting this decision will be provided in the final RA report.

Photo Documentation
Photo documentation of pre-remediation site conditions in the various work areas will be collected. The EPA-approved site identification sign has been installed at the entrance to the site. Photographic and/or video documentation of each phase of site remediation (clearing, excavation, restoration, etc.) will be collected as work progresses.

6.0 SITE PLAN

Permits and Plans
Excavation activities at the site will require state permit equivalencies and local permits both prior to and/or during execution of certain aspects of the work. All contractors will review all submitted permit equivalency documentation prior to the start of work activities to ensure substantive requirements are met.

Where applicable, all subcontractors that are awarded contracts will be required to obtain/follow all necessary permits required for site work. The management of site activities will be completed by the OSC and direction to

contractors provided through the issuance of daily work orders.

Health and Safety Plan

The safety of site workers and the public will be the highest priority. EPA will be utilizing its ERRS contractor for the construction activities. ERRS will be responsible for the overall safety of its workers and subcontractors. All workers under the control of the ERRS contractor will be provided site specific safety training appropriate to their work functions prior to commencing any work on-site.

In December 2016, the ERRS contractor developed a site-specific Health and Safety Plan (HASP); it was accepted by EPA and is attached to this RAWP as Appendix A. Any persons that are retained to work on the site shall abide by the provisions of the site HASP. All personnel within the designated work area shall wear, at a minimum, hard hats, safety glasses, and steel toed boots. Additional Personal Protective Equipment (PPE) selection will be based on the job analysis evaluation in the HASP. Personnel shall receive site specific instruction pertaining to the hazards associated with the activities for the day prior to each day's activity, and before each new activity is undertaken. These safety meetings will be documented.

EPA will utilize its RST3 Contractor for project sampling, air monitoring, and other technical support activities. RST3 will provide a HASP for RST3 activities which will be incorporated as an appendix to the ERRS HASP. The ERRS HASP will be the official health and safety plan for the site.

All work areas around the site will be demarcated with the appropriate signage (i.e., warning/danger signs) or fencing for the protection of on-site personnel and authorized visitors, and to prevent access of unauthorized persons onto the site.

Worker Safety

All applicable worker health and safety standards will be followed for the duration of on-site activities. Primary standards will include OSHA Construction Rules and the OSHA Lead and Arsenic Standards. More detailed information regarding worker health and safety is included in the site HASP.

Public Safety

Due to the proximity of businesses and residential areas around the site, public safety will be a high priority. Potential hazards to the public may include air releases of dust and safety concerns with truck traffic and the use of heavy equipment being operated at the site. EPA will implement the established site Community Air Monitoring Plan, attached as Appendix C to this RAWP, to monitor for potential air releases. EPA will also implement engineering controls to protect against off-site migration of contaminated water and soil via runoff from rain events and/or vehicles and equipment working at the site. Controls may include silt fencing, construction of clean site haul roads, as well as equipment/vehicle decontamination areas when required.

Housekeeping and Signs

The Contractor will remove all scrap metal, trash, miscellaneous construction debris, and concrete debris generated or encountered, as necessary. During the work period they will erect signs and/or barriers (barricade tape, fences, etc.) as required to protect site personnel and visitors.

7.0 MOBILIZATION

Mobilization activities are directed by the OSC. All contractors and associated personnel will be briefed on the scope of work and project schedule. Work will be directed to the contractor via daily work orders. Some mobilization activities have been completed since January 2017, including establishing support areas, clearing and grubbing, delineation soil sampling, and delivery of crushed stone and some supplies.

Surface water from the eastern portion of the site drains through a 24-inch reinforced concrete pipe (RCP) into the western portion of site and discharges into Raritan Bay via Margaret's Creek. On March 8, 2017, an inspection of

these areas was conducted by the Middlesex County Mosquito Control Commission (MCMCC) and EPA. In preparation for the site work, on April 19, 2017 MCMCC personnel removed blockages in each of these areas.

Site Facilities and Security

The site support facilities are located immediately inside of Gate 1 entrance and consist of two office trailers, a break trailer, a storage container, potable restroom units and gravel-covered parking area. Electricity to each of the office and break trailers is provided by the local utility company. All vehicular access into the site will be through Gate 1. Egress from the site will be through Gate 2. A decontamination area and truck scale will be installed within the roadway leaving the site. The location of the gates, access roads, truck scale, support area and storage areas are illustrated on Figure 2.

Site security will be achieved through the use of temporary fence and existing fence. In addition, unarmed site security officers will be on-site during non-working hours. Their typical work shift will be 5:00 pm to 6:00 am, Monday through Friday, 24 hours a day on weekends and holidays, at the discretion of the OSC. Access gates will be locked during non-working hours. As excavation activities progress, orange perimeter construction fencing will be utilized to demarcate work areas. The main gate to the site will be maintained and not blocked during the remediation for access by Middlesex County Utilities Authority (MCUA) and Old Bridge Township Fire Department.

Other site setup tasks include monitoring well and sanitary sewer vent protection, possible temporary water treatment system and discharge connection to MCUA publicly owned treatment works (POTW) or surface water discharge, soil erosion and sediment control barriers, sediment containment area, material storage area, and soil stockpile/load out area. Erosion control will be performed in accordance with the Soil Erosion and Sediment Control Plan approved by the Freehold Soil Conservation District.

8.0 AIR MONITORING/SAMPLING

A Community Air Monitoring Plan (CAMP) has been prepared for this project to protect the local community and ensure the effectiveness of site engineering measures for the control of particulate/dust emissions. The CAMP addresses two critical aspects of the work being performed: 1) actual work zone safety (i.e.-worker health and safety) and 2) identifying and documenting potential releases into the surrounding community. The adjacent community consists of residential dwellings, commercial establishments and commuter traffic. A complete copy of the CAMP is attached to this RAWP as an appendix.

If particulate/dust emissions are encountered above site-specific action levels, a work stoppage will occur until conditions change (for example, high wind conditions) and/or site engineering controls or procedures are appropriately adjusted (for example, additional dust suppression may be warranted).

Perimeter air monitoring will be conducted utilizing SKC air monitoring pumps, and real-time Data Ram dust monitors.

The ERRS contractor will be responsible for conducting air monitoring of its personnel to establish worker exposure during the completion of the various work elements.

9.0 EXCAVATION

The primary excavation areas include areas where slag and/or battery casing material were visually identified and/or soil and sediment sample results confirmed the presence of lead impacts above the ROD cleanup criteria. Excavation of soil will be based upon cut-lines developed by EPA's evaluation of previous soil sampling results. The contractor will be required to excavate to the approximate horizontal and vertical limits shown on the Contract Drawing **Sheet C-5** or the limits established based on pre-excavation sampling results. Under this action, no excavation will extend into open water areas. These areas will be included in a later phase of the overall site

RA.

Site-wide excavation sequencing will be implemented as proposed on Contract Drawing **Sheet C-1**. The overall approach to remediation will be to begin excavation activities within those areas which contain the largest volume of waste material, which includes areas that primarily contain slag. However, excavation sequencing may be altered based on the direction from the OSC. This includes areas which primarily contain slag. Excavated materials will be transported via off-road dump trucks to the waste stockpile area. Because disposal costs are based upon the size of slag and fragments within the waste stream, the material excavated from each of these areas will be segregated at either the point of excavation or within the soil stockpile area to remove slag pieces with a diameter greater than 6- inches in size prior to stockpiling for loadout.

The remediation includes the excavation of soil, sediment, slag and battery casing material to depths expected to range from 0.5 to 8 feet below ground surface (bgs). Additional confirmation sampling may still be necessary in some areas. In such cases, screening samples will be collected and evaluated using a calibrated Niton Thermal XRF. Screening results will determine if the excavation needs to continue. If the results indicate the area is below 250 parts per million (ppm) of lead, the sample will be submitted for laboratory analysis to confirm the concentrations present. If the XRF lead result is above 250 ppm, the Contractor will continue excavation and the soil or sediment will be re-sampled. This evaluation process will continue until the site cleanup criteria is met, groundwater is encountered, or until the OSC determines no further excavation is warranted. Upon receiving acceptable sampling results, the excavated area(s) will be backfilled with clean fill and loosely compacted.

Should groundwater be encountered during the excavation activities, an evaluation will be made to determine if removal of the groundwater is necessary to continue removal of waste material or backfilling. If a significant volume of water is observed, it will be pumped into a holding tank for discharge or disposal, as appropriate.

Soil

Stockpile areas will include a 30 mil base liner and earthen berm or concrete barriers on three sides. Each area will be sloped to a sump pit where liquids will accumulate and pumped to an on-site holding tank.

Waste material excavated from upland areas will be transported to the soil stockpile/loadout area located along the south side of the exit roadway. Any waste material determined to contain excessive water will be transported to the soil drying area. All contaminated soil will be staged on-site and covered with six millimeter reinforced polyethylene plastic sheeting. The excavation of contaminated soils is anticipated to generate approximately 15,000 tons of material. Both stockpiles will be covered nightly.

Sediment

Pre-excavation sediment delineation sampling is on-going within the wetland areas. Once fully delineated, excavation will begin at the furthest points within the impacted area and sediments will be loaded directly into the off-road dump trucks for transportation to the soil drying area. Backfilling operations will commence immediately following the receipt of post-excavation sample results confirming that site remediation cleanup criteria have been achieved.

Dewatering, as necessary

Sediment remediation activities will involve the management of surface water during excavation, and may require additional steps such as the installation of barriers or diversion trenches, and pumping, containerization and sampling of water. Any necessary dewatering for sediment excavation will be conducted using installation of temporary barriers around the excavation area and dewatering the excavation area using pumps. Sample frequency and analyses will be pursuant to the applicable permit(s). Based upon an evaluation of the analytical results obtained from representative samples of this water, this water may be re-used on-site, filtered and returned to the same excavation area or discharged to the Old Bridge Municipal Utilities Authority (OBMUA) system. Water generated from excavation dewatering, stockpiles, and the drying area may be treated on-site, as necessary, before discharging to the OBMUA. Alternate water disposal options may also be utilized, if needed.

Dust Suppression

Water will be used to control dust generated during site operations, including during excavation activities and during the transportation/handling of waste. Misting of site roads, work areas and stockpile areas will be accomplished with a mobile water truck. The amount of water will be limited to what is needed to eliminate dust emissions from the operation, not to completely saturate excavated soils. Water will be supplied by an outside vendor and delivered to the site and stored in an on-site tank. The implementation of the CAMP will also be used to evaluate the effectiveness of dust suppression efforts.

10.0 POST-EXCAVATION SAMPLING

Pre-excavation delineation sampling results will be used to determine excavation limits to the extent possible. Excavation areas which have not been fully delineated will require the collection of post-excavation samples to confirm that site cleanup criteria have been achieved. In such cases, excavation work will continue in another area of concern while awaiting sampling results. EPA will use the pre-excavation and post-excavation sample locations to confirm that the post-remedial requirements have been met, in accordance with N.J.A.C. 7:26E-6.4. The frequency to be followed is as follows:

- One bottom sample from the excavation bottom for every 900 square feet of area.
- One sidewall sample for every 30 linear feet of excavation sidewall, with a minimum of one sample located on each sidewall. Excavation sidewalls to be sampled include the overall perimeter sidewalls and interior sidewalls between adjacent excavations when there is a change in excavation depth of over one foot. In all cases, the liner feet of sidewall shall be measured at the top of the excavation or along the top of sloped sidewalls.

If deeper excavation is required within localized portions of the overall excavation, additional sidewall samples will be collected when the difference in excavation depths is greater than 2 feet."

All post-excavation samples collected for lead analysis will be collected using the following standard operating procedures (SOPs):

- EPA/ERT General Field Sampling Guidelines #2001;
- EPA/ERT Sampling Equipment Decontamination #2006; and
- EPA/ERT Soil Sampling #2012.

During cleanup activities, contractor personnel will adhere to the protocols specified in the Quality Assurance Project Plan (QAPP) for this site. A copy of the QAPP will be maintained on-site at all times. All referenced SOPs above are included as Appendix B of the RAWP.

11.0 SOIL DISPOSAL VENDORS

All stockpiled soils generated during this remedial action will be transported off-site for disposal.
The disposal vendor will be required to meet both regulatory requirements and scheduling aspects of the project. All transporters of the waste will demonstrate compliance with applicable state and federal requirements governing the transporting of hazardous and non-hazardous wastes.

The Comprehensive Environmental Response, Compensation, and Liability Act Off-Site Rule will apply to all selected off-site disposal facilities utilized for excavated wastes. Transportation of the excavated wastes will adhere to applicable Department of Transportation shipping requirements which includes weight limitations, manifesting and reporting.

12.0 RESTORATION OF AFFECTED AREAS

Site restoration will involve the grading of areas affected by the removal of contaminated soil, sediment, slag or battery casings and associated activities. The restoration of the site will be consistent with applicable portions of the Technical Specification Sections 02201, 02900, 02921, 02955 and 02957. All backfill will be analyzed by an off- site laboratory and certified clean in accordance with Technical Specification Section 01450.

Pursuant to EPA direction and upon confirmation that remediation criteria have been achieved, excavated area(s) will be backfilled to grades that will prevent soil erosion concerns and do not present a physical hazard. Compaction will be accomplished utilizing on-site equipment (i.e., excavator and/or bulldozer).

Local vendors will be used to supply clean backfill materials for restoring the property. Vendors providing clean backfill material will be required to provide, prior to delivery, a certification indicating that the material is from a virgin source or supply analytical data supporting the quality of the material. EPA will also collect samples to verify the quality of the material being delivered to the property. Certified clean material will meet the requirements of New Jersey Administrative Code (N.J.A.C.) 7:26D, Residential Direct Contact Soil Cleanup Criteria.

EPA verification of clean fill meeting NJDEP criteria will be completed via sampling in accordance with the NJDEP Field Sampling Procedures Manual (2005). Each grab sample will be submitted for full target compound list (TCL) plus acrolein, acrylonitrile, benzidine, 1,2-diphenylhydrazine, n-nitrosodimethylamine and tertiary butyl alcohol; target analyte list (TAL) plus 30 (incl. mercury and cyanide), extractable petroleum hydrocarbons (EPH) and radium 226. Gamma radiation exposure screening of the backfill material shall also be performed.

The use of hydro-seeding technology will be evaluated at the time of seeding. Silt fence will be installed in areas where it is necessary to prevent soil from eroding during heavy rain events. Every effort will be made to restore all the areas to pre-existing conditions with little or no impact on the environment.

Restoration of the wetland areas will be completed in accordance with the requirements outlined in the RD and will be followed to the extent practicable based on field conditions at the time. In addition, restoration activities including planting, landscaping or other activities may be performed by other entities with EPA oversite.

The final property grading survey will be completed once all restored areas have been inspected by EPA for settling/erosion. If required, additional backfill will be used to regrade the affected portions of the excavation area. Site restoration will be performed as directed by the OSC through the issuance of Daily Work Orders.

13.0 DEMOBILIZATION

Upon completion of the site work, all equipment, materials, and supplies will be demobilized from the site. Heavy and general equipment will be cleaned on-site prior to demobilization through the use of a pressure washer. Site security will be terminated at the discretion of the OSC.

14.0 EPA REGION 2 "CLEAN and GREEN" POLICY

The environmental benefits of the remedial design and remedial action should be increased by considering technologies and practices that are sustainable in accordance with EPA Region 2's "Clean and Green" energy policy, including consideration of green remediation technologies and practices.

Examples of applicable practices are those that reduce emissions of air pollutants, minimize fresh water consumption, incorporate native vegetation into re-vegetation plans, and consider beneficial reuse and/or recycling of materials.

The contractor shall implement green remediation practices into the site remedial action and construction activities whenever feasible in accordance with the EPA Region 2 "Clean & Green" Policy, issued on March 17, 2009 and updated on April 11, 2010. Green remediation strategies will be implemented to reduce direct and indirect greenhouse gas and other emissions, increase energy efficiency, conserve and efficiently manage resources and materials, reduce waste, and increase reuse of materials.

To the extent practicable, the green practices identified in Technical Specification Section 01670 of the RD will be followed, and the contractor will provide documentation and records supporting the green remediation practices implemented to EPA.

15.0 SCHEDULE

The implementation of excavation activities specified in this RAWP are anticipated to begin in June 2017. It is estimated that work on the site during the excavation phase will require 6 to 8 months from start to completion.

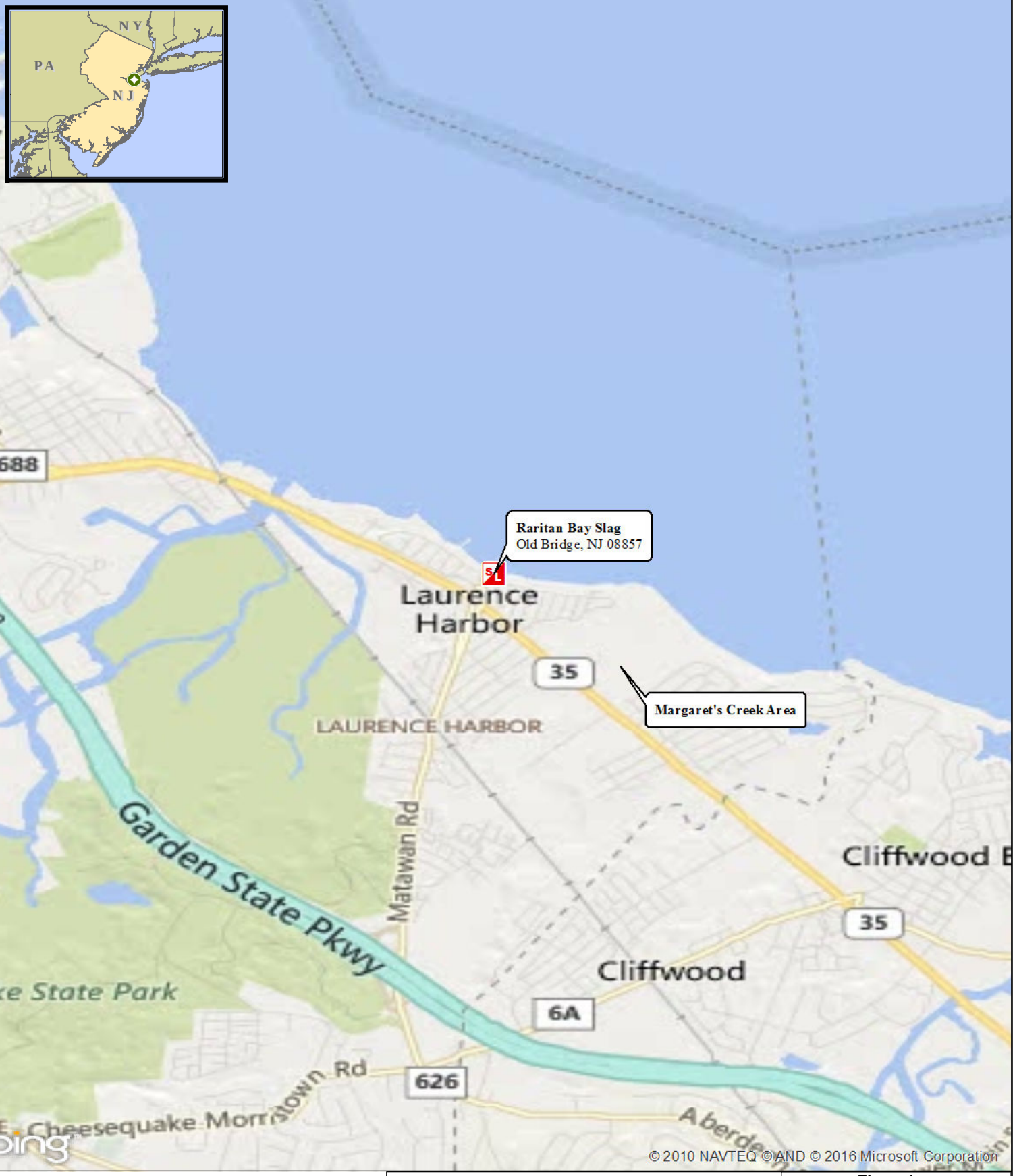
Projected work hours will generally be 40-45 hours per week, Monday through Friday. Daily hours will be within 7:00 am to 4:30 pm. Hours outside of this schedule may be necessary in limited cases such as scheduling of off-site disposal, equipment maintenance or repairs, backfilling, dewatering, and/or emergency situation, should it arise. Daily work hours will be determined on-site based on the activities being completed.

16.0 REPORTING

During the duration of the project implementation, a significant amount of project reporting and documentation will be required. The Contractor will be responsible for maintaining accurate and complete records during the performance of the remedial action. The following is a list of reports and documentation that will be coordinated:

- Submittals – All submittals including soil-testing reports, analytical data reports, and manufacturer information for specific products utilized, will be generated and submitted in compliance with their respective Technical Specifications. The contractor will provide copies of all submittals to EPA as part of the construction completion reporting.
- Transportation and Disposal Manifests – The Contractor will be responsible for the generation of a complete and accurate waste manifest package. This package will include at a minimum; hazardous and non-hazardous waste manifests, hazardous material shipping papers, waste profile sheets, and other information used to identify the proper waste code. Also provided will be original manifests signed by the disposal facilities for material transported off-site.
- Daily Logbook - A designated logbook will be used to document daily on-site activities. The daily logbook will be kept in the field office.
- RA Report Document Tracking – Site documents generated by field activities that will be tracked by the RPM in support of the Remedial Action Report (RAR). Weekly and monthly documentation will be required from the OSC and on-site Contractors in support of the preparation of the RAR.
- Sign-in / Out Log – A daily sign in / out log will be maintained in the field office trailer for all personnel working or present at the site.
- Survey – The certified survey records for post excavation, backfill, and final restoration contours will be maintained and provided and included in construction completion documentation. The survey records will be submitted in compliance with the Technical Specifications.

At the completion of all work under this RAWP, a Remedial Action Report will be prepared by EPA to document the remediation activities which were conducted at the site.



Legend

Site Location

N

0 0.175 0.35 0.7 1.05 1.4 Miles

Weston Solutions, Inc.
Federal East Division

In Association With
Scientific and Environmental Associates, Inc.,
Environmental Compliance Consultants, Inc.,
Avatar Environmental, LLC, On-Site Environmental,
Inc.and Sovereign Consulting, Inc

Figure 1:
Site Location Map

Raritan Bay Slag Site
Old Bridge, New Jersey

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

DATE MODIFIED: 10/6/2016

GIS ANALYST:	T. Benton
EPA OSC:	A. Confortini
RST SPM:	M. Mannino
FILENAME:	160829_SITELOCATIONMAP.MXD

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SCALE

1:1,140

LEGEND

- Fenceline
- Traffic Flow Pattern

Site Layout Features

- Truck Scale
- Decontamination Pad
- Soil Stockpile Area
- Soil Drying Area
- Water Storage Area
- Support Facilities Area

Notes:

1.) All traffic entering the Site will use Gate 1 and all traffic exiting the Site will use Gate 2.

2.) The Support Facilities Areas located at Gate 1 will consist of an officer trailer, break trailer, potable restrooms units, a generator, and a small gravel-covered parking area.

3.) The decontamination pad, soil stockpile area, and soil drying area will be constructed with of an impermeable 30 mil base liner and earthen berm or concrete barriers on three sides. Each area will be sloped to a sump pit where liquids will accumulate and pumped to an on-site holding tank.

Figure 2:
Site Layout Map

RARITAN BAY SLAG SITE
OLD BRIDGE, NEW JERSEY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

In Association With
Scientific and Environmental Associates, Inc.,
Environmental Compliance Consultants, Inc.,
Avatar Environmental, LLC, On-Site Environmental, Inc., and Sovereign Consulting, Inc.

GIS ANALYST:	T. BENTON
EPA OSC:	A. CONFORTINI
RST SPM:	M. MANNINO
PROJECT #:	00070008
FIGURE	2
REVISION	0
DATE MODIFIED	9/26/2016

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SB069
SB016
SB180
SB123
SB071
SB178
SB181
SB176
SB074
SB152
SB151
A-97
SB080
SB066
SB077
SB019
SB084
SB042
SB065
SB168
SB024
SB169
SB243
SB048
SB085
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LEGEND

- Fenceline
- Wetland Area
- Documented Slag Area
- Above 400 mg/kg

Proposed Scope of Work Area

- Proposed Excavation Area
- Proposed Secondary Excavation Area

0 37.5 75 150 225 300 Feet

Weston Solutions, Inc.
Federal East Division

In Association With
Scientific and Environmental Associates, Inc.,
Environmental Compliance Consultants, Inc.,
Avatar Environmental, LLC, On-Site Environmental,
Inc., and Sovereign Consulting, Inc.

DATE MODIFIED: 2/16/17

Figure 3:
Lead Exceedance and Excavation Areas

RARITAN BAY SLAG SITE
OLD BRIDGE, NEW JERSEY

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

DRAWN BY:	T. BENTON
EPA OSC:	A. CONFORTINI
RST SPM:	M. MANNINO
PROJECT #:	30400.031.007.3124

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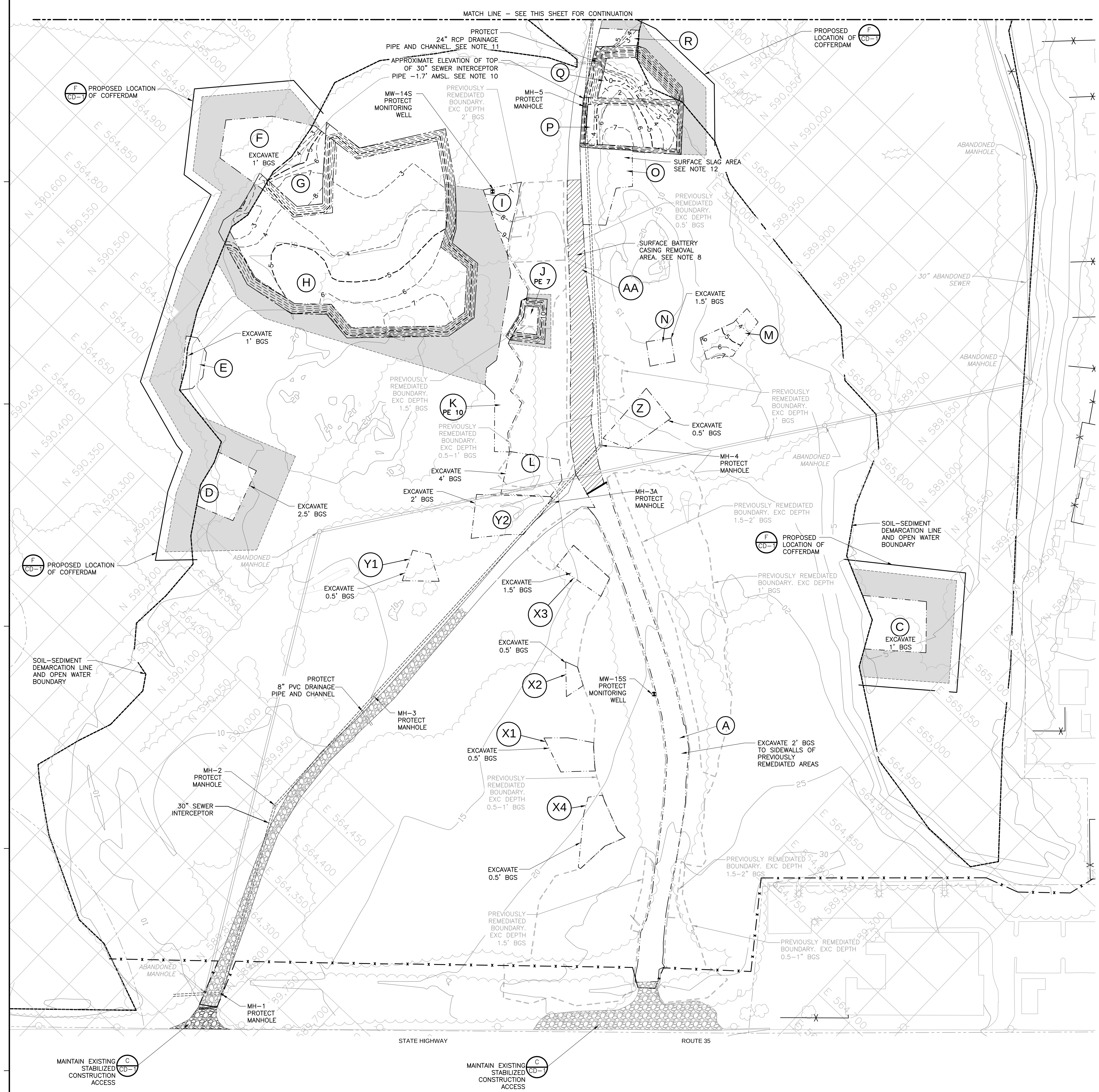
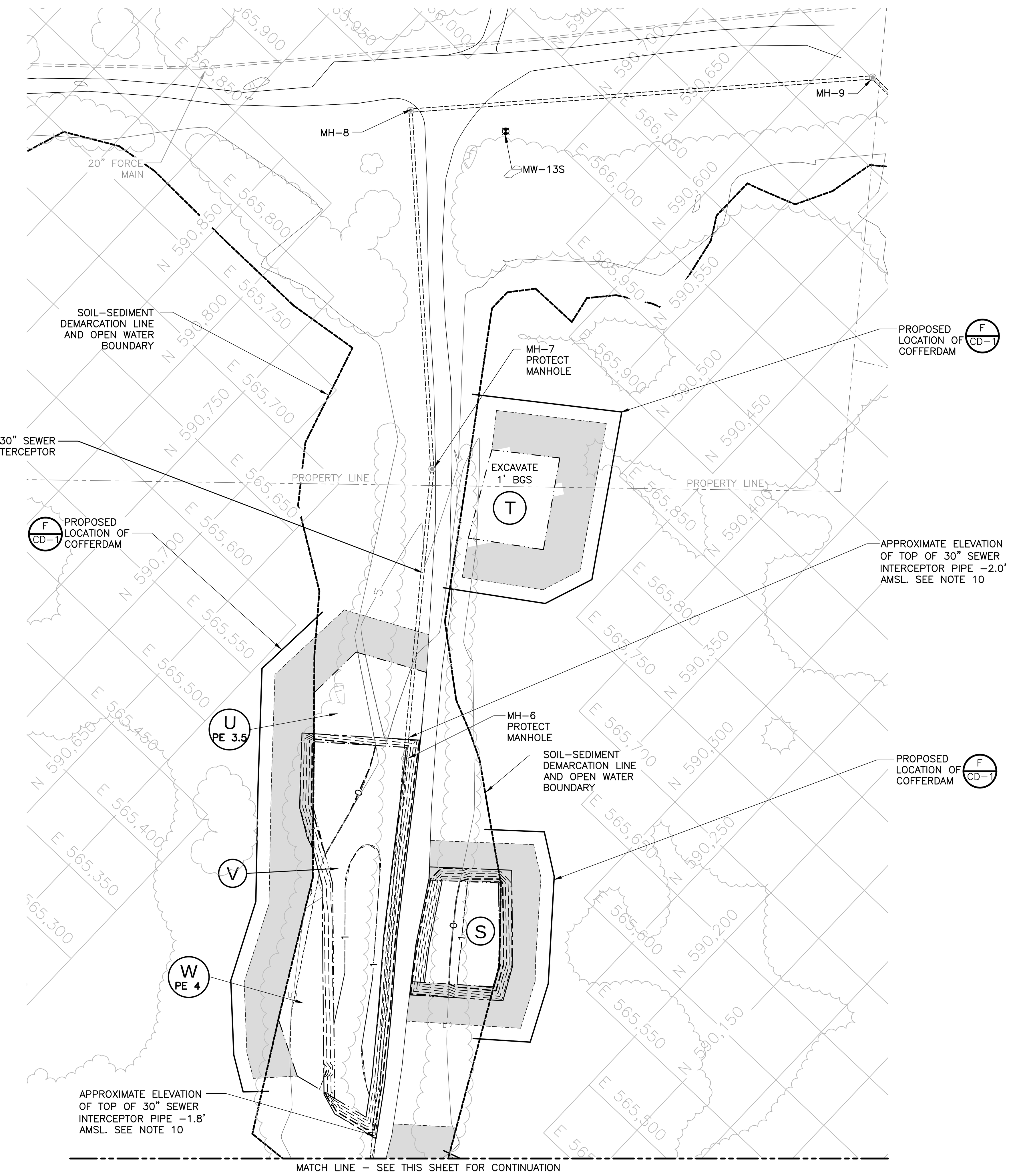




LEGEND

(line)	LIMITS OF PRIMARY EXCAVATION AREA
(line)	BOTTOM OF PRIMARY EXCAVATION AREA
(hatch)	SURFACE BATTERY CASING REMOVAL AREA
(shading)	SECONDARY EXCAVATION AREA
(line)	PREVIOUSLY REMEDIATED AREA
(A)	EXCAVATION AREA ID
6	PROPOSED FINAL EXCAVATION CONTOUR
PE 20	PROPOSED FINAL EXCAVATION ELEVATION

NOTES:

1. TOPOGRAPHIC SURVEY SHALL BE COMPLETED IN EXCAVATION AREAS PRIOR TO EXCAVATION.
2. TEMPORARY COFFERDAMS AND SURFACE WATER CONTROL MEASURES INCLUDING SILT FENCING SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 02140 AND DETAILS D AND F ON SHEET CD–1. HAYBALES MAY BE USED TO SUPPORT SILT FENCE WHEN INSTALLED ON SLOPES IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS AND DETAIL E ON SHEET CD–1. IN AREAS WHERE SILT FENCE WILL BE INSTALLED TO MEET COFFERDAMS, SILT FENCE SHALL BE INSTALLED 5 FEET INTO AND PARALLEL TO THE COFFERDAM. HAY BALES SHALL BE INSTALLED BETWEEN SILT FENCE AND COFFERDAM WHERE MEASURES OVERLAP.
3. THE CONTRACTOR SHALL IMPLEMENT APPROPRIATE DEWATERING MEASURES PRIOR TO EXCAVATION OF AREAS C, D, F, P, Q, R, S, T, U, V AND W IN ACCORDANCE WITH SECTION 02140 AND THE CONTRACTOR'S APPROVED PLAN.
4. THE CONTRACTOR SHALL PROTECT ALL MONITORING WELLS AND MCUA AND/OR OBMUA FEATURES WITHIN OR ADJACENT TO EXCAVATION AREAS OR ACCESS ROADS FROM DAMAGE DURING EXCAVATION AND BACKFILL OPERATIONS.
5. SURFACE WATER SHALL BE DIRECTED AWAY FROM THE EXCAVATION AND CONSTRUCTION AREAS TO PREVENT EROSION, TO PREVENT SURFACE WATER RUNOFF FROM BECOMING CONTAMINATED BY ACCUMULATING IN EXCAVATIONS, AND TO PREVENT ADDITIONAL PUMPING REQUIRED TO REMOVE THE WATER FROM THE EXCAVATIONS.
6. THE CONTRACTOR SHALL DIVERT ANY EXISTING DRAINAGE CHANNELS ENCOUNTERED WITHIN EXCAVATION AREAS AWAY FROM EXCAVATION, PROVIDE FOR POSITIVE DRAINAGE AWAY FROM THE EXCAVATION AREA, AND ELIMINATE PONDING AREAS.
7. THE CONTRACTOR SHALL PERFORM REMEDIAL EXCAVATION TO THE ELEVATIONS/DEPTHS SHOWN ON THIS SHEET IN ACCORDANCE WITH SECTION 02111. THE CONTRACTOR SHALL FOLLOW THE RECOMMENDED CONSTRUCTION SEQUENCE SHOWN ON SHEET C–1 OR AS APPROVED BY THE EPA'S REPRESENTATIVE.
8. WITHIN AREA AA, THE CONTRACTOR SHALL SCRAPE THE TOP 4 INCHES OF ROAD SURFACE MATERIAL TO REMOVE BATTERY CASINGS. IF NECESSARY, ADDITIONAL SCRAPING SHALL BE PERFORMED TO REMOVE ANY VISIBLE BATTERY CASINGS.
9. WATER FROM DECONTAMINATION, DEWATERING, STORMWATER RUNOFF THAT CONTACTS CONTAMINATED MATERIAL, AND OTHER WASTEWATER GENERATED ON SITE SHALL BE COLLECTED, TREATED AT THE ONSITE WATER TREATMENT SYSTEM, AND DISCHARGED TO THE POTW OR TO SURFACE WATER.
10. THE CONTRACTOR SHALL PROTECT THE 30–INCH OBMUA SEWER INTERCEPTOR PIPE. IN EXCAVATION AREAS Q AND V, THE TOP OF SEWER PIPE IS LOCATED WITHIN 4 FEET OF THE BOTTOM OF EXCAVATIONS. THE CONTRACTOR SHALL FIELD VERIFY PIPE LOCATION IN THESE AREAS AND TAKE PRECAUTIONS TO PROTECT THE PIPE.
11. THE CONTRACTOR SHALL PROTECT THE 24–INCH RCP DRAINAGE PIPE WHICH DAYLIGHTS WITHIN THE PROPOSED EXCAVATION SLOPE OF AREA Q. STORMWATER SHALL BE TEMPORARILY DIVERTED DURING EXCAVATION OF AREA Q.
12. REMOVE SURFACE SLAG BASED ON VISUAL OBSERVATION. POST–EXCAVATION SAMPLES SHALL BE COLLECTED UNDERNEATH SLAG AFTER ALL SLAG HAS BEEN REMOVED. BASED ON POST–EXCAVATION SAMPLING RESULTS, ADDITIONAL EXCAVATION SHALL BE PERFORMED AS NECESSARY IN ACCORDANCE WITH SECTION 02111.
13. THE CONTRACTOR SHALL CONTINUALLY INSPECT, EVALUATE, AND MAINTAIN THE EXCAVATION SLOPE TO PREVENT CRACKS, BULGES, SLOUGHS, OR FAILURES. A MINIMUM EXCAVATION SLOPE RATIO OF 2H:1V SHALL BE MAINTAINED AS INDICATED ON THIS SHEET.
14. TO THE EXTENT POSSIBLE, THE CONTRACTOR SHALL PERFORM DIRECT LOADING OF EXCAVATED MATERIAL FOR OFF–SITE TRANSPORTATION AND DISPOSAL FROM ALL AREAS EXCEPT SEDIMENT AREAS AND ADDITIONAL AREAS WHERE DEWATERING/DRYING IS REQUIRED BASED ON FIELD CONDITIONS. BASED ON AVAILABLE DATA, SLAG AND BATTERY CASINGS SHALL BE CLASSIFIED AS RCRA HAZARDOUS WASTE AND SHALL BE SEGREGATED FROM SOIL/SEDIMENT TO THE EXTENT POSSIBLE TO THE DEPTHS INDICATED ON SHEET C–6 AND SENT TO AN APPROVED RCRA HAZARDOUS PERMITTED LANDFILL FOR TREATMENT AND DISPOSAL. CONTAMINATED SOIL AND DRIED SEDIMENT SHALL BE STOCKPILED AND SAMPLED FOR WASTE CHARACTERIZATION. BASED ON THE WASTE CHARACTERIZATION RESULTS, CONTAMINATED SOIL AND SEDIMENT SHALL BE SENT TO AN APPROVED SUBTITLE D LANDFILL FOR DISPOSAL OR RCRA HAZARDOUS PERMITTED LANDFILL FOR TREATMENT AND DISPOSAL. ALL WASTE CHARACTERIZATION SAMPLING SHALL BE PERFORMED IN ACCORDANCE WITH SECTION 01450 AND CONTRACTOR'S APPROVED PLANS.
15. FOLLOWING PRIMARY EXCAVATION, THE CONTRACTOR SHALL VISUALLY INSPECT EXCAVATION SIDEWALLS AND BOTTOM FOR SLAG AND/OR BATTERY CASINGS. IF NO SLAG OR BATTERY CASINGS ARE FOUND, PERFORM POST–EXCAVATION SAMPLE AS INDICATED ON SHEET C–7. THE CONTRACTOR SHALL PERFORM SECONDARY EXCAVATION OF CONTAMINATED MATERIALS AS DIRECTED BY THE EPA'S REPRESENTATIVE IN ACCORDANCE WITH SECTION 02111.
16. BACKFILL OPERATIONS SHALL TAKE PLACE SIMULTANEOUSLY WITH EXCAVATION ACTIVITIES TO LIMIT THE OPEN EXCAVATION AREAS.
17. THE OBMUA FIRE ACCESS ROAD SHALL BE USED AS THE PRIMARY HAUL ROAD.
18. THE CONTRACTOR SHALL PROPOSE AND IMPLEMENT MEANS TO PROVIDE UNINTERRUPTED EMERGENCY ACCESS FROM RT 35 TO THE BEACH DURING EXCAVATION OF AREAS A AND AA WHICH SHALL BE REVIEWED AND ACCEPTED BY OBMUA AND LOCAL EMERGENCY RESPONSE AGENCIES DURING PREPARATION OF THE CONTRACTOR'S EMERGENCY RESPONSE PLAN.
19. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADDING AND/OR SUBTRACTING SOIL EROSION AND SEDIMENTATION CONTROL MEASURES BASED ON OBSERVED FIELD CONDITIONS IN ACCORDANCE WITH SECTION 02370.

1" = 50'

Figure 4

THOMAS MATHEW
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE NO. 24GE04398400

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: A. BOURGEOIS
DRAWN BY: G. RODRIGUEZ
SHEET CHK'D BY: M. CHOKSHI
CROSS CHK'D BY: M. RAHMANI
SUBMITTED BY: T. MATHEW
DATE: JANUARY 2017

CDM Federal Programs Corporation

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 2

RARITAN BAY SLAG SUPERFUND SITE–MARGARET'S CREEK SECTOR
OLD BRIDGE TOWNSHIP, NEW JERSEY

EXCAVATION PLAN

PROJECT NO. 3323–062
FILE NAME: C005STPL.DWG
SHEET NO.
C-5

FINAL DESIGN SUBMITTAL

DRAWING INDEX

GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE HEALTH AND SAFETY AT THE SITE. THE CONTRACTOR SHALL CONTROL ACCESS INTO THE SITE AT ALL TIMES DURING REMEDIAL ACTION. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ALL NECESSARY WARNING AND SAFETY DEVICES TO PROTECT THE PUBLIC SAFETY AND HEALTH UNTIL THE REMEDIAL ACTION IS COMPLETE.
2. THE CONTRACTOR SHALL OBTAIN AND COMPLY WITH ALL FEDERAL, STATE, AND LOCAL PERMITS AND APPROVALS REQUIRED FOR REMEDIAL CONSTRUCTION ACTIVITIES UNLESS OTHERWISE NOTED IN THE CONTRACT DOCUMENTS. EPA WILL OBTAIN THE NJDEP DLUR PERMIT EQUIVALENCY, SOIL EROSION AND SEDIMENT CONTROL PLAN CERTIFICATION, AND THE NJPDES DSW PERMIT IF DISCHARGE OF WATER WILL BE TO SURFACE WATER.
3. AFTER AWARD OF CONTRACT, ELECTRONIC SITE SURVEY FILES WILL BE MADE AVAILABLE TO THE CONTRACTOR FOR USE IN LAYING OUT THE WORK AREA.
4. THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE. THERE MAY BE UNDERGROUND UTILITIES WHICH EXIST AND ARE UNKNOWN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING ALL UTILITY COMPANIES AND IF NECESSARY, PERFORM GEOPHYSICAL SURVEY TO FIELD VERIFY THE LOCATION OF UTILITIES.
5. THE CONTRACTOR SHALL ERECT AND MAINTAIN THROUGHOUT CONSTRUCTION ALL TEMPORARY SOIL EROSION AND SEDIMENT CONTROL BARRIERS IN ACCORDANCE WITH SECTION 02370 AND THE SOIL EROSION AND SEDIMENT CONTROL PLAN CERTIFIED BY THE FREEHOLD SOIL CONSERVATION DISTRICT OR AS DIRECTED BY THE EPA'S REPRESENTATIVE.
6. THE CONTRACTOR SHALL MAINTAIN THE FLOW OF ALL STREAMS, DRAINAGE DITCHES, STORM SEWERS, AND SANITARY SEWERS AT ALL TIMES BY A MEANS ACCEPTABLE TO THE EPA'S REPRESENTATIVE.

GENERAL SEQUENCE OF CONSTRUCTION

PRE–REMEDIAL ACTION MOBILIZATION

1. CONDUCT UTILITY MARKOUTS AND CLEARANCES AS NEEDED FOR PRE–EXCAVATION SAMPLES.
2. COLLECT PRE–EXCAVATION SAMPLES IN ACCORDANCE WITH SECTION 02100 AND ANALYZE IN ACCORDANCE WITH SECTION 01450. PERFORM CLEARING AS REQUIRED TO ACCESS PRE–EXCAVATION SAMPLE LOCATIONS.
3. TREAT AREAS WHERE PHRAGMITES ARE PRESENT WITH HERBICIDE, AS SPECIFIED IN SECTION 02100. NOTE THAT TREATMENT WILL BE REQUIRED IN ADVANCE OF EXCAVATION.
4. PERFORM TOPOGRAPHIC SURVEY.

SITE PREPARATION

1. OBTAIN ALL APPLICABLE PERMITS AND APPROVALS REQUIRED FOR THE REMEDIAL CONSTRUCTION ACTIVITIES.
2. CONDUCT UTILITY MARKOUTS AND CLEARANCES.
3. PERFORM SITE PREPARATION ACTIVITIES INCLUDING CLEARING WITHIN LIMITS. PERFORM GRUBBING INCIDENTAL TO EXCAVATION.
4. ESTABLISH TEMPORARY FACILITIES.
5. ERECT SOIL AND SEDIMENT CONTROL BARRIERS IN ACCORDANCE WITH SECTION 02370 AND THE SOIL EROSION AND SEDIMENT CONTROL PLAN CERTIFIED BY THE FREEHOLD SOIL CONSERVATION DISTRICT.
6. CONSTRUCT SEDIMENT CONTAINMENT AREA AND SOIL STOCKPILE/LOADOUT AREAS INCLUDING SUMPS. CONSTRUCT TEMPORARY DECONTAMINATION SYSTEM IF NECESSARY IN ACCORDANCE WITH CONTRACTOR'S APPROVED PLAN.
7. CONSTRUCT TEMPORARY WATER TREATMENT SYSTEM AND CONTAINMENT AREA.

EXCAVATION

1. STAGE 1
   A. EXCAVATE A PORTION OF AREA A (OBMUA FIRE ACCESS ROAD) AS SHOWN ON SHEET C–4 TO PREPARE THIS AREA FOR INSTALLATION OF THE DECONTAMINATION FACILITY. STOCKPILE EXCAVATED MATERIAL. CONSTRUCT THE DECONTAMINATION FACILITY AS SHOWN ON SHEET C–4 AND CD–2 AND IN ACCORDANCE WITH CONTRACTOR'S APPROVED PLAN.
2. STAGE 2
   A. IMPLEMENT DEWATERING MEASURES AND TEMPORARY COFFERDAMS FOR SEDIMENT EXCAVATION AREAS. EXCAVATE SEDIMENT AREAS C, F, AND T. CONTAIN SEDIMENT WITHIN THE SEDIMENT CONTAINMENT AREA AND TILL AS NECESSARY TO FACILITATE DRYING.
   B. COLLECT AND TREAT WATER USING THE TEMPORARY WATER TREATMENT SYSTEM AND DISCHARGE TO THE MCUA POTW OR TO SURFACE WATER IN ACCORDANCE WITH THE APPLICABLE APPROVED PERMIT OR PERMIT EQUIVALENCY.
   C. LOAD DRIED SEDIMENTS FROM CONTAINMENT AREA AND DISPOSE OF OFF SITE IN ACCORDANCE WITH SECTION 02120 AND THE CONTRACTOR'S APPROVED PLAN.
3. STAGE 3
   A. EXCAVATE REMAINING AREAS TO LIMITS SHOWN ON SHEET C–5. PROCEED WITH EXCAVATION GENERALLY FROM NORTH TO SOUTH OR IN ACCORDANCE WITH CONTRACTOR'S APPROVED PLAN. IMPLEMENT DEWATERING MEASURES AS NECESSARY.
   B. TO THE EXTENT POSSIBLE, SEGREGATE LARGE PIECES OF SLAG AND BATTERY CASINGS FROM SOIL/SEDIMENT.
   C. LOAD EXCAVATED MATERIAL FROM CONTAINMENT/STOCKPILE AREAS AND DISPOSE OF OFF SITE IN ACCORDANCE WITH SECTION 02120 AND CONTRACTOR'S APPROVED PLAN. DIRECT LOAD SOIL FROM EXCAVATIONS WHERE POSSIBLE.
   D. FOR EACH EXCAVATION AREA, INSPECT EXCAVATION BOTTOMS AND SIDEWALLS FOR CONTAMINATION USING VISUAL OBSERVATIONS. PERFORM POST–EXCAVATION SAMPLING AS SHOWN ON SHEET C–7 AND IN ACCORDANCE WITH SECTION 02111 AND ANY REQUIRED SECONDARY EXCAVATION AS DIRECTED BY THE EPA'S REPRESENTATIVE, PRIOR TO BACKFILL.

SITE RESTORATION

1. UPON RECEIVING CONFIRMATORY RESULTS AND EPA'S REPRESENTATIVE APPROVAL, PERFORM BACKFILLING AND COMPACTION OF CLEAN FILL TO THE RESTORATION GRADES AS SHOWN ON SHEETS C–8A AND C–8B CONCURRENT TO EXCAVATION ACTIVITIES TO MINIMIZE OPEN EXCAVATION AREA.
2. AFTER THE COMPLETION OF ALL EXCAVATION WORK, RESTORE THE SITE TO THE FINISHED SUBGRADES AS SHOWN ON SHEETS C–8A AND C–8B AND IN ACCORDANCE WITH SECTIONS 02201 AND 02900. RESTORE THE OBMUA FIRE ACCESS ROAD. RESTORE WETLAND AREAS IN ACCORDANCE WITH SECTION 02955 AND 02957.
3. DEMOBILIZE THE TEMPORARY WATER TREATMENT AND DISCHARGE SYSTEM.
4. REMOVE SEDIMENT CONTAINMENT AREA, STOCKPILE/LOADOUT AREA, AND DECONTAMINATION FACILITY.
5. RECONSTRUCT DRAINAGE CHANNELS DISTURBED BY REMEDIAL CONSTRUCTION AND REMOVE ANY TEMPORARY DIVERSION STRUCTURES. REMOVE ALL SOIL EROSION AND SEDIMENT CONTROL DEVICES.
6. DEMOBILIZE TEMPORARY FACILITIES.

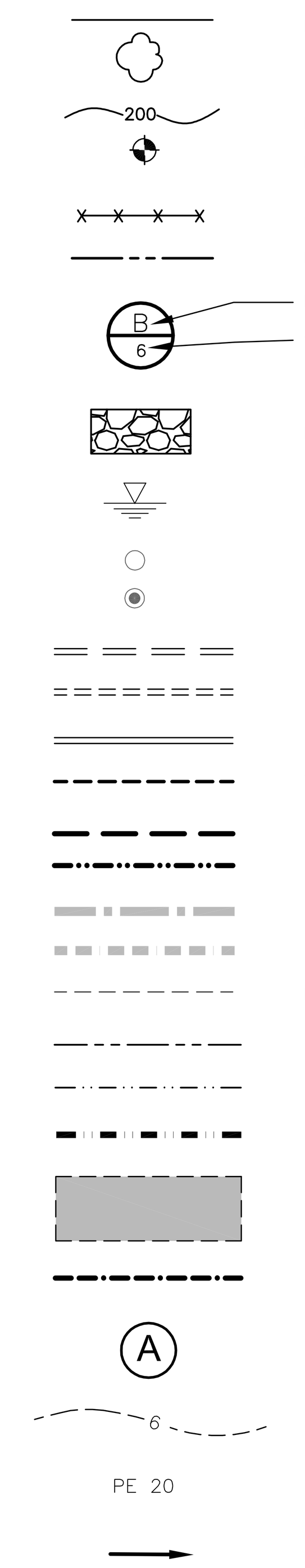
ACRONYMS

ACRONYMS

- AMSL – ABOVE MEAN SEA LEVEL
- ASTM – AMERICAN SOCIETY OF TESTING MATERIALS
- BGS – BELOW GROUND SURFACE
- DGA – DENSE GRADED AGGREGATE
- DIA – DIAMETER
- DLUR – DIVISION OF LAND USE REGULATION
- DSW – DISCHARGE TO SURFACE WATER
- EL – ELEVATION
- EPA – ENVIRONMENTAL PROTECTION AGENCY
- EX – EXISTING
- EXC – EXCAVATION
- FAC – FACULTATIVE
- FACW – FACULTATIVE–WETLAND
- FHA – FLOOD HAZARD AREA
- FT/FT – FOOT/FEET
- ID – IDENTIFICATION
- IN – INCH
- INV – INVERT
- MCUA – MIDDLESEX COUNTY UTILITIES AUTHORITY
- MIN – MINIMUM
- MH – MANHOLE
- MW – MONITORING WELL
- NAD – NORTH AMERICAN DATUM
- NAVD – NORTH AMERICAN VERTICAL DATUM
- NB – NORTH BOUND
- NJ – NEW JERSEY
- NJDEP – NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
- NJPDES – NEW JERSEY POLLUTANT DISCHARGE ELIMINATION SYSTEM
- NO – NUMBER
- NTS – NOT TO SCALE
- OBL – OBLIGATE
- OBMUA – OLD BRIDGE MUNICIPAL UTILITIES AUTHORITY
- OC – ON CENTER
- P – PRIMARY EXCAVATION SAMPLE
- PE – PRIMARY ELEVATION (ABOVE MEAN SEA LEVEL)
- POTW – PUBLICLY OWNED TREATMENT WORKS
- PVC – POLYVINYL CHLORIDE
- RCP – REINFORCED CONCRETE PIPE
- REV – REVISION
- S – SECONDARY EXCAVATION SAMPLE
- SB – SOUTH BOUND
- SF – SQUARE FEET
- SW – SURFACE WATER

LEGEND

NOTE:
EXISTING SITE CONDITIONS ARE SHOWN IN GREY. ALL PROPOSED WORK IS SHOWN IN BLACK



- EXISTING PAVED AREA/ROADWAY
- TREE
- ELEVATION CONTOUR
- EXISTING MONITORING WELL
- CHAIN LINK FENCE
- PROPERTY LINE
- DETAIL DESIGNATION
- SHEET DESIGNATION
- DENSE GRADED AGGREGATE
- WATER LEVEL
- ABANDONED OBMUA MANHOLE
- ACTIVE OBMUA MANHOLE
- ACTIVE MCUA FORCEMAIN
- ACTIVE OBMUA SANITARY SEWER PIPE
- ABANDONED OBMUA SEWER PIPE
- SOIL–SEDIMENT DEMARCATION LINE AND OPEN WATER BOUNDARY
- WETLAND BOUNDARY
- 50–FOOT WETLAND TRANSITION BOUNDARY
- FLOOD HAZARD ZONE VE BOUNDARY
- FLOOD HAZARD ZONE AE BOUNDARY
- DRAINAGE PIPE
- LIMITS OF PRIMARY EXCAVATION AREA
- BOTTOM OF PRIMARY EXCAVATION AREA
- CLEARING AND GRUBBING LIMITS
- SECONDARY EXCAVATION AREA
- PREVIOUSLY REMEDIATED AREA
- EXCAVATION AREA ID
- PROPOSED FINAL EXCAVATION CONTOUR
- PROPOSED FINAL EXCAVATION ELEVATION
- HAUL ROUTE DIRECTION

UTILITY COMPANIES AND OTHER CONTACTS

DESCRIPTION	CONTACT
OLD BRIDGE MUNICIPAL UTILITIES AUTHORITY	71 BOULEVARD WEST CLIFFWOOD BEACH, NJ 07735 SEWER DIVISION – 732–566–5557
MIDDLESEX COUNTY UTILITIES AUTHORITY	2571 MAIN STREET EXTENSION P.O. BOX 159 SAYREVILLE, NJ 08872 732–721–3800 ENVIRONMENTAL QUALITY ADMINISTRATOR – KEVIN AIELLO, EXT 230

Figure 5

THOMAS MATHEW
PROFESSIONAL ENGINEER
NEW JERSEY LICENSE NO. 24GE04398400

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: A. BOURGEOIS
DRAWN BY: G. RODRIGUEZ
SHEET CHK'D BY: M.CHOKSHI
CROSS CHK'D BY: M. RAHMANI
SUBMITTED BY: T. MATHEW
DATE: JANUARY 2017

CDM Federal Programs Corporation

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 2

RARITAN BAY SLAG SUPERFUND SITE–MARGARET'S CREEK SECTOR
OLD BRIDGE TOWNSHIP, NEW JERSEY

DRAWING INDEX, LEGEND, AND GENERAL NOTES

PROJECT NO. 3323–062
FILE NAME: C001ABLG

SHEET NO.
C-1

FINAL DESIGN SUBMITTAL

SITE HEALTH AND SAFETY PLAN

EMERGENCY AND RAPID RESPONSE SERVICES
Raritan Bay Site

Prepared for

U.S. Environmental Protection Agency - Region 2
2890 Woodbridge Avenue
Edison, NJ 08837-3679

Contract No.: EP-S2-15-02
Task Order: 0047
Project No: RB2-47

December 2016

Environmental Restoration LLC
1666 Fabick Drive
Fenton, MO 63026

SITE HEALTH AND SAFETY PLAN

EMERGENCY AND RAPID RESPONSE SERVICES
Raritan Bay Site

I hereby certify that the enclosed Site Health and Safety Plan, shown and marked in this submittal, has been prepared in accordance with OSHA 29 CFR 1910 and is proposed to be incorporated with Contract No.: **EP-S2-15-02**- Task Order 0047. This Site Health and Safety Plan is submitted for Government approval.

Plan Review:

		804-852-4584
Carl Duffey Site Health and Safety Officer	Date	Phone Number

Plan Preparer:

	12/8/2016	708-333-9915
Nick Michailides Manager, Health and Safety	Date	Phone Number

Acceptance as Submittal:

		908-420-4455
Andrew Confortini OSC, USEPA Region 2	Date	Phone Number

Table of Contents

Table of Contents (Continued)

Attachments

LIST OF ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
COC	contaminant of concern
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
dBA	decibel A-weighted
DEET	N, N-diethyl-m-toluamide
EMT	emergency medical technician
ERRS	Emergency and Rapid Response Services
EZ	Exclusion Zone
HASP	Site Health and Safety Plan
HAZWOPER	Hazardous Waste Operation and Emergency Response
HIPO	high loss potential
HMIS	Hazardous Materials Identification System
HSO	Site Health and Safety Officer
HTRW	hazardous, toxic and radioactive waste
IDLH	immediately dangerous to life and health
kV	kilovolt
MCL	Maximum Contaminant Level
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
mg/m^3	Milligrams per cubic meter
NFPA	National Fire Prevention Association
NIOSH	National Institute of Occupational, Safety and Health
NPL	National Priorities List
NRC	National Response Center
O&M	Operations and Maintenance
OSC	On Scene Coordinator
OSHA	Occupational Safety and Health Administration
PM	Project Manager
RM	Response Manager
PEL	Permissible Exposure Limit
POL	petroleum, oils, and lubricants
PPE	personal protective equipment
PPM	parts per million
RIR	recordable incident rate
SCBA	self-contained breathing apparatus
SDS	Safety Data Sheets
SOP	Standard Operating Procedure
SOW	Scope of Work
USEPA	United States Environmental Protection Agency
WNV	West Nile Virus

1.0 Introduction and Site Entry Requirements

This document describes the health and safety guidelines developed for the Raritan Bay Slag Response project, to protect on-site personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes. The procedures and guidelines contained herein were based upon the best available information at the time of the plan's preparation. Specific requirements will be revised when new information is received or conditions change. A written amendment will document all changes made to the plan. Any amendments to this plan will be included in Attachment A. Where appropriate, specific OSHA standards or other guidance will be cited and applied.

All work practices and procedures implemented on site must be designated to minimize worker contact with hazardous materials and to reduce the possibility of physical injury. All work will be performed in accordance with applicable Federal 29 CFR 1910 and 1926 health and safety regulations, specifically 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response.

1.1 Daily Safety Meetings

Daily safety meetings will be held at the start of each shift. They are used to communicate daily activities, site conditions, hazards, and control measures, as well as to solicit input from site workers on safety concerns and improvements. The meetings may also be used to present safety training topics and refresher items. A Daily Toolbox Safety Meeting Record shall document items discussed and be signed by all personnel in attendance

1.2 Site Specific Training and Acknowledgement

The Response Manager shall be responsible for informing all individuals assigned to this project of the contents of this plan and ensuring that each person signs the Site Specific Training Record in Attachment Z. By signing the Site Specific Training Record, individuals are acknowledging receipt of this training and that they recognize the potential hazards present on-site and the policies and procedures required to reduce the risk of exposure or adverse effects associated with these hazards.

1.3 Key Personnel

Key Personnel	
Names and Titles	**Contact Information**
USEPA OSC Region 2	Andrew Confortini (Mobile) 908-420-4455
Carl Duffey – ER Response Manager	804-852-4584 (Mobile) Email: c.duffey@erllc.com
Carl Duffey – ER HSO	804-852-4584 (Mobile) Email: c.duffey@erllc.com
Nick Michailides – ER Project HS Manager	708-333-9915 (Office) 314-749-2290 (Mobile) n.michailides@erllc.com
Subcontractors	
Company	**Scope of Services**
NA	NA

2.0 Roles and Responsibilities

2.1 Response Manager (RM): Carl Duffey

The Response Manager, as the field representative for ER and its subcontractors, has the responsibility for fulfilling the terms of the contract. The PM must oversee the project and ensure that all technical, regulatory and safety requirements are met. The Response Manager is the on-site Health and Safety Officer (HSO) when the HSO is not on site. The Response Manager is responsible for the duties listed in Section 2.2.

2.2 Site Health and Safety Officer (HSO): Carl Duffey

The ER Site Health and Safety Officer will be assigned to the site on a full-time basis with functional responsibility for implementing the Site Health and Safety Plan as ER applies to ER personnel.

Specific Duties Include:

a. Assist PM in providing a safe and healthful work environment.
b. Supervise confined space entries (i.e. perform as PRCS supervisor), if needed.
c. Assist PM in reporting and investigating all incidents.
d. Ensure proper decontamination of personnel and equipment is accomplished.
e. Ensure that air monitoring equipment is calibrated and operational.
f. Conduct personal air monitoring as required.
g. Perform respirator fit tests, as necessary.
h. Inventory and inspect PPE prior to personnel entries into exclusion zone.
i. Prepare summary letter of personal air sampling results.
j. Ensure proper personal protective equipment is being utilized.
k. Assist PM in obtaining required personnel training and medical records.
l. Inspect first aid kits and fire extinguishers.

2.3 Project Health and Safety Manager (PHSM): Nick Michailides

The Project Health and Safety Manager provides support and leadership to the project to protect the health and safety of the employees and the public. This includes, but is not limited to, communicating on safety and health issues, providing training, establishing special hazard control programs, assisting or conducting incident investigations, making inspections and surveys, evaluating or developing new protective measures, accumulating and distributing incident statistics, and identifying requirements of safety and health laws and regulations.

2.4 Other:

Any persons who observe a health and safety hazard should immediately report observations/concerns to appropriate key personnel listed in Section 2.1 or 2.2 above. All employees have the authority and obligation to stop any task or operation where concerns or questions regarding the control of Health, Safety, or Environmental concerns exist.

2.5 U.S. EPA On-Scene Coordinator (OSC): Andrew Confortini
The OSC has overall project authority and directs the project manager regarding the tasks required to meet project objectives. The OSC has the authority to stop work and initiate corrective actions should there be a reason to do so.

3.0 Site Background and Scope of Work

3.1 Site Background

The Raritan Bay Slag (RBS) Site is a USEPA project which was added to the National Priorities List in 2009. The hazards associated with the project are related to the presence of lead within fill materials

Excessive rain and wind from Hurricane Sandy caused major flooding and erosion in numerous areas throughout New Jersey and New York, including at the RBS Site. Since Hurricane Sandy, numerous investigations have been completed within the Margaret's Creek portion of the Site. As a result, lead-containing crushed battery casing material and slag/kettle bottoms were identified within many areas of the property. In the spring 2015, mitigation activities commenced and involved the recovery of surface battery casings and the excavation and disposal of lead-contaminated casings and soil.

The purpose of this task order is to excavate and dispose of lead containing slag/kettle bottoms and soil from locations previously identified at the Site.

3.2 Scope of Work

The entire work outlined below will be conducted within the Margaret's Creek area. The slag/kettle bottoms are located within localized portions of the Site and have been determined to contain elevated concentrations of lead which is releasing into the environment and presenting a threat. The Site encompasses approximately 44 acres in a mixed upland/lowland/wetland area. Approximately 800' of site roadway may need to be stabilized. Kettle bottoms/slag are present in an area approximately 6.5 acres in size to a depth of approximately 4' below the surface. Soil mixed with battery chips is within an area approximately 2.5 acre in size to a depth of approximately 1 foot. Dewatering maybe necessary in wetland areas.

The anticipated period of performance for the Margaret's Creek work is January – May 2017. Site work hours are 7:00am to 4:30pm Monday to Friday. Actual work hours may be modified as hours of daylight changes.

The following is an outline of the general activities which will be required under this Task Order.
The contractor shall provide all necessary personnel, equipment, and materials to perform the scope of work set forth below. Additional technical direction will be provided by the EPA On-Scene Coordinator (OSC) through work orders. The contractor shall coordinate all subcontract consent review packages with the OSC. The contractor shall conduct all operations in accordance with applicable local, state, and federal regulations.

ER has been tasked by the EPA to perform the following:

1. Provide project support facilities including: office trailer, equipment/break trailer, portable toilets, trash disposal, project signage, electricity and internet.
2. Develop a Site health and safety plan.
3. Provide unarmed security services during non-working hours.
4. Identify specialized equipment and submit provisional rates for said equipment in accordance with contract.
5. Excavate contaminated soils & stockpile for transportation and disposal (T & D).
6. Provide T&D off Site for the following waste: approximately 13,000 tons of hazardous kettle bottoms/slag – 2.5 feet minus, and 2,000 tons of hazardous soil mixed with battery casing chips. Disposal facilities must be in compliance with the off-site rule 40 CFR 300.440.
7. Provide a source of water for dust control.
8. Prepare a plan for dewatering ponded water and for the disposal/treatment of removed water.
9. Provide approximately 15,000 tons of certified clean fill that meets NJDEP standards.
10. Provide replacement vegetation for upland, lowland and wetland areas
11. Conduct backfill and restoration activities to pre-excavation elevations
12. Decontamination of equipment.

12. Demobilize personnel and equipment.

4.0 Hazard Assessment

This section is to be addressed in the daily tool box safety meeting as each task is to be initiated. Each Task-Specific Safety Assessment is designed to develop awareness to chemical and physical hazards specific to each task. It would be impractical to repeat in complete detail each control measure and SOP for each job task. Sources, Hazards and Control Measures will be addressed for each job task.

Specific work tasks with unique hazards and/or PPE requirements must be evaluated or reevaluated prior to beginning work. This task review will be led by the Program/Project Health and Safety Manager and the HSO, and will include knowledgeable individuals such as the worker(s) and the supervisor. PPE requirements, based on this assessment, will be included in Section 6 of the HASP or in the AHA for the specific task. All workers must be trained in the requirements of the HASP and the applicable AHAs prior to beginning work. The required PPE may be changed by the HSO, based on the results of additional air monitoring, or on task-specific needs. Downgrades will require the approval of the Project Health and Safety Manager unless otherwise permissible by the HASP.

The following section outlines the AHAs, Referenced Standard Operations Procedures (SOPs) and Chemical Hazards associated with this project. Applicable SOPs are available from ER's Health and Safety Database. AHAs will be developed for each of the SOW activities listed in Section 3.2 and submitted prior to the start of field work.

The AHAs should be revised for site-specific activities and review with the work crew before commencing any activity.

The following table lists ER health and safety SOPs that are applicable to this project.

Referenced SOPs:	
ER SOPs applicable to this project or task order:	
HS-01 Air Monitoring and Sampling HS-02 Blood Borne Pathogens Exposure Control Plan HS-05 Cold Stress HS-08 Decontamination Measures HS-10 Motor Vehicle Operation HS-13 Excavation and Trenching Operations HS-15 Hazard Communication Program HS-16 Hearing Conservation HS-17 Heat Stress HS-18 Heavy Equipment Operation	HS-24 Personal Protective Equipment HS-26 Respiratory Protection HS-30 Traffic Control Safety HS-36 Proper Lifting Techniques HS-48 Lead Hazard Safety Program HS-49 Tool Safety and Inspection HS-50 First Aid HS-51 Incident Reporting and Investigation HS-52 General Waste Management HS-53 Spill Prevention Response HS-55 Short Service Employee HS-56 Stop Work Authority HS-58 Fatigue Management HS-73 Assured Grounding Program
UXO known or suspected to present? Yes ❑ No ☑	UXO support and plans provided Yes ❑ No ☑
Lifts Yes ❑ No ☑	
Items to be lifted: N/A	Critical ❑ Ordinary ❑
Excavations YES – Excavation of battery casing material in Type C Soil down to four foot (04 ft) depth.	

4.1 Chemical Hazards

Chemical	Media	PEL	Route of Entry	Symptoms Acute/Chronic
Lead	Soil	.05 mg/m^3	Inhalation Ingestion Contact	Lassitude, insomnia; facial pallor; anorexia, low-weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension

The above listings should not be taken as a complete assessment of the hazards posed by materials at the Raritan Bay site. . .Therefore, personnel must be alert for symptoms of possible exposure such as unusual smells, stinging, burning eyes, nose and throat, skin irritation, as well as feeling extremely ill, depressed, sleepy or tired. Symptoms must be immediately reported to the site supervisor.

See Attachment C for Chemical Hazard Information and SDS' / SDS'

4.2 Task Specific Hazards and Controls (AHAs)

Activity Hazard Analysis		
Job Task:	**Mobilization and Set Up and Demobe**	
Personal Protective Equipment:	**Level D**	
Hazard	**Sources**	**Control Measures**
Traffic related injury	Driving motor vehicles	Follow HS-10 Motor Vehicle Operation Adjust controls/mirrors prior to operation Utilized defensive driving techniques.
Ergonomics	Lifting and Bending	Follow HS-36 Proper Lifting Techniques Use Buddy system Use mechanical means when feasible
Cuts/Punctures	Sharp Objects	Beware of sharp objects Wear cut resistant gloves
Cold	Winter Temperatures	Follow HS-05 Schedule proper breaks Maintain communication/observation of co-worker Multiple layers of clothing (gloves, hats, thermals) Proper hydration
Noise	Equipment/power hand tools	Hearing protection required when use powered hand tools Hearing protection for levels > 85 dBs
Dermatitis	Poisonous Plants / Chemical Derm	Survey work crew for past reactions and assign accordingly Survey area and identify sources Beware of and avoid contact Eliminate plant if possible
Wildlife/domestic animals	Insects/Spiders/Bees/Ticks/Mosquitoes/Dogs	Survey area and identify sources Beware of and avoid contact Apply appropriate repellant per label directions
Slips/Trips/Falls	Terrain Debris	Identify/mark hazards Remove debris from walking / working surfaces Cover/fill in holes Mow tall grass if feasible
Struck by/caught between	Vehicle & Equipment Operation/Traffic	Follow HS-10 Motor Vehicle Operation Follow HS-18 Heavy Equipment Operation Follow HS-30 Traffic Control Safety Only qualified drivers permitted to operate vehicles Wear ANSI Class 2 high-visibility safety vest Wear seat belts while in operation Back up alarms functional and loud enough to hear over surroundings

Activity Hazard Analysis		
Job Task: Tree and brush clearing and chipping of trees and brush.		
Personal Protective Equipment: Modified Level D with chaps and face shield		
Hazard	**Sources**	**Control Measures**
Struck by/against/caught between	Excavator / Trucks	Follow HS-10 Motor Vehicle Operation Follow HS-18 Heavy Equipment Operation Only qualified drivers permitted to operate vehicles / heavy equipment Wear ANSI Class 2 high-visibility safety vest Wear seat belts while in operation Back up alarms functional and loud enough to hear over surroundings
Cuts / Lacerations	Chain Saw Operation	Control work area to authorized personnel only Utilize PPE per Section 6 of this HASP to include chaps, safety boots, hearing protection & face shield
Flying Debris	Chipper Operation	Control work area to authorized personnel only Utilize PPE per Section 6 of this HASP to include chaps, safety boots, hearing protection & face shield No loose clothing / jewelry/ uncontrolled long hair when in close proximity of chipper operation
Noise	Chipper / Equipment/power hand tools	Hearing protection required when use powered hand tools Hearing protection for levels > 85 dBs Follow HS-16
Slips/Trips/Falls	Uneven Terrain Debris	Identify/mark hazards Remove debris from walking / working surfaces
Ergonomics	Lifting and Bending	Follow HS-36 Proper Lifting Techniques Use Buddy system . >40 lbs. Use mechanical means when feasible
Wildlife/domestic animals	Insects/Spiders/Bees/Ticks/Mosquitoes/Dogs	Survey area and identify sources Beware of and avoid contact Apply appropriate repellant per label directions
Punctures	Sharp Objects Brush	Beware of sharp objects Wear cut resistant gloves (CR 4 rating)
Cold	Winter Temperatures	Follow HS-05 Schedule proper breaks Maintain communication/observation of co-worker Multiple layers of clothing (gloves, hats, thermals) Proper hydration

Activity Hazard Analysis		
Job Task: Pump site waters		
Personal Protective Equipment: **Modified Level D**		
Hazard	**Sources**	**Control Measures**
Contaminated water, Ergonomics, noise	Pump and hose operation	Operate pump according to operator's manual, connect hoses making sure gaskets are intact, check hoses for holes, tears or leaks, secure hose fittings with included clips or tie wire. Make sure pump is off & hoses are drained before disconnecting from pump.
Noise	Equipment/power hand tools	Hearing protection required when use powered hand tools Hearing protection for levels > 85 dBs Follow HS-16
Slips/Trips/Falls	Uneven Terrain Debris	Identify/mark hazards Remove debris from walking / working surfaces
Ergonomics	Lifting and Bending	Follow HS-36 Proper Lifting Techniques Use Buddy system . >40 lbs. Use mechanical means when feasible
Cold Stress	Seasonal Temperatures	Follow HS-05 Drink fluids and adhere to break schedule Provide warm break area
Punctures	Sharp Objects Brush	Beware of sharp objects Wear cut resistant gloves (CR4 rating)

Activity Hazard Analysis		
Job Task: Excavate soil/materials/debris		
Personal Protective Equipment: **Modified Level D**		
Hazard	**Sources**	**Control Measures**
Struck by/against/caught between	Excavator operation	Follow HS-18 Heavy Equipment Operation Follow HS-13 Excavation and trenching Only qualified drivers permitted to operate vehicles / heavy equipment Wear ANSI Class 2 high-visibility safety vest Wear seat belts while in operation Back up alarms functional and loud enough to hear over surroundings
Noise	Equipment operation	Hearing protection at levels > 85 dBs. Follow HS-16
Slips/Trips/Falls	Uneven Terrain Debris	Identify/mark hazards Remove debris from walking / working surfaces
Cold	Winter Temperatures	Follow HS-05 Schedule proper breaks Maintain communication/observation of co-worker Multiple layers of clothing (gloves, hats, thermals) Proper hydration
Punctures	Sharp Objects	Beware of sharp objects Wear cut resistant gloves (CR 4)
Lead	Soil	Maintain dust control Control work area to authorized personnel only Utilize PPE per Section 6 of this HASP Minimize contact with contaminated soils Follow HS-48
Ergonomics	Lifting and Bending	Follow HS-36 Proper Lifting Techniques Use Buddy system . >40 lbs. Use mechanical means when feasible
Wildlife/domestic animals	Insects/Spiders/Bees/Ticks/Mosquitoes/Dogs	Survey area and identify sources Beware of and avoid contact Apply appropriate repellant per label directions
Struck by/against/caught between	Excavator / Trucks	Follow HS-10 Motor Vehicle Operation Follow HS-18 Heavy Equipment Operation Only qualified drivers permitted to operate vehicles / heavy equipment Wear ANSI Class 2 high-visibility safety vest Wear seat belts while in operation Back up alarms functional and loud enough to hear over surroundings

Activity Hazard Analysis		
Job Task: Backfill of excavated areas / Load out of soil and waste for Disposal		
Personal Protective Equipment: **Modified Level D**		
Hazard	**Sources**	**Control Measures**
Struck by/against/caught between	Heavy Equipment Operation / Truck Operation	Follow HS-10 Motor Vehicle Operation Follow HS-18 Heavy Equipment Operation Only qualified drivers permitted to operate vehicles Wear ANSI Class 2 high-visibility safety vest Wear seat belts while in operation Back up alarms functional and loud enough to hear over surroundings
Noise	Equipment operation	Hearing protection at levels > 85 dBs. Follow HS-16
Slips/Trips/Falls	Uneven Terrain Debris	Identify/mark hazards Remove debris from walking / working surfaces
Ergonomics	Lifting and bending	Follow HS-36 Proper Lifting Techniques Use Buddy system > 40 lbs Use mechanical means when feasible
Cold	Winter Temperatures	Follow HS-05 Schedule proper breaks Maintain communication/observation of co-worker Multiple layers of clothing (gloves, hats, thermals) Proper hydration
Punctures	Sharp Objects Brush	Beware of sharp objects Wear cut resistant gloves (CR 4)

Activity Hazard Analysis		
Job Task: Equipment Decontamination and Site Demobilization		
Personal Protective Equipment: **Modified Level D**		
Hazard	**Sources**	**Control Measures**
Struck by/against/caught between	Heavy Equipment Operation / Truck Operation	Follow HS-10 Motor Vehicle Operation Follow HS-18 Heavy Equipment Operation Only qualified drivers permitted to operate vehicles Wear ANSI Class 2 high-visibility safety vest Wear seat belts while in operation Back up alarms functional and loud enough to hear over surroundings
Noise	Equipment operation	Hearing protection at levels > 85 dBs. Follow HS-16
Slips/Trips/Falls	Uneven Terrain Debris	Identify/mark hazards Remove debris from walking / working surfaces
Ergonomics	Lifting and bending	Follow HS-36 Proper Lifting Techniques Use Buddy system > 40 lbs Use mechanical means when feasible
Cold	Winter Temperatures	Follow HS-05 Schedule proper breaks Maintain communication/observation of co-worker Multiple layers of clothing (gloves, hats, thermals) Proper hydration
Punctures	Sharp Objects Brush	Beware of sharp objects Wear cut resistant gloves (CR 4)

4.3 Physical Hazards

PHYSICAL/ENVIRONMENTAL HAZARD ANALYSIS

HAZARD	PRE PLANNING TO CONTROL HAZARD	ACTIVE CONTROL MEASURES
Electrical	1. Locate and mark existing energized lines. 2. De-energize lines if necessary to perform work safely. 3. All electrical circuits will be grounded. 4. All 120 volt single phase which are not a part of the permanent wiring will have a ground-fault interrupter in place. 5. Temporary wiring will be guarded, buried or isolated by elevation to prevent accidental contact by personnel or equipment. 6. Evaluate potential for high moisture/standing water areas and define special electrical wiring needs-typically requirement for low voltage lighting systems.	1. Utilize Qualified Electrical Contractor for any new or temporary electrical construction. 2. Ensure electrical equipment/material meet all local, state and federal code and specifications 3. Use GFCI for all power tool usage.
Ergonomic	1. All operations evaluated for ergonomic impact. 2. Procedures written to define limits of lifting, pulling, etc. 3. Procedures to define how personnel will utilize proper ergonomic concepts and utilize mechanical material handling equipment. 4. Necessary mechanical material handling equipment specified and ordered for project.	1. Proper body mechanics techniques stressed and enforced on a daily basis. 2. Mechanical handling equipment maintained and utilized. 3. Proper body mechanics stressed in scheduled safety meetings. 4. Injuries reported and medically treated if in doubt about severity. 5. Operations changed as necessary based on injury experience or potential.
Existing Site Topography	1. Survey site prior to layout. Identify areas unsafe for personnel or equipment due to physical conditions. 2. Identify/locate existing utilities. 3. Determine impact of site operations on surrounding properties, communities, etc. 4. Identify mechanized equipment routes both on site and onto and off the site. 5. Layout site into exclusion and contamination reduction zones based on initial site evaluation.	1. Awareness to work environment - regular inspection/audits to identify changing conditions. 2. Shut down operations when unknown conditions encountered.
Fires & Explosions	1. Evaluate all operations for fire and explosion potential. 2. Define specific procedures for unique operations presenting unusual hazard such as flammable tank demolition. 3. Ensure that properly trained personnel and specialized equipment is available. 4. Define requirements for handling and storage of flammable liquids on site, need for hot work permits and procedures to follow in the event of fire or explosion. 5. Define the type and quantity of fire suppression equipment needed on site. 6. Coordinate which local fire fighting agencies to discuss unique fire hazards, hazardous materials, etc. 7. Ensure site operations comply with 29CFR 1910.157G.	1. Inspect fire suppression equipment on a regular basis. 2. Store flammables away from oxidizers and corrosives. 3. Utilize Hot Work Permit for all hot work on-site. 4. Follow any site specific procedures regarding work around flammables. 5. Review and practice contingency plans. 6. Discuss on regular basis at scheduled safety meetings.
Flammable Vapor and Gases	1. Evaluate site to determine sources of likely flammable gas or vapor generation. 2. Develop specific procedures to be followed in the event of exposure to flammables. 3. Specify specialized equipment needs for inerting flammable atmospheres, ventilating spaces and monitoring flammable vapor concentrations. 4. Define requirements for intrinsically safe equipment. 5. Develop contingency plan to follow in the event of fire or explosion.	1. Calibrated monitoring equipment available and utilized by trained personnel whenever working where flammable gas or vapor is present. 2. Monitoring performed at regular frequency and in all areas where vapor could generate or pool. 3. Equipment and operations shut down when threshold levels are exceeded. 4. Contingency plans reviewed regularly by all involved personnel. 5. Work areas are carefully inspected to look for possible ignition sources. Sources are removed. 6. Operations shut down if specific task procedures can't be followed to the letter.
Heavy Equipment Operation	1. Define equipment routes and traffic patterns for site. 2. Insure that operators are properly trained on equipment operation for all equipment required on project. 3. Define safety equipment requirements, including back up alarm and roll over, for all equipment on site. 4. Define equipment routes and traffic patterns for site. 5. Implement SOP of requiring operators to safety inspect equipment on a daily basis in accordance with manufacturer requirements.	1. Equipment inspected as required. 2. Equipment repaired or taken out of service. 3. Ground spotters are assigned to work with equipment operators. 4. Utilize standard hand signals and communication protocols. 5. Personnel wear the proper PPE; utilize hearing protection, gloves for handling rigging, etc.

PHYSICAL/ENVIRONMENTAL HAZARD ANALYSIS

HAZARD	PRE PLANNING TO CONTROL HAZARD	ACTIVE CONTROL MEASURES
	6. Evaluate project requirements to ensure that equipment of adequate capacity is specified.	6. Equipment safety procedures discussed at daily scheduled safety meetings. 7. Personnel do not exceed lifting capacities, load limits, etc. for equipment in question. 8. Personnel follow basic SOP's which prohibit passengers on equipment, activating brakes and grounding buckets, securing loads prior to movement, etc.
Illumination	1. Evaluate all operations and work areas to determine lighting requirements. 2. Specify specialized lighting requirements including explosion proof, intrinsically safe, lighting needs. 3. Determine if nighttime outdoor operations are necessary. 4. Evaluate tasks to be performed and number of light plants necessary to allow operations. 5. Ascertain if outdoor lighting from nighttime operations will have an impact on surrounding communities.	1. Inspect specialized equipment and discard or replace as needed. 2. Add additional lighting to areas with lighting deficiencies. 3. Inspect drop cords and portable lights on regular basis. Replace or repair as necessary.
Noise	1. Local community noise standards examined. 2. Expected loud operations evaluated to determine compliance with community standards. 3. Loud operations scheduled for approved time periods. 4. Noise level standards established for equipment brought onto site. 5. Hearing protection requirements defined for personnel expected to have excessive exposures.	1. Personnel receive annual audiogram. 2. Personnel required to wear hearing protection. 3. Routine noise level monitoring and dosimetry performed. 4. Defective equipment repaired as needed. 5. Ongoing hearing conservation education promoted at scheduled safety meetings. 6. Medical evaluation following noise (impact) exposure if symptoms present themselves.
Personal Injuries	1. Site operations will be evaluated for exposures with serious injury potential such as falling objects, pinch points, flying objects, falls from elevated surfaces, etc. 2. A written Fall Prevention Program will be developed if workers will be required to work at heights greater than 6 feet from unguarded work locations. 3. PPE requirements will be based on potential for injury.	1. Personnel will wear required PPE. 2. Specialized equipment such as rope grabs, winches, etc. will be inspected prior to each use. 3. Defective equipment will be immediately replaced. 4. All injury and near miss incidents will be reported to the HSO. 5. First aid/CPR trained person on site at all times. 6. First aid on site. 7. Transport for medical care if necessary.
Small Equipment Usage	1. Site operations will be evaluated to determine need for specialized intrinsically safe, explosion-proof and UL approved equipment and instruments. 2. Implement requirement for G.F.I., double insulated tool usage, or assured grounding program in all outdoor operations, will be utilized. 3. Specify equipment needs to ensure that equipment used only for the purpose for which it is designed and to prevent abuse or misuse of the equipment. 4. Specify requirements for the inspections and maintenance of specialized equipment. 5. Specify that all equipment utilized on the project meets all OSHA requirements.	1. Inspect each tool prior to each use. 2. Ensure all guards are in use and properly positioned. 3. Ensure item being worked on is properly braced if necessary. 4. Get help when appropriate to hold or brace item being worked on. 5. Wear leather or other appropriate gloves in addition to level C PPE.
Weather Conditions	1. Evaluate prevailing weather conditions for the site. 2. Contingency plans developed for likely severe weather conditions such as tornado, and extreme thunderstorm. 3. Provide for daily weather forecast service in extreme weather areas. 4. Plan to weatherize safety systems, such as showers and eye washes that would be impacted by extreme cold weather. 5. Order necessary specialized cold weather clothing. 6. Grounding and bonding requirements defined for thunderstorm areas. 7. Sheltered air conditioned break areas provided for extreme hot and cold weather zones.	1. Employees trained in contingency plan for severe weather conditions. 2. Emergency water sources inspected regularly in cold areas. 3. Weather service contacted regularly during storm conditions. 4. Supervisory personnel cease operations during extreme storm conditions (i.e., thunderstorms). 5. Personnel evacuate to safe assembly area.
Heat Stress	1. Anticipate possible high temperatures (summer months). 2. Be aware of heat stress symptoms, quit sweating, pale, clammy skin, dizziness	1. Cool break area. 2. Drink water. 3. Buddy system/ awareness 4. First aid on site.

PHYSICAL/ENVIRONMENTAL HAZARD ANALYSIS

HAZARD	PRE PLANNING TO CONTROL HAZARD	ACTIVE CONTROL MEASURES
		5. Medical care if symptoms persist.
Cold Stress	1. Anticipate possible low temperatures (winter months). 2. Remember the temperature does not have to be below freezing to have a cold stress situation.	1. Warm break area. 2. Warm decaffeinated drinks. 3. Buddy system/ awareness. 4. First aid on site. 5. Medical care if symptoms persist

5.0 Training Requirements

This section describes ER's project training requirements and site visitor policy. Training of all personnel shall be in accordance with OSHA 29 CFR 1910.120 and the National Fire Protection Association (NFPA) standards.

5.1 Project Training Requirements

The training listed in Table 5-1 will be provided to project participants as noted. All required training will be documented and this documentation maintained onsite.

Project Training Requirements:		
Topic	**Description**	**Personnel**
General Training		
Site Safety and Health Plan	Site-specific hazards and control requirements, before commencement of field work. Includes training in proper use and care of PPE.	All project personnel
Activity Hazard Analysis	Activity-specific hazards, controls and training requirements for a specific phase or activity, prior to commencement of activity	Workers, supervisors and oversight personnel engaged in the activity
Daily Safety Briefing	In addition to plan-of-the-day and daily hazard reminders, often used to cover a specific topic; provided refresher training on various issues; or changes in hazards, controls or procedures.	All field workers, supervisors and field oversight personnel
Emergency Action Plan	Roles, responsibilities, recognition of emergency conditions, reporting and notification, evacuation and other procedures.	All project personnel, with detailed information on procedures for workers with special responsibilities
OSHA 40-Hour Hazardous Waste Operation (HAZWOPER) Training	General hazards and controls for hazardous waste activities at remediation sites, prior to performing work in an exclusion zone.	General site workers, supervisors, oversight personnel on HAZWOPER sites
OSHA 8-Hour Supervisor	Managing HAZWOPER work activities	Supervisors and management support staff on HAZWOPER sites
OSHA 8-Hour Refresher	Current annual refresher for HAZWOPER sites.	Workers, supervisors and oversight personnel engaged in the activity
OSHA 10-Hour Construction Safety	10-Hour OSHA Construction Safety Course	HSO at a minimum.
Hazard Communication	Requirements for SDS, labels; hazards of site materials and controls; location of and access to inventories and SDS.	All project personnel potentially exposed to hazardous materials
Fire Extinguisher	General education on selection, distribution, and proper use of fire extinguishers.	All project personnel
Special Training		
First aid/ Cardiopulmonary Resuscitation (CPR)	Red Cross, National Safety Council or other authorized course, with current refresher	At least 2 ER project personnel
Fall Protection	Fall (from elevation) hazards, fall protection techniques, especially proper use of personal fall arrest systems and rescue procedures.	Task-specific, workers exposed to fall hazards.
Confined Space Entry	Site-specific confined space hazards and procedures.	Workers engaged in confined space activities including entrants, attendants and supervisors.
Lockout/tagout	Site-specific energy control and verification procedures.	Authorized personnel working on de-energized systems, and affected employees whose work may be impacted by a lockout/tagout situation.
Forklifts	Hazards and operation procedures, including machine-specific safe operating procedures.	Forklift operators

Project Training Requirements:		
Topic	**Description**	**Personnel**
Other Heavy Equipment operations	Qualified by Construction Manager, Superintendent or Equipment Supervisor as documented on ECC Equipment Operator Qualifications Form	Equipment Operators
Power tools (e.g. chain saws, chippers, powder-actuated tools, compressed air systems)	Hazards and proper use and maintenance as described in operations manual. Powder-operated tool users certified by manufacturer.	Tool users

5.2 Visitor Indoctrination Policy

All site visitors will be required to review the daily tailgate safety issues and sign the visitor log. At a minimum, all visitors must be informed of the anticipated hazards and PPE requirements, designated work zones, escort procedures, and emergency procedures.

6.0 Personal Protective Equipment

Unless otherwise approved by the project HSO, all activities will include at least American National Standards Institute (ANSI) approved hard hats, safety-toe boots, safety glasses with side impact protection and high visibility vests.

The purpose of PPE and clothing is to protect individuals from chemical and physical hazards.

6.1 Level A Protection Shall Be Used When: (NOT ANTICIPATED)

- The extremely hazardous substance requires the highest level of protection for skin, eyes and the respiratory system;
- Substances with a high degree of hazard to the skin are known or suspected;
- Chemical concentrations are known to be above IDLH levels; or,
- Biological hazards requiring Level A are known or suspected.

Protective Gear- Level A	Type
Pressure Demand SCBA	Full Face (MSHA/NIOSH approved)
Fully Encapsulated Chemical Resistant/Protective Coveralls	Tychem® TK or equivalent
Inner Chemical Resistant Coveralls	Saranex or equivalent
Inner Gloves	Nitrile
Outer Chemical Gloves	Nitrile
Outer Work Gloves	
Safety Shoes/Boots	Chemical resistant steel toed
Hard Hat	ANSI approved
Radio Communication	2-way (intrinsically safe)
Modifications:	

6.2 Level B Protection Shall Be Used When: (NOT ANTICIPATED)

- The substance(s) has been identified and requires a high level of respiratory protection but less skin protection;
- Concentrations of chemicals in the air are IDLH or above the maximum use limit of an APR with full-face mask;
- Oxygen deficient or potentially oxygen deficient atmospheres (<19.5%) are possible; and/or,
- Confined space entry may require Level B.
- Incomplete identification of gases and vapors, but not suspected to be harmful to skin or skin absorbable.

Level B Protective equipment at a Minimum Shall Consist of:

Protective Gear- Level B	Type
Pressure Demand SCBA / Air Line System	Full Face (MSHA/NIOSH approved)
Chemical Resistant/Protective Coveralls	Saranex / Acid Suits*
Inner Gloves	Nitrile
Outer Chemical Gloves	Nitrile
Outer Work Gloves	Cut resistant Glove**
Safety Shoes/Boots	Chemical resistant steel toed
Hard Hat	ANSI approved
Radio Communication	2-way (intrinsically safe)
Modifications:	* Acid suits will be used during liquid acid transfer activities. ** Cut resistant gloves will be preferred PPE for hand protection as normal work glove (CR 4)

6.3 Level C Protection Shall Be Used When: (NOT ANTICIPATED)

- The same level of skin protection as Level B, but a lower level of respiratory protection is required;
- The types of air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove contaminants; or,
- The substance has adequate warning properties and all criteria for the use of APR respirators have been met.

Level C Protective Equipment at a Minimum Shall Consist of:

Protective Gear- Level C	Type
Air Purifying Respirator (APR)	Full face (MSHA/NIOSH approved)
Cartridges	Combination OV/P-100
Chemical Resistant/Protective Coveralls	Tyvek or equivalent*
Inner Gloves	Nitrile
Outer Chemical Gloves	Nitrile
Outer Work Gloves	Cut Resistant Gloves**
Safety Shoes/Boots	Chemical resistant steel toed
Hard Hat	ANSI approved
Radio Communication	2-way (intrinsically safe)
Modifications:	* Saranex will be used during liquid acid transfer activities. ** Cut resistant gloves will be preferred PPE for hand protection as normal work glove (CR 4)

6.4 Mod Level D Protection Shall Be Used When:

- The atmosphere is demonstrated to be within OSHA permissible limits
- Work functions preclude splashes, immersion or the potential for unexpected inhalation of, or contact with, hazardous concentrations of harmful chemicals.

Mod Level D Protection Equipment at a Minimum Shall Consist of:

Protective Gear- Level C	Type
Chemical Resistant/Protective Coveralls	Particulate resistant (i.e. Kleengard A20 or equivalent)
Safety Shoes/Boots	Steel toed/shank work boots
Boot Covers (booties)	Latex - During muddy conditions as necessary
Work Gloves	Cut Resistant Gloves**
Hard Hat	NIOSH approved
Face Shield	As necessary

Safety Glasses	NIOSH approved
Modifications:	** Cut resistant gloves will be preferred PPE for hand protection as normal work glove (CR 4)

6.5 Level D Protection Shall Be Used When:

- The atmosphere contains no known hazard; and,
- Work functions preclude splashes, immersion or the potential for unexpected inhalation of, or contact with, hazardous concentrations of harmful chemicals.

Level D Protection Equipment at a Minimum Shall Consist of:

Protective Gear - Level D	Type
Standard Work Clothes	Cotton (Long pants/sleeved shirt)
Rain Suit	PVC
Safety Shoes/Boots	Steel Toed
Boot Covers	Latex booties, as needed per discretion
Work Gloves	Cut resistant Gloves**
Hard Hat	ANSI approved
Face Shield	As needed per HSO discretion
Safety Glasses	ANSI approved
Modifications:	** Cut resistant gloves will be preferred PPE for hand protection as normal work glove (CR 4)

6.6 Decisions to Upgrade/Downgrade PPE

All decisions to downgrade from Level B to C or D must be accompanied by air monitoring results. The Project Health and Safety Manager must be consulted prior to on-site decisions to downgrade. All decisions must be documented with an Addendum to the HASP.

The following conditions will necessitate reevaluation of PPE use.

- commencement of a new work not previously identified
- change of job tasks during a work phase
- change of season/weather
- contaminants other than those identified in Safety Plan
- change in ambient levels of contaminants
- change in work which affects degree of chemical contact

6.7 Project Personal Equipment Requirements

Project Personal Protective Equipment Requirements:							
Activity	**Respiratory Protection**	**Head Protection**	**Body Protection**	**Hand Protection**	**Eye/Face Protection**	**Foot Protection**	**Hearing Protection**
Site Mobilization and Set up. (Level D)	None	ANSI-approved hardhat	ANSI Class 2 Hi Vis Vest	Cut Resistant Work Glove (CR 4)	ANSI-approved safety glasses	ANSI-approved safety boots	Hearing Protection >85 dBA
Tree/brush Clearing And chipping of trees & brush(Level D)	None	ANSI approved hard hat	ANSI Class 2 Hi Vis Vest	Cut Resistant Work Glove (CR 4	ANSI-approved safety glasses	ANSI – approved safety boots	Hearing Protection >85 dBA
Pumping site water (Modified Level D)	None	ANSI approved hard hat	ANSI Class 2 Hi Vis Vest	Cut Resistant Work Glove (CR 4	ANSI-approved safety glasses	ANSI – approved safety boots	Hearing Protection >85 dBA

Project Personal Protective Equipment Requirements:							
Activity	**Respiratory Protection**	**Head Protection**	**Body Protection**	**Hand Protection**	**Eye/Face Protection**	**Foot Protection**	**Hearing Protection**
Surface & Subsurface Excavation. (Modified Level D)	None	ANSI-approved hardhat	Breathable Tyvek or equivalent	Cut Resistant Work Glove (CR 4	ANSI-approved safety glasses	ANSI-approved safety boots	Hearing Protection >85 dBA
Backfill of excavated areas/Load Out Battery Casing & Soil Material. (Modified Level D)	None	ANSI-approved hardhat	Breathable Tyvek or equivalent	Cut Resistant Work Glove (CR 4	ANSI-approved safety glasses	ANSI-approved safety boots	Hearing Protection >85 dBA
Equipment Decontamination & Site Demobilization (Level D)	None	ANSI-approved hardhat	ANSI Class 2 Hi Vis Vest	Cut Resistant Work Glove (CR 4	ANSI-approved safety glasses	ANSI-approved safety boots	Hearing Protection >85 dBA

Personal Protective Equipment Inspection and Care

Inspection and care of PPE are covered in the ER Corporate SOP HS-24.

6.8 Respiratory Protection Program

ER shall implement ER SOP HS-26 Respiratory Protection Program for its employees and subcontractors and train them on its contents. The program will be administered by the HSO.

Respiratory protective equipment shall be NIOSH-approved and use shall conform to OSHA 29 CFR Part 1910.134 Requirements. ER and subcontractors shall maintain a written respirator program detailing selection, use, cleaning, maintenance and storage of respiratory protective equipment. Please note that tight fitting APRs are not anticipated on this site.

7.0 Medical Surveillance

The purpose of the medical surveillance program is to identify exposure-related health effects early, before they result in disease. It is used to protect coworkers who might be potentially affected and also to identify previously unrecognized health issues that may affect the workplace. Although the regulations guiding this industry provide specific direction in some cases as to test protocols and frequency, for the most part these are open to interpretation. We avoid the time and expense of testing for all possible exposure outcomes, and emphasize quality and accuracy of the tests that are performed.

7.1 Pre-Employment Medical Examination

a. Pre-employment medical examinations are required for persons working at hazardous waste sites.
b. All examinations must be completed and documented prior to assignment to this site.
c. All examinations will be conducted following parameters established by WorkCare™.

7.2 Site Specific Medical Examination Requirements

No site specific medical examination required.

7.3 Annual Medical Examination

The medical examination must have been within a 6-month period prior to on-site activity and repeated annually.

7.4 Suspected Exposure Medical Examination

a. Following any suspected uncontrolled exposure to site contaminants, personnel should be scheduled for a special medical examination.
b. The medical examination will be specific for the contaminants and the associated target organs or physiological system.
c. Questions regarding the type of medical examination can be directed to ER's Corporate Health and Safety Manager.

7.5 Contractor Physical Examination Requirements

All subcontractors entering the contamination reduction or exclusion zone will have adequate medical surveillance satisfying 29 CFR 1910.120.10 (f).

8.0 Health and Hazard Monitoring

According to 29 CFR 1910.120 (h) Air Monitoring shall be used to identify and quantify airborne levels of hazardous substances and health hazards in order to determine the appropriate level of employee protection needed on-site. USEPA will notify ER if the contractor shall be tasked for all air monitoring on this project. ER will ensure they maintain an air monitoring program to evaluate concentrations of specific chemical groups or contaminants in ambient air during work activities. This program will include both real-time, direct monitoring equipment, and chemical-specific personal air monitoring as appropriate.

Both area and personal monitoring will be conducted to document potential exposures to hazardous constituents, as well as to evaluate the adequacy of the Personal Protection Equipment (PPE) program.

8.1 Routine Air Monitoring Requirements: (NOT ANTICIPATED)

- Upon initial entry to rule out IDLH conditions
- When the possibility of an IDLH condition or flammable atmosphere has developed
- When work begins on a different portion of the site
- Contaminants other than those previously identified are being handled
- A different type of operation is initiated
- Employees are handling leaking drums or containers or working in areas with obvious liquid contamination
- During confined space work

Air monitoring will consist at a minimum of the criteria listed below. All air monitoring data will be documented and available in the command post site files for review by all interested persons. Air monitoring instruments will be calibrated and maintained in accordance with the manufacturer's specifications. Calibration and maintenance performed will be entered in the site log and/or instrument log book.

8.2 Site Specific Air Monitoring Requirements:

Health Hazard Monitoring:					
Real Time (Air, noise, heat, radiation, light)					
Activity	**Target Analyte**	**Instrument**	**Frequency**	**Action Levels**	**Actions/Upgrade and Rationale**
Site wide	**Temperature Extremes Heat	Thermometer In conjunction with web site www.intellicast.com for heat index, rel hum% measurements if WBGT is not available	Observe workers for signs of heat stress and implement physiological monitoring if warranted. **Every 2 hours** **Every 60 minutes** **Every 30 minutes**	80-90 ^{O}F HEAT INDEX **90 -105 ^{O}F HEAT INDEX** **105 – 130 ^{O}F HEAT INDEX** **>130 ^{O}F HEAT INDEX**	Implement work rest schedule per HS-17
Site Wide	Temperature Extremes Cold Stress	Thermometer In conjunction with web site www.intellicast.com for heat index, rel hum% measurements if WBGT is not available	Observe workers for signs of cold stress. Refer to cold stress ER SOP HS-05	See ER SOP HS-05 *** See ACGIH warm up schedule	Implement work rest schedule and refer to ER SOP HS-05

**When permeable work clothes are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80°F (see table above), or sooner if workers exhibit symptoms of heat stress. These heat index values were devised for shady, light wind conditions. Exposure to full sunshine can increase the values by up to 15°F. In addition, strong winds, particularly with very hot, dry air, can be extremely hazardous. When wearing impermeable clothing (i.e. – clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted by all ER employees and their subs when the ambient temperature reaches 80°F or at a lower temperature when workers begin to exhibit signs and symptoms of heat stress.

***

Air Temperature – Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		20 mph Wind	
˚C	˚F	Max. Work Period	No. Of Breaks	Max. Work Period	No. Of Breaks	Max. Work Period	No. Of Breaks	Max. Work Period	No. Of Breaks
-26 to -28	-15 to -19	Normal Breaks (1)		Normal Break (1)		75 min.	2	40 min.	4
-29 to -31	-20 to -24	Normal Breaks (1)		75 min.	2	55 min.	3	30 min.	5
-32 to -34	-25 to -29	75 min.	2	55 min.	3	40 min.	4	Non-emergency work should cease	
-35 to -37	-30 to -34	55 min.	3	40 min.	4	30 min.	5		
-38 to -39	-35 to -39	40 min.	4	30 min.	5	Non-emergency work should cease			
-40 to -42	-40 to -44	30 min.	5						

< -42	< -44	Non-emergency work should cease	Non-emergency work should cease		

8.3 Integrated Personnel Exposure Monitoring

No integrated personnel exposure monitoring anticipated.

9.0 Site Control and General Field Safety Rules

9.1 Work Zones

The primary purpose for site controls is to establish the hazardous area perimeter, to reduce migration of contaminants into clean areas and to prevent access or exposure to hazardous materials by unauthorized persons. At the end of each workday, the site should be secured or guarded, to prevent unauthorized entry. Site work zones will include:

Clean Zone/Support Zone (SZ)

This uncontaminated support zone or clean zone will be the area outside the exclusion and decontamination zones and within the geographic perimeters of the site. This area is used for staging of materials, parking of vehicles, office and laboratory facilities, sanitation facilities, and receipt of deliveries. Personnel entering this zone may include delivery personnel, visitors, security guards, etc., who will not necessarily be permitted in the exclusion zone. All personnel arriving in the support zone will upon arrival, report to the command post and sign the site entry/exit log.

[1] Location of the SZ will be determined in conjunction with USEPA CP.

Contamination Reduction Zone (CRZ)

The contamination reduction zone will provide a location for removal of contaminated personal protective equipment and final decontamination of personnel and equipment. All personnel and equipment shall exit via the CRZ. A separate CRZ area will be established for heavy equipment.

[1] The CRZ is a buffer zone between contaminated and clean areas.
[2] Identified by signage and yellow banner guard.

Exclusion Zone/Hot Zone (EZ)

The exclusion zone will be the "hot-zone" or contaminated area inside the site perimeter. Entry to and exit from this zone will be made through a designated point and all personnel will be required to sign the hot zone entry/exit log located at the decon area. Appropriate warning signs to identify the EZ should be posted (i.e. "DANGER - AUTHORIZED PERSONNEL ONLY", "PROTECTIVE EQUIPMENT REQUIRED BEYOND THIS POINT", etc.) Exit from the EZ must be accompanied by personnel and equipment decontamination as described in Section 10.0.

[1] Will be identified by red banner guard.
[2] General Safety Rules for EZ
  a. wear the appropriate level of PPE defined in plan
  b. do not remove any PPE
  c. no smoking, eating or drinking
  d. no horseplay
  e. no matches or lighters
  f. implement the communication and line of sight system

9.2 General Field Safety Rules

The following site rules are applicable to all ER projects:

- Horseplay is not allowed at any time
- All visitors must be sent to the command post
- Participate in Tailgate Safety Meetings
- There shall be no horseplay allowed at any time on the project
- Continually observe work location and be alert to changes that may affect safety
- Immediately report incidents, accidents, near misses, or unusual situations to HSO or the Site Supervisor
- It is ER policy to practice administrative hazard control for all site areas by restricting entrance to exclusion zones to essential personnel and by using operational SOPs
- Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or set equipment on the ground. Stay away from any waste drums unless necessary. Protect equipment from contamination by bagging
- Eating, drinking, using gum or smoking, or applying cosmetics is permitted only in designated areas in the support zone. Areas shall be marked where smoking is permitted
- Wash hands, face, and any exposed skin during decontamination, before eating, drinking or using tobacco products, and at the end of each shift
- Work within physical and mental limits
- Alert your senses to potentially dangerous situations (e.g., strong, irritating, or nauseating odors)
- Familiarize yourself with the physical characteristics of the site
- Take adequate rest breaks and replace body fluids (water and electrolyte) continuously
- Avoid rushing and/or taking short cuts
- Beards or other facial hair that interferes with respirator fit will preclude wearing a respirator.
- All equipment must be decontaminated or discarded upon exit from the exclusion zone.
- All personnel exiting the exclusion zone must go through the decontamination procedures described in Section 10.0.
- Safety Equipment described in Section 6.0 will be required for all field personnel.
- Personnel will only travel in vehicles where individual seats (for each occupant are provided. Seat belts will be worn as required.
- Fire extinguishers will be available on site and in all areas with increased fire danger such as the refueling area.
- A minimum of two personnel will always be on site whenever heavy equipment is operated. Only necessary personnel need to be on or around heavy equipment.
- Employees will not interfere with or tamper in any way with air monitoring equipment.
- Conduct visual checks on machinery and equipment prior to use, and complete the daily inspection form
- Backhoes or other equipment with booms shall not be operated within 10 feet of any electrical conductor.

Minimum Clearance from Energized Overhead Electric Lines

NOMINAL SYSTEM VOLTAGE	MINIMUM REQUIRED CLEARANCE
0-50 kV	10 feet
51-100 kV	12 feet
101-200 kV	15 feet
201-300 kV	20 feet
301-500 kV	25 feet
501-750 kV	35 feet
751-1000 kV	45 feet

- Visitor log will be maintained at the command post or with the security guard. All personnel coming on site will sign in and out on a daily basis.
- Security will be maintained at the site by closing all gates during normal work hours. Site will be locked up in the evening.
- If unauthorized members of the public are found on site, contact the RM immediately and do not leave the individual unattended.
- Visitors are not allowed in the work areas without authorization. Visitors must sign in at the Command Post and receive authorization to enter the site.
- Buddy System
  1. The buddy system is mandatory at any time that personnel are working in the exclusion zone, remote areas, , or when conditions present a risk to personnel.
  2. A buddy system requires at least two trained/experienced people who work as a team and maintain at a minimum audible and/or visual contact while operating in the exclusion zone.
- Communication Procedures
  1. Radios will be used for onsite communications and Channel 2 will be the designated channel.
  2. The crews should remain in constant radio or visual contact while on site.
  3. The site evacuation signal will be 3 blasts on the air or vehicle horn.

Conformance with these site rules is mandatory for continued project participation

10.0 Decontamination Procedures

In general, everything that enters the EZ at this site, must either be decontaminated or properly discarded upon exit from the EZ. All personnel, including any state and local officials must enter and exit the EZ through the CRZ. Prior to demobilization, contaminated equipment will be decontaminated and inspected before it is moved into the SZ. Any material that is generated by decontamination procedures will be stored in a designated area in the EZ until disposal arrangements are made.

NOTE: The type of decontamination solution to be used is dependent on the type of chemical hazards. The decontamination solution for this site includes soap/water solutions. Decontamination solution will be changed daily (at a minimum) and collected and stored on-site until disposal arrangements are finalized.

10.1 Procedures for Equipment Decontamination

All contaminated equipment will be decontaminated before leaving the site. Decontamination procedures will vary depending upon the actual equipment involved, but generally include spraying with water. This decontamination solution (decon water) will be containerized, temporarily stored on-site, and disposed of in accordance with the Decon Water Disposal Plan.

Equipment decontamination will consist of the following steps:

1. Primary method will be remove clinging soil by using shovels, brooms, and brushes
2. The soil removed will be picked up for proper disposal
3. If dry decon is not sufficient the equipment shall be rinsed with high-pressure washer.

10.2 Procedure for Personnel Decontamination

This decontamination procedure applies to personnel at this site wearing Modified Level D protection. These are the minimum acceptable requirements:

Station 1: Equipment Drop
Deposit equipment used on-site (tools, sampling devices and monitoring instruments, radios, etc.) on plastic drop cloths. These items must be decontaminated or discarded as waste prior to removal from the exclusion zone.

Station 2: Outer Boot and Glove Removal

Remove outer boots and gloves. If outer boots are disposable, deposit in container with plastic liner. If non-disposable, store in a clean dry place.

Station 3: Outer Garment Removal
Remove Chemical Resistant Outer Garments and deposit in container lined with plastic. Decontaminate or dispose of splash suits as necessary.

Station 4: Inner Glove Removal
Remove inner gloves. Deposit in container for disposal.

Station 5: Field Wash
Thoroughly wash hands and face with soap and water. Shower as soon as possible.

Eating, drinking, chewing gum/tobacco, smoking, or any practice that increases the probability of hand to mouth transfer and/or ingestion of materials is prohibited in any areas where the possibility of contamination exists and is permitted only in the designated break area.

Personnel will not wear or bring dirty/decontaminated clothing into the break areas.

10.3 Disposition of Decontamination Wastes

1. All equipment and solvents used for decontamination shall be decontaminated or disposed of with the established waste streams.

2. Commercial laundries or cleaning establishments that decontaminate or are used to launder contaminated clothing shall be informed of the presence and potentially harmful effects of the contaminants.

11.0 Hazard Communication Program

Each contractor will be responsible for maintaining a copy of their Hazardous Communication Program and SDS on site. The following items are specific to this job site:

11.1 Safety Data Sheets

1. Safety Data Sheets will be maintained at the Command Post in the Health and Safety Binder or be readily available via the internet.
2. SDS will be available to all employees for review during the work shift.
3. See Attachment C and/or the ER Health and Safety Binder or available on internet.

11.2 Container Labeling

1. All containers received on site will be inspected by the contractor using the material to ensure the following:
   a. all containers clearly labeled
   b. appropriate hazard warning
   c. name and address of the manufacturer

11.3 The following chemicals shall/may be brought to the site: SDS shall be available for all chemicals listed)

1. Gasoline
2. Diesel Fuel
3. Grease
4. _____
5. _____

11.4 Employee Training and Information

1. Prior to starting work, each employee will attend a health and safety orientation and will receive information and training on the following:
   a. an overview of the requirements contained in the Hazardous Communication Standard
   b. Hazardous chemicals present at the site
   c. the location and availability of the written Haz Com Program
   d. physical and health effects of the hazardous chemicals
   e. methods of preventing or eliminating exposure
   f. emergency procedures to follow if exposed
   g. how to read labels and review of SDS to obtain information
   h. location of SDS file and location of hazardous chemical list

Hazard Communication Program and applicable SDS are available on the ER Intranet.

12.0 Emergencies/Incidents/Injuries

It is essential that site personnel be prepared in the event of an emergency. Emergencies can take many forms; illnesses or injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather. The following sections outline the general procedures for emergencies. Emergency information should be posted as appropriate.

12.1 Emergency Contacts

Emergency Call List and Project Organization		
Service	**Name/Organization**	**Emergency Phone**
Fire/Police/Emergency Medical		911
Police		911
Sheriff		911
*Occupational Medical Clinic Primary	Meridian Occ Health Holmdel 100 Commons Way Suite, 160 Holmdel, NJ 07733	732-450-2930
*Hospital (after Hours and Emergencies)	Bayshore Community Hospital ER 727 North Beers Street Holmdel, NJ 07733	732-739-5900
Injury Care Management	One Source / Mike Pelz	815-370-2940 Primary 219-427-5933 Secondary
USEPA	OSC Andrew Confortini	908-420-4455
ER RM / HSO	Carl Duffey	804-852-4584
ER PHSM	Nick Michailides	314-473-2290

*Directions from site to hospital and clinic are located in Attachment B and will be posted in the project office and available in all ER vehicles.

The route to the hospital and clinic shall be verified by Carl Duffey or his designee.

Route verified by (print)_____ on (date)_____at(time)_____

- Distance from site to hospital is approximately ____miles. Approximate driving time is ____minutes.
- Distance from site to the clinic is approximately ____miles. Approximate driving time is ____minutes.

The following ER individuals have been trained in CPR and First Aid: Carl Duffey and TBD

A list of ALL site personnel that are trained in CPR and First Aid is included in Attachment D.

12.2 Additional Emergency Numbers

Poison Control Center	800-222-1222
National Response Center	800-424-8802
Center for Disease Control	404-488-4100 (24 hr)
AT&F (Explosives Information)	800-424-9555
Chemtrec	800-424-9300

Environmental Restoration Contacts

Environmental Restoration	888-814-7477 (24 Hr.)
Environmental Restoration (St. Louis)	636-227-7477

12.3 Emergency Equipment Available On-Site

Communications Equipment	Location
Public Telephones	N/A
Private Telephones	N/A
Mobile Telephones	RM 804-852-4584
Two-Way Radios	Channel TBD
Emergency Alarms/Horns	Vehicle Horns / Air Horn
Other:	N/A

Medical Equipment	Location
First Aid Kits	Equipment Operator & RM Vehicles
Stretcher/Backboard	N/A
Eye Wash Station: *(within 100 feet of hazard zone)*	TBD
Safety Shower	N/A

Fire Fighting Equipment	Location
Fire Extinguishers	EO Vehicle
Other	Excavator

Spill or Leak Equipment	Location
Absorbent Boom/Pads:	N/A
Dry Absorbent:	N/A

Additional Emergency Equipment	Location
N/A	

12.4 Incident Reporting/Investigations

All incidents, including personal injury and property damage, must be reported to the RM, Supervisor, or HSO **within 20 minutes of incident**.

The RM will contact the Project Health and Safety Manager by telephone immediately. The RM, HSO, and effected employees will conduct an immediate investigation of the incident and document all results on the Incident and Investigation Report form.

13.0 Emergency Response Contingency Plan

13.1 Project Personnel Responsibilities During Emergencies

As the administrator of the project, the RM has primary responsibility for responding to and correcting emergency situations. The RM will:

- Take appropriate measures to protect personnel including: withdrawal from the exclusion zone, total evacuation and securing of the site or up-grading or down- grading the level of protective clothing and respiratory protection.
- Take appropriate measures to protect the public and the environment including isolating and securing the site, preventing run-off to surface waters and ending or controlling the emergency to the extent possible.
- Ensure that appropriate Federal, State and local agencies are informed, and emergency response plans are coordinated. In the event of fire or explosion, the local fire department should be summoned immediately. In the event of an air release of toxic materials, the local authorities should be informed in order to assess the need for evacuation. In the event of a spill, sanitary districts and drinking water systems may need to be alerted.
- Ensure that appropriate decon treatment or testing for exposed or injured personnel is obtained.
- Determine the cause of the incident and make recommendations to prevent the recurrence.
- Ensure that all required reports have been properly prepared and submitted.

.2 Medical Emergencies:

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.) First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to Vice President of Health and Safety.

Onsite First Aid Support

Onsite medical support during project execution will be available from two or more individuals who are trained in First Aid and Cardiopulmonary Resuscitation (CPR) and blood borne pathogens. First aid kits shall be Type III, 16 unit kits, including one pocket mouthpiece or CPR barrier. Kits shall be checked prior to use, and at least weekly when work is in progress to ensure that contents are replaced as used.

Medical Transport of Employees and Case Management

For non-life threatening injuries, a local clinic will be identified with the assistance of the Corporate Medical Consultant, One Source Injury Management Care will be contacted prior to transporting any non-life threatening injured worker to the clinic to develop an appropriate medical treatment plan. If medical evaluation is necessary, the One Source will contact the clinic ahead of the arrival of the patient to establish oversight of case management. Under no circumstances will an injured employee drive unescorted to a hospital, clinic, etc. An employee with minor injury may be transported by car after first aid treatment is given. The HSO or other project management personnel will transport the injured person to the facility. The employee who transports the injured person shall be trained in first

aid and CPR whenever possible. When the injury is severe, or when in doubt concerning the severity of injury, the employee will be transported by ambulance.

Injured employees that require medical treatment or are taken to a doctor, hospital, clinic, etc., will not be allowed to resume work without a written return to work statement from the treating physician. This statement shall supply a medical diagnosis of the problem, the date of return to work, and work limitations. Should a return to work statement such as "light duty" be given, the treating physician will be contacted to determine the specific limitation. ER will make an assessment of work the employee routinely performs whether or not the limitation interferes with the employee's routine job assignment.

Whenever there are questions on the appropriateness of the diagnosis or prescribed course of treatment, One Source will be contacted to arrange for a second opinion. Copies of all Incident and Investigation Reports will be sent to the ER Vice President of Health and Safety.

13.3 Fire or Explosion:

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival the RM or designated alternate will advise the fire commander of the location, nature and identification of the hazardous materials on- site.

If it is safe to do so, site personnel may:

- Use firefighting equipment available on site.
- Remove or isolate flammable or other hazardous materials which may contribute to the fire.

13.4 Spills, Leaks or Releases:

In the event of a spill or a leak, site personnel will:

- Locate the source of the spillage and stop the flow if it can be done safely.
- Begin containment and recovery of the spilled materials.

13.5 Evacuation Routes and Resources:

Evacuation routes will be established by work area locations for this site. All buildings and outside work areas shall be provided with two designated exit points. Evacuation shall be conducted immediately, without regard for equipment under conditions of extreme emergency. See site map for evacuation routes.

- Evacuation notification will be three blasts on an air horn, vehicle horn, or by verbal communication via radio.
- Keep upwind of smoke, vapors or spill location.
- Exit through the decontamination corridor if possible.
- If evacuation is not via the decontamination corridor, site personnel should remove contaminated clothing once they are in a location of safety and leave it near the exclusion zone or in a safe place.
- The RM will conduct a head count to insure all personnel have been evacuated safely.
- In the event that emergency site evacuation is necessary, all personnel are to:
  - Escape the emergency situation;
  - Decontaminate to the maximum extent practical; and,
  - Meet at the command post.
- In the event that the command post is no longer in a safe zone, meet: at the designated upwind location established in the daily safety meeting.

Attachment A

Site Safety Plan Amendments

Site Safety Plan Amendment	
Amendment No.:	
Site Name:	
Date of Issue:	
Type of Amendment:	
Reason for Amendment:	
Alternate Safeguard Procedures:	
Required Changes in PPE:	

_____ _____
USEPA On-Scene Coordinator (Date)

_____ _____
ER Response Manager (Date)

_____
ER Project HS Manager (Date)

Attachment B

Site Maps

Hospital Location

Attachment C

Chemical Hazard Information / Chemical Inventory

Attachment D

FA / CPR Personnel

Attachment Z

Site Specific Training Record

SITE-SPECIFIC TRAINING RECORD

This is to advise that _____ conducted a Site-Specific Training
(Instructor's name)

course for _____ at the
(Company Name)

_____ project on _____.
(TO #, Project Name) (Date)

The total duration of the instructions was _____ hours.

Instruction covered the topics checked off below:

- Site Location, Description and History ☐
- Potential site hazards (chemical, physical, and biological) ☐
- Chemical, physical, and toxicological properties of site contaminants ☐
- Safe work practices ☐
- Training requirements ☐
- Medical Surveillance ☐
- Control Zones ☐
- Monitoring ☐
- Selection, use, and limitation, of personal protective equipment ☐
- Personnel and equipment decontamination ☐
- Emergency response procedures ☐
- Hazard communication ☐
- Blood borne pathogen briefing ☐

The following participant attended the training course for the full duration indicated above.

_____ _____
Name (Print) Signature

GENERAL FIELD SAMPLING GUIDELINES

CONTENTS

Complete Rewrite: SOP #2001; Revision 1.0; 03/15/13; U.S. EPA Contract EP-W-09-031

SUPERCEDES: SOP #2001; Revision 0.0; 08/11/94; U.S. EPA Contract 68-C4-0022

GENERAL FIELD SAMPLING GUIDELINES

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the general field sampling techniques and guidelines that will assist the Scientific Engineering Response and Analytical Services (SERAS) personnel in planning, choosing sampling strategies and sampling locations, and frequency of Quality Control (QC) samples for proper assessment of site characteristics. The ultimate goal is to ensure data quality during field collection activities.

2.0 APPLICABILITY

This SOP applies to the collection of aqueous and non-aqueous samples for subsequent laboratory analysis to determine the presence, type, and extent of contamination at a site.

3.0 DESCRIPTION

Representative sampling ensures that a sample or a group of samples accurately reflect the concentration of the contaminant at a given time and location. Depending on the contaminant of concern and matrix, several variables may affect the representativeness of the samples and subsequent measurements. Environmental variability due to non-uniform distribution of the pollutant due to topographic, meteorological and hydrogeological factors, changes in species, and dispersion of contaminants and flow rates contribute to uncertainties in sampling design.

Determining the sampling approach depends on what is known about the site from prior sampling (if any) and the site history, variation of the contaminant concentrations throughout a site, potential migration pathways, and human and environmental receptors. The objectives of an investigation determine the appropriate sampling design.

The frequency of sampling and the specific sample locations that are required must be defined in the site-specific Quality Assurance Project Plan (QAPP).

3.1 Planning Stage

The objectives of an investigation are established and documented in the site-specific QAPP. The technical approach including the media/matrix to be sampled, sampling equipment to be used, sampling design and rationale, and SOPs or descriptions of the procedure to be implemented are included in the QAPP. Refer to the matrix-specific SOPs for sampling techniques which include the equipment required for sampling.

During the planning stage, the data quality objectives (DQOs) will be determined. In turn, the project's DQOs will determine the need for screening data or definitive data. Screening data supports an intermediate or preliminary decision but eventually is supported by definitive data before the project is complete (i.e., placement of monitor wells, estimation of extent of contamination). Definitive data is suitable for final decision making, has defined precision and accuracy requirements and is legally defensible (i.e., risk assessments, site closures).

3.2. Sampling Design

Representative sampling approaches include judgmental, random, systematic grid, systematic simple random, stratified random and transect sampling. Sampling designs may be applied to soil,

sediment and water; however, the random and systematic random approaches are not practical for sampling water systems, especially flowing water systems.

3.2.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations based on the professional judgment of the field team. This method is useful to locate and to identify potential sources of contamination. It may not be representative of the full site and is used to document worst case scenarios. For example, groundwater sampling points are typically chosen based on professional judgment, whether permanently installed wells or temporary well points.

3.2.2 Systematic Sampling

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. A random point is chosen as the origin for the placement of the grid. A grid is constructed over a site and samples are collected from the nodes (where the grid lines intersect). Depending on the number of samples that are required to be collected, the distance between the sampling locations can be adjusted. The representativeness of the sampling may be improved by shortening the distance between sample locations.

Systematic random sampling is used for estimating contaminant concentrations within grid cells. Instead of sampling at each node, a random location is chosen within each grid cell. The systematic grid and random sampling approaches are useful for delineating the extent of contamination, documenting the attainment of clean-up goals, and evaluating and determining treatment and disposal options.

Transect sampling involves one or more transect lines established across the site. Samples are collected at systematic intervals along the transect lines. The number of samples to be collected and the length of the transect line determines the spacing between the sampling points. This type of sampling design is useful for delineating the extent of contamination at a particular site, for documenting the attainment of clean-up goals, and for evaluating and determining treatment and disposal options.

3.2.3 Simple and Stratified Random Sampling

Statistical random sampling includes simple, stratified and systematic sampling. Simple random sampling is appropriate for estimating means and total concentrations, if the site or population does not contain a major trend or pattern of contamination. A statistician will generate the sampling locations based on sound statistical methods. Stratified random sampling is a useful tool for estimating average contaminant concentrations and total amounts of contaminants within specified strata and across the entire site. It is useful when a heterogeneous population or area can be broken down into regions with less variability within the boundaries of a stratum then between the strata. Additionally, strata can be defined based on the decisions that will be made. This type of sampling design uses historical information, known ecological and human receptors, soil type, fate and transport mechanism and other ecological factors to divide the sampling area into smaller regions or strata. Sampling locations are selected from each stratum using random sampling.

The simple random sampling approach is applied when there are many sample locations and the concentrations are assumed to be homogeneous across a site with respect to the parameter(s) that are going to be analyzed or monitored for. The stratified random sampling approach is useful for sampling drums, evaluating and determining treatment and disposal options, and locating and identifying sources of contamination.

3.3 Sampling Techniques

Sampling is the selection of a representative portion of a larger population or body. The primary objective of all sampling activities is to characterize a site accurately in a way that the impact on human health and the environment can be evaluated appropriately.

3.3.1 Sample Collection Techniques

Sample collection techniques may be either grab or composite. A grab sample is a discrete aliquot representative of a specific location at a given time and collected all at once from one location. The representativeness of such samples is defined by the nature of the materials that are sampled. Samples collected for volatile organic compounds (VOCs) are always grab samples and are never homogenized. Composite samples are non-discrete samples composed of more than one specific aliquot collected at selected sampling locations. Composite samples must be homogenized by mixing prior to putting the sample into containers. Composite samples can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. Incremental sampling conducted over a grid is a special case of composite sampling and is detailed in SOP #2019, *Incremental Soil Sampling*. Choice of collecting discrete or composite samples is based on project's DQOs.

3.3.2 Homogenization

Mixing of soil and sediment samples is critical to obtain a representative sample. An adequate volume/weight of sample is collected and placed in a stainless steel or Teflon® container, and is thoroughly mixed using a spatula or spoon made of an inert material. Once the sample is thoroughly mixed the sample is placed into sample containers specific for an analysis. Avoid the use of equipment made of plastic or polyvinyl chloride (PVC) when sampling for organic compounds when the reporting limit (RL) is in the parts per billion (ppb) or parts per trillion (ppt) ranges. Refer to SERAS SOP #2012, *Soil Sampling*, for more details on homogenization.

3.3.3 Filtration

In-line filters are used specifically for collecting groundwater samples for dissolved metals analysis and for filtering large volumes of turbid groundwater. Groundwater samples collected for VOCs are typically not filtered due to potential VOC losses. Filtering groundwater is performed to remove silt particulates from samples to prevent interference with the laboratory analysis. The filters used in groundwater sampling are either cartridge type filters inserted into a reusable housing, or are self-contained and disposable. Filter chambers are usually made of polypropylene housing an inert filtering material that removes particles larger than 0.45 micrometers (µm). Refer to SERAS SOP

#2007, *Groundwater Well Sampling* and SERAS SOP #2013, *Surface Water Sampling*, for more details on filtration techniques.

3.4 Quality Assurance /Quality Control Samples

QA/QC samples provide an evaluation of both the laboratory's and the field sampling team's performance. Including QA/QC samples in a sampling design allows for identifying and measuring sources of error potentially introduced from the time of sample container preparation through analysis. The most common QA/QC samples collected in the field are collocated field duplicates, field replicates, equipment blanks, field blanks and trip blanks. Extra volume/mass is collected for a matrix spike/matrix spike duplicate (MS/MSD) at a frequency of 5% (one in 20 samples). Spiking is performed in the laboratory. For additional information or other QA/QC samples pertinent to sample analysis, refer to SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

Collocated field duplicates may be collected based on site objectives and used to measure variability associated with the sampling process including sample heterogeneity, sampling methodology, and analytical procedures. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. This is useful for determining whether the sample has been homogenized properly. Equipment blanks (also known as rinsate blanks) are typically collected at a rate of one per day. The equipment blank is used to evaluate the relative cleanliness of non-dedicated equipment.

3.5 Sample Containers, Preservation, Storage and Holding Times

The amount of sample to be collected, the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix sampled and the analyses to be conducted. This information is provided in SERAS SOP #2003, *Sample Storage, Preservation, and Handling*. Field personnel need to be cognizant of any short holding times that warrant immediate shipment/transfer to the laboratory.

3.6 Documentation

Field conditions and site activities must be documented. Scribe will be used to document sample locations and generate chain of custody records. Other field measurements not typically entered into Scribe will be documented in a site-specific logbook or in a personal logbook. All sample documentation will be maintained in accordance with SERAS SOP #2002, *Sample Documentation* and SERAS SOP #4005, *Chain of Custody Procedures.*

4.0 RESPONSIBILITIES

4.1 SERAS Task Leaders

Task Leaders (TLs) are responsible for the overall management of the project. Task Leader responsibilities include ensuring that field personnel are well informed of the sampling requirements for a specific project and that SOP and QA/QC procedures stated in the site-specific QAPP are adhered to, issuing a Field Change Form that documents any changes to sampling activities after the QAPP has been approved and maintaining sample documentation.

4.2 SERAS Field Personnel

Field personnel are responsible for reading the QAPP prior to site activities and performing sample collection activities as written. They are responsible for notifying the TL of deviations from sample collection protocols which occurred during the execution of sampling activities. Field staff will collect samples and prepare documentation in accordance with SERAS SOP #2002, *Sample Documentation*. In addition, field personnel are responsible for reading and conforming to the approved site-specific Health and Safety Plan (HASP).

4.3 SERAS Program Manager

The SERAS Program Manager is responsible for the overall technical and financial management of the project.

4.4 SERAS QA/QC Officer

The QA/QC Officer is responsible for reviewing this SOP and ensuring that the information in this SOP is updated on a timely basis. Compliance to this SOP may be monitored by either conducting a field audit or reviewing deliverables prepared by the SERAS TL.

4.5 Health and Safety (H&S) Officer

The H&S Officer is responsible for ensuring that a HASP has been written in conformance with SOP # 3012, *SERAS Health and Safety Guidelines for Field Activities* and approved prior to field activities. Additionally, the H& S Officer is responsible for ensuring that SERAS site personnel's H&S training is current as per SOP # 3006, *SERAS Field Certification Program* and that their medical monitoring is current as per *SERAS SOP #3004, SERAS Medical Monitoring Program.*

SAMPLING EQUIPMENT DECONTAMINATION

CONTENTS

CONTENTS (cont)

SUPERCEDES: SOP #2006; Revision 3.0; 1/23/92; U.S. EPA Contract EP-W-09-031.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which

includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. For the soil and water matrices, these are discussed in ERT/SERAS SOP #2003, Sample Storage, Preservation and Handling. For air and waste samples, sample preservation, containers, handling, and storage are discussed in the specific SOPs for the technique selected.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has

been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

- The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

- If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

- Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

Non-phosphate detergent
Selected solvents (acetone, hexane, nitric acid, etc.)
Tap water
Distilled or deionized water

5.2 Decontamination Tools/Supplies

Long and short handled brushes
Bottle brushes
Drop cloth/plastic sheeting

Paper towels
Plastic or galvanized tubs or buckets
Pressurized sprayers (H_2O)
Solvent sprayers
Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

Trash bags
Trash containers
55-gallon drums
Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In general, the following solvents are typically utilized for decontamination purposes:

- 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- Acetone (pesticide grade)[(1)]
- Hexane (pesticide grade)[(1)]
- Methanol[(1)]

[(1)] - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment

enters the areas of potential exposure. The equipment decontamination plan should include:

- The number, location, and layout of decontamination stations.
- Decontamination equipment needed.
- Appropriate decontamination methods.
- Methods for disposal of contaminated clothing, equipment, and solutions.
- Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

<u>Mechanical</u>

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1 Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2 Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The

elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3 Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station . Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4 Water Basin

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5 Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process.

Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6 Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7 Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8 Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9 Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10 Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1 Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2 Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3 Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4 Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5 Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6 Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the

acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7 Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8 Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9 Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10 Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.

2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

3. Empty soap and water liquid wastes from basins and buckets and store in appropriate drum or container. Refer to the DOT

requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.

5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.

6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.

7. Empty low-pressure sprayer water onto the ground.

8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field. Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day, per type of sampling device for samples, to meet QA2

and QA3 objectives. For further information, refer to ERT/SERAS SOP #2005, Quality Control Samples.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A
Table
SOP #2006
August, 1994

TABLE 1
Soluble Contaminants and Recommended Solvent Rinse

SOLVENT[1]	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents [2]	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent[2]	Hexane	PCBs

(1) - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

(2) - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B
Figures
SOP #2006
August, 1994

FIGURE 1. Contamination Reduction Zone Layout

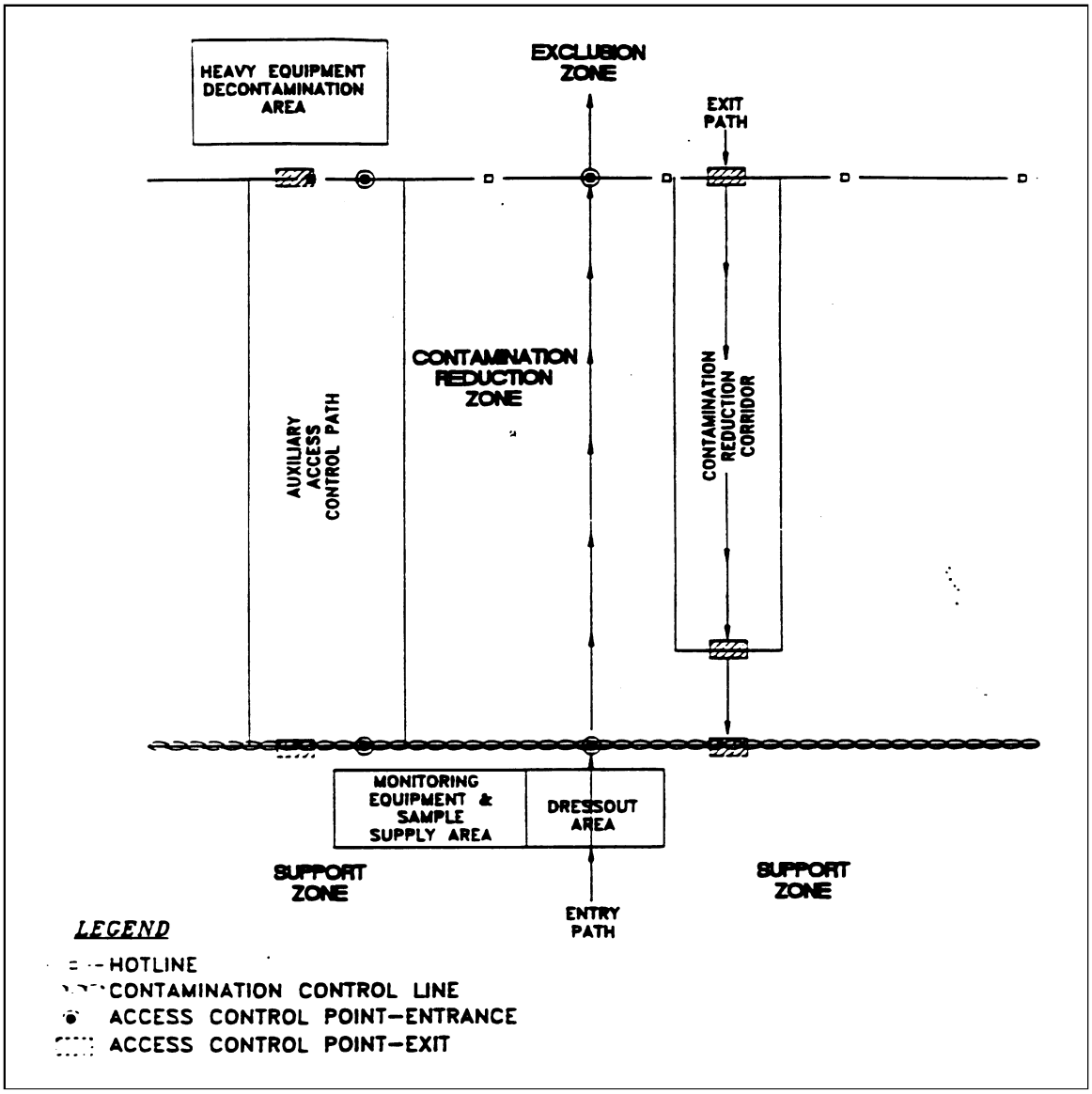
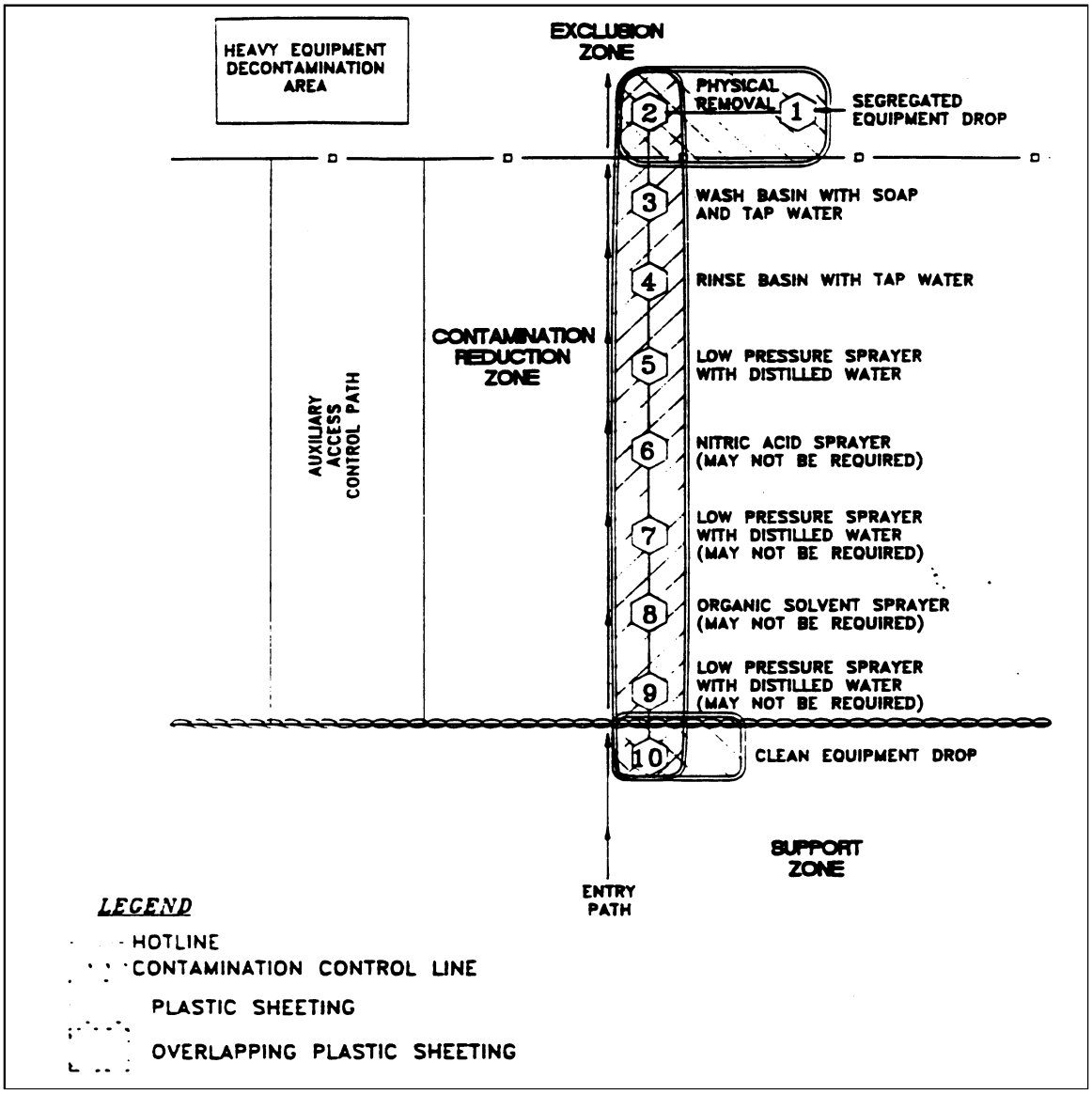


FIGURE 2. Decontamination Layout



SOIL SAMPLING

CONTENTS

*These sections affected by Revision 1.0.

SUPERCEDES: SOP #2012; Revision 0.0; 2/18/00; U.S. EPA Contract 68-C99-223.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for the collection of representative surface soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push technology, or other mechanized equipment (except for a back-hoe). Sample depths typically extend up to 1-foot below ground surface. Analysis of soil samples may define the extent of contamination, determine whether concentrations of specific contaminants exceed established action levels, or if the concentrations of contaminants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with a final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Surface soil samples can be used to investigate contaminants that are persistent in the near surface environment. Contaminants that are detected in the near surface environment may extend to considerable depths, may migrate to the groundwater, surface water, the atmosphere, or may enter biological systems.

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (discrete or composite), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and/or scoop. Sampling at greater depths may be performed using a hand auger, continuous-flight auger, trier, split-spoon sampler, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples must be cooled and maintained at 4^{o}C and protected from sunlight immediately upon collection to minimize any potential reaction. The amount of sample to be collected, proper sample container type and handling requirements are discussed in the Scientific, Engineering, Response Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling.*

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary problems associated with soil sampling: 1) cross contamination of samples, and 2) improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, decontamination of sampling equipment is necessary. The guidelines for preventing, minimizing and limiting cross contamination of samples are discussed in the Environmental Response Team (ERT)/SERAS SOP #2006, *Sampling Equipment Decontamination*. Improper sample collection procedures can disturb the sample matrix, resulting in volatilization of contaminants, compaction of the sample, or inadequate homogenization of the samples (when required), resulting in variable, non-representative results.

5.0 EQUIPMENT/APPARATUS

Soil sampling equipment includes the following:

- Site maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan (HASP)
- Traditional survey equipment or global positioning system (GPS)
- Tape measure
- Survey stakes or flags
- Camera and image collection media
- Stainless steel, plastic*, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Site logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Plastic sheeting
- Spade or shovel
- Spatula(s)
- Scoop(s)
- Plastic* or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoon sampler
- Soil core sampler
  - Tubes, points, drive head, drop hammer, puller jack and grip
- Photoionization detector (PID), Flame ionization detector (FID) and/or Respirable Aerosol Monitor (RAM)

- Backhoe (as required)
- En Core® samplers

* Not used when sampling for semivolatile compounds.

6.0 REAGENTS

Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the analytes to be determined, the sampling methods to be employed, and the types and amounts of equipment and supplies required to accomplish the assignment.

2. Obtain the necessary sampling and air monitoring equipment.

3. Prepare schedules and coordinate with staff, client, and regulatory agencies, as appropriate.

4. Perform a general site reconnaissance survey prior to site entry in accordance with the site specific HASP.

5. Use stakes or flags to identify and mark all sampling locations. Specific site factors, including extent and nature of contamination, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared prior to soil sampling; utility clearances must be confirmed before beginning intrusive work.

6. Pre-clean and decontaminate equipment in accordance with the site specific work plan, and ensure that it is in working order.

7.2 Sample Collection

7.2.1 Surface Soil Samples

The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The over-burden or over-lying surface material is removed to the required depth and a stainless steel or plastic scoop is used to collect the sample. Plastic utensils are not to be used when sampling for semivolatile compounds.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected by this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials must not be used.

The following procedure is used to collect surface soil samples:

1. If volatile organic compound (VOC) contamination is suspected, use a PID to monitor the sampler's breathing zone during soil sampling activities.

2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard sticks, rocks, vegetation and other debris from the sampling area.

3. Accumulate an adequate volume of soil, based on the type(s) of analyses to be performed, in

a stainless, plastic or other appropriate container.

4. If volatile organic analysis is to be performed, immediately transfer the sample directly into an appropriate, labeled sample container with a stainless steel spoon, or equivalent, and secure the cap tightly to ensure that the volatile fraction is not compromised. Thoroughly mix the remainder of the soil to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly, or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, head, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger head. If additional sample volume is required, multiple grabs at the same depth are made. If a core sample is to be collected, the auger head is then replaced with a tube auger. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected.

Several types of augers are available; these include bucket or tube type, and continuous flight (screw) or post-hole augers. Bucket or tube type augers are better for direct sample recovery because a large volume of sample can be collected from a discrete area in a short period of time. When continuous flight or post-hole augers are used, the sample can be collected directly from the flights or from the borehole cuttings. The continuous flight or post-hole augers are satisfactory when a composite of the complete soil column is desired, but have limited utility for sample collection as they cannot be used to sample a discrete depth.

The following procedure is used for collecting soil samples with an auger:

1. Attach the auger head to an extension rod and attach the "T" handle.

2. Clear the area to be sampled of surface debris (e.g., twigs, rocks, litter). It may be advisable to remove a thin layer of surface soil for an area approximately six inches in radius around the sampling location.

3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents the accidental brushing of loose material back down the borehole when removing the auger or adding extension rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.

4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger head, proceed to Step 10.

5. Remove auger tip from the extension rods and replace with a tube sampler. Install the

proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.

7. Remove the tube sampler and unscrew the extension rods.

8. Remove the cutting tip and the core from the device.

9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the core or a discrete portion of the core into the appropriate labeled sample container using a clean, decontaminated stainless steel spoon. If required, homogenize the sample as described in Step 10.

10. If VOC analysis is to be performed, transfer the sample directly from the auger head into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger head to the drill assembly, and follow steps 3 through 11, making sure to decontaminate the auger head and tube sampler between samples.

12. Abandon the hole according to applicable state regulations.

7.2.3 Sampling at Depth with a Trier

The system consists of a trier and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a zero degree to forty-five degree (0^o to 45^o) angle from the soil surface plane. This orientation minimizes the spillage of sample.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. If VOC analyses are required, transfer the sample directly from the trier into an appropriate, labeled sample container with a stainless steel spoon, or equivalent device and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; if composite samples are to be collected, place a sample from another sampling interval into the

homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18- or 24- inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with American Society for Testing and Materials (ASTM) D1586-99, "*Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".*

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the head piece on top.

2. Place the sampler at a 90 degree (90^{o}) angle to the sample material.

3. Using a well ring, drive the sampler. Do not drive past the bottom of the head piece or compression of the sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain the sample.

5. Withdraw the sampler, and open it by unscrewing the bit and head, and then splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2- and 3.5-inch diameter tubes. A larger barrel (diameter and/or length) may be necessary to obtain the required sample volume.

6. Without disturbing the core, transfer it to the appropriately labeled sample container(s) and seal tightly. Place the remainder of the sample into a stainless steel, plastic, or appropriate homogenization container, and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into the appropriate, labeled containers and secure the caps tightly, or if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.

7. Abandon the hole according to applicable state regulations.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil when a detailed examination of stratigraphy and soil characteristics is required. The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is imperative to ensure that all sampling locations are clear of overhead and buried utilities.

2. Review the site specific HASP and ensure that all safety precautions including appropriate monitoring equipment are installed as required.

3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.

4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.

5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

6. If VOC analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.

7. Abandon the pit or excavation according to applicable state regulations.

7.2.6 Sampling for VOCs in Soil Using an En Core® Sampler

An En Core® sampler is a single-use device designed to collect and transport samples to the laboratory. The En Core® sampler is made of an inert composite polymer and reduces the open-air handling of soil samples in the field and in the laboratory; thereby, minimizing losses of VOCs.

1. Assemble the coring body, plunger rod and T-handle according to the instructions provided with the En Core® sampler.

2. Turn the T-handle with the T-up and the coring body down and push the sampler into the soil until the coring body is completely full. Remove the sampler from the soil. Wipe excess soil from the coring body exterior.

3. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. Be sure that the cap is seated properly to seal the sampler. Push and cap to lock arm in place.

4. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.

5. Attach the label to the coring body cap, place in a plastic zippered bag, seal and put on ice.

Generally, three En Core® samplers are required for each sample location. These samplers are shipped to the laboratory where the cap is removed and the soil samples are preserved with methanol or sodium bisulfate.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

2. All data must be documented in site logbooks or on field data sheets. At a minimum, the following data is recorded:

Sampler's name and affiliation with project
Sample number
Sample location
Sample depth
Approximate volume of sample collected
Type of analyses to be performed
Sample description
Date and time of sample collection
Weather conditions at time of sampling
Method of sample collection
Sketch of sample location

2. All instrumentation must be operated in accordance with applicable SOPs and/or the manufacturer's operating instructions, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and must be documented.

3. The types of quality control (QC) samples to be collected in the field shall be documented in the site-specific Work Plan.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific HASP.

12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1989. *Soil Sampling Quality Assurance User's Guide*. EPA-600/8-89-046.

U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II.* Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, ER, B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

American Society for Testing and Materials. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D 1586-99.

En Novative Technologies, Inc. 2001. *En Core® Sampler Sampling Procedures*. Web site access. March 13, 2001.

APPENDIX A
Figures
SOP #2012
July 2001

FIGURE 1. Sampling Augers

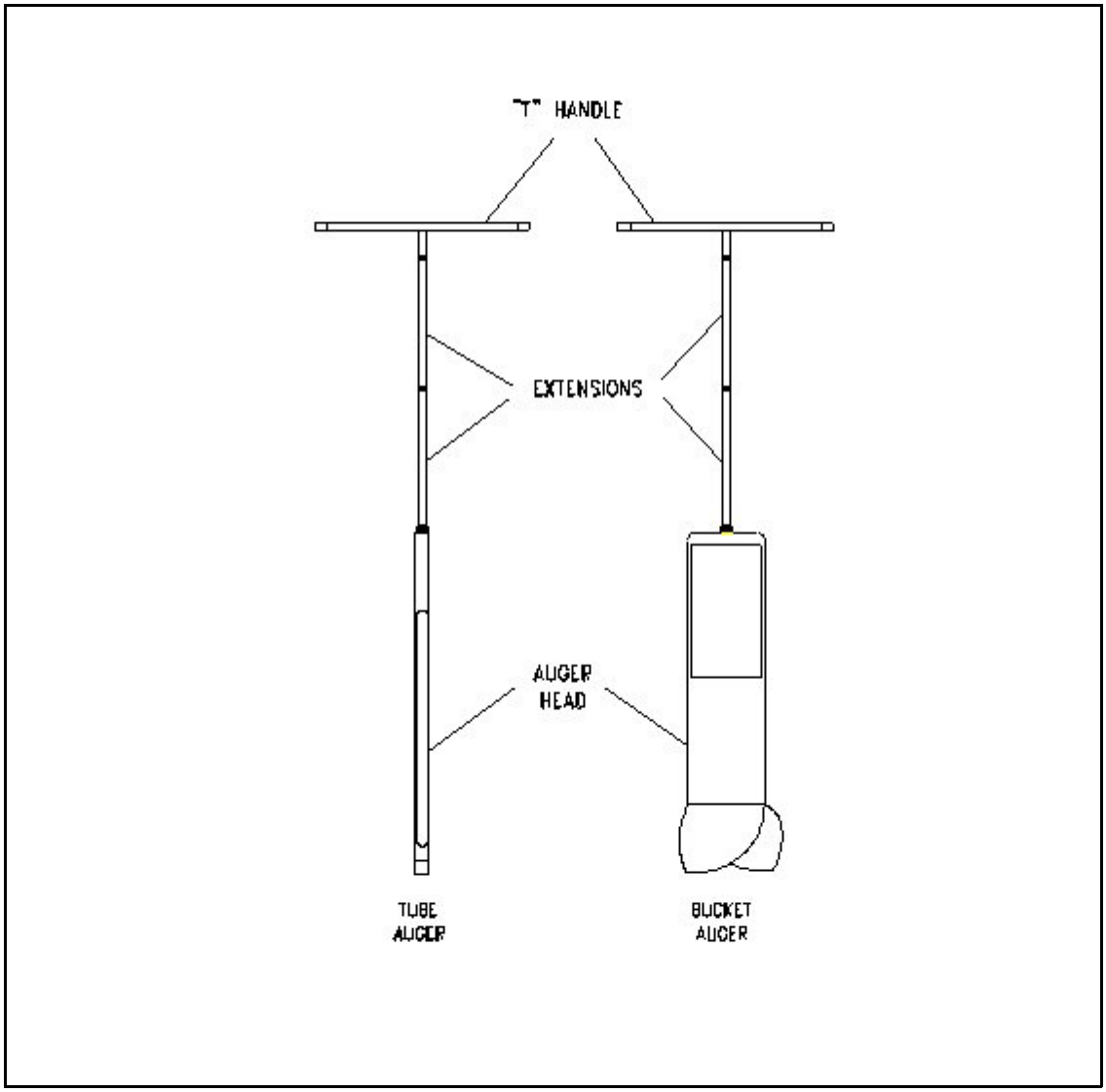
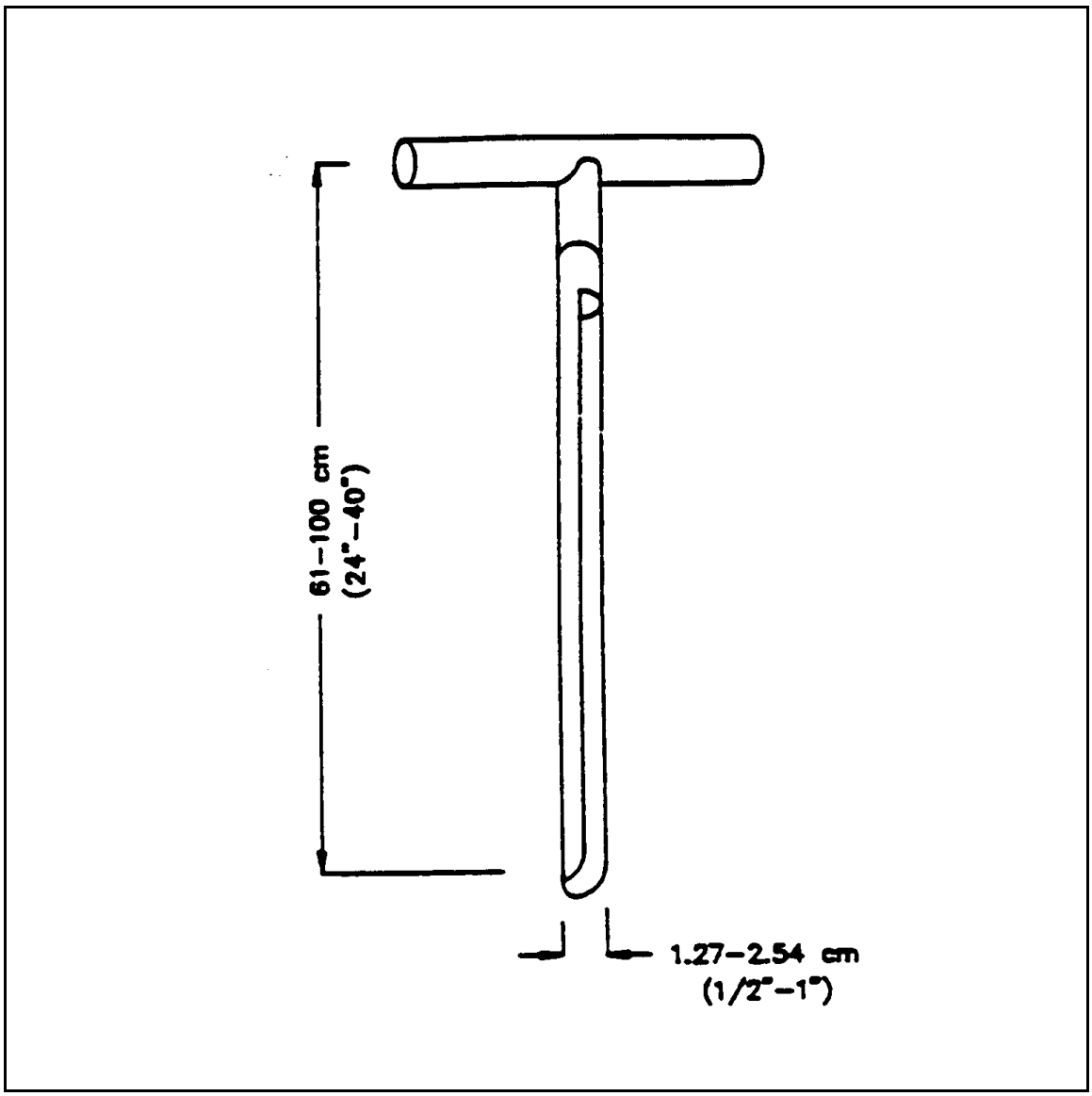


FIGURE 2. Sampling Trier


61-100 cm
(24"-40")
1.27-2.54 cm
(1/2"-1")

Weston Solutions, Inc.
Suite 201
1090 King Georges Post Road
Edison, New Jersey 08837-3703
732-585-4400 • Fax: 732-225-7037
www.westonsolutions.com

The Trusted Integrator for Sustainable Solutions

REMOVAL SUPPORT TEAM 3
EPA CONTRACT EP-S2-14-01

April 17, 2017

Mr. Andy Confortini, On-Scene Coordinator
U.S. Environmental Protection Agency
Removal Action Branch
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT No.: EP-S2-14-01
TDD No.: TO-0007-0124
DOCUMENT CONTROL No.: RST3-03-F-0061

SUBJECT: FINAL SITE-SPECIFIC COMMUNITY AIR MONITORING PLAN - RARITAN BAY SLAG SITE, OLD BRIDGE, MIDDLESEX COUNTY, NEW JERSEY

Dear Mr. Confortini,

Enclosed please find the Final Site-Specific Community Air Monitoring Plan (CAMP) for the air monitoring and sampling activities to be conducted in support of the Removal Action at the Raritan Bay Slag Site located in Old Bridge, Middlesex County, New Jersey. Site activities are expected to commence in March/April 2017. The U.S. Environmental Protection Agency comments regarding the draft versions of this deliverable have been incorporated.

If you have any questions or comments, please do not hesitate to contact me at (732) 570-4997.

Sincerely,

Weston Solutions, Inc.

For Michael Lang
RST 3 Site Project Manager

Enclosure
cc: TDD File No.: TO-0007-0124

Final Site-Specific Community Air Monitoring Plan for Environmental Services/ Excavation Activities

U.S. EPA, Region 2
Removal Action

Site:

Raritan Bay Slag Site
Old Bridge, Middlesex County, New Jersey

Prepared for:

US EPA, Region 2
Removal Action Branch
2890 Woodbridge Avenue
Edison, NJ 08837

Prepared by:

Removal Support Team 3
Weston Solutions, Inc.
1090 King Georges Post Road, Suite 201
Edison, NJ 08837

April 17, 2017

TDD No.: TO-0007-0124
DCN: RST3-03-F-0061

Author: Michael Lang

Title: RST 3 Site Project Manager

Date: April 17, 2017

Reviewer: Timothy Benton

Title: RST 3 Operations Leader

Date: *April 17*, 2017

Table of Contents

Tables

Attachments

1.0 INTRODUCTION

This Site-Specific Community Air Monitoring Plan (CAMP) has been prepared for the Removal Action to be implemented at the Raritan Bay Slag Site (the Site) which is scheduled to begin in the March/April 2017. The Site is located in Old Bridge, Middlesex County, New Jersey and encompasses approximately 40 acres along the Raritan Bay shoreline. Site features include an active park, seawall, beach areas, and a marshland area (Margaret's Creek).

During the late 1960's, a seawall was constructed using slag material containing high concentrations of residual lead. As a result of Hurricane Sandy, shoreline material was deposited in portions of the Old Bridge Waterfront Park. The U.S. Environmental Protection Agency (EPA) Removal Action Branch (RAB) was tasked with removing storm-deposited debris from the park, assessing and remediating park surface soils that had become contaminated with lead, repairing damaged portions of the seawall, and establishing fencing and signage along the park. These activities were completed in October 2013.

In August 2014, EPA's Division of Environmental Science and Assessment (DESA) conducted sampling activities in the Margaret's Creek portion of the Site to determine if the effects of Hurricane Sandy had caused the migration of previously documented surface soil lead contamination. The sample results confirmed the presence of elevated lead concentrations in previously identified areas and that migration had occurred.

In September and October 2014, Weston Solutions, Inc., Removal Support Team 3 (RST 3) mobilized to the Site to assist the EPA On-Scene Coordinator (OSC) with the collection of additional soil samples, documentation of test pits in areas where surficial slag/battery casing materials were observed, and the reconnaissance and sampling of crushed battery casings. Based on the analytical results of the soil samples collected from the Site in September and October 2014, lead was detected at concentrations ranging from 1.8 milligrams per kilogram (mg/kg) to 66,000 mg/kg. A total of 35 soil samples contained concentrations of the lead exceeding 400 mg/kg, EPA's Cleanup Criteria for the Site. A total of four crushed battery casing samples contained concentrations exceeding the 5 milligrams per liter (mg/L) Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) Regulatory Limit. Lead was detected at concentrations ranging from 2.6 mg/L to 23 mg/L in the battery casing samples. In addition to the September and October 2014 sampling results, slag material was observed in test pits excavated within Areas of Concern (AOC) 5 and 7, and in the vicinity of the August 2014 DESA sampling location Area 9 Post-Sandy (A9PS) 27 (A9PS27). Based on the identification of slag material, EPA determined that additional investigation work in the Margaret's Creek area was warranted for delineation purposes.

The objectives of the additional investigation work in December 2014 were to delineate the extent of visible slag identified during previous investigations (AOC 5, AOC 7, and A9PS27) and to determine if slag material was present throughout other portions of the Site. A total of 79 test pits were excavated during the investigation. Test pit operations delineated the areal extent of slag material at AOC 5 (26,735 cubic feet [ft^3]), AOC 7 (72,440 ft^3), and A9PS27 (33,103 ft^3). Volume calculations were conducted in Geographic Information System (GIS) and were based on an average slag waste thickness of 4 feet. A total of nine test pits contained slag out of the 79 test pits investigated. The depth to slag material ranged from just below the surface to 7 feet below ground surface (bgs). Non-slag material encountered during excavation and sampling

activities included wood waste, asphalt, metal, concrete, and brick material and several large diameter telephone poles.

In March/April 2015, as part of the delineation of the Site, RST 3 collected 80 soil samples from areas designated by the EPA OSC and submitted the samples to EPA's DESA laboratory for lead analysis. On April 15, 2015, RST 3 collected 20 soil samples and submitted the samples to EPA's DESA laboratory for lead analysis. The objective of the March/April 2015 sampling was to delineate the areas to be excavated as part of the 2015 Removal Action.

On April 13, 2015, EPA and RST 3 mobilized to the Site to begin Removal Action activities. RST 3 deployed four air stations to monitor dust levels around the perimeter of the Site. On April 21, 2015, RST 3 collected three air samples and submitted the samples to Bonner Analytical Testing Co. for lead analysis. The Removal Action activities consisted of the excavation and off-site disposal of soil located in AOCs 2, 3, and 4. On May 20, 2015, RST 3 demobilized from the Site as the EPA OSC suspended Removal Action activities due to the discovery of an endangered turtle breading area that runs through the Site.

During the week of February 22, 2016, EPA and RST 3 mobilized to the Site to complete the soil delineation sampling activities in the southwestern portion of the Site. As part of the sampling event, a total of 129 soil samples were collected from locations identified by the EPA OSC. All samples were submitted to the DESA laboratory for lead analysis. The validated analytical results of the soil samples indicated additional areas of the Site that contained elevated concentrations or lead which required further Removal Action activities.

On April 11, 2016, Removal Action activities at the Site resumed. As part of the removal activities, RST 3 was tasked with establishing the excavation boundaries based on the validated analytical results of the February 2016 sampling event. In addition to documenting all removal activities, RST 3 established perimeter air monitoring stations during intrusive activities and collected post excavation soil samples per the direction of the EPA OSC. This phase of the Removal Action included the excavation and off-site disposal of several areas located throughout the western portion of the Site. Post excavation soil samples were collected by RST 3 to document that the objectives of the Removal Action were achieved. This phase of the Removal Action was completed in May 2016.

Based upon the analytical results from prior remedial investigations conducted at the Site, EPA determined that specific areas within Margaret's Creek required additional delineation sampling. In addition, as part of the 2016 Removal Action conducted at the Site, areas of the documented battery casings were hand-picked by the EPA's Emergency and Rapid Response Services (ERRS) Contractor. However, the soil within these areas was not previously sampled to determine the lead content after the hand-picking of the battery casings was complete. Therefore, in order to ascertain the level of Site-related contamination in these areas, on July 6 and 7, 2016 and August 3, 2016, RST 3 mobilized to the Site to provide EPA with soil sampling support. RST 3 was tasked by the EPA with the collection of soil samples from locations selected by the EPA OSC in AOCs identified at the Site, as well as the hand-picked battery casing areas. A total of 39 soil samples, including one field duplicate, were collected from 12 locations within four of the AOCs (Areas B, M, S, and T) identified as part of previous investigation of the Site. An additional 112 soil samples, including seven field duplicates, were collected from areas of the Site where the hand-picking of battery casings was completed by the EPA's ERRS Contractor.

The validated analytical results of the soil samples collected by RST 3 during the July and August 2016 sampling event were compared with EPA RMLs for residential soils (EPA's Cleanup Criteria for the Site). The EPA's Cleanup Criteria for lead is 400 mg/kg. Based upon the validated analytical results, concentrations of lead above the EPA's Cleanup Criteria were only detected in one of the four AOCs identified as part of previous investigation of the Site (Area S). Concentrations of lead in samples collected from this area ranged from 5.8 mg/kg to 78,000 mg/kg, with a total of six soil samples indicating concentrations of lead above the EPA's Cleanup Criteria. Based upon the validated analytical results, concentrations of lead above the EPA's Cleanup Criteria was detected in 11 of the 112 soil samples collected from areas of the Site where the hand-picking of battery casings was completed by the EPA's ERRS Contractor. Concentrations of lead in samples collected from these areas ranged from 7.4 mg/kg to 1,900 mg/kg.

Additional delineation activities at the Site are currently ongoing.

1.1 Community Air Monitoring Program Objectives

The primary contaminant of concern in on-site soils is lead. The selected remedy for the Removal Action is the excavation and off-site disposal of lead-contaminated soils and slag. Work zone activities at the Site will include, but are not limited to, soil and slag excavation and handling, road clearing/construction, as well as activities involving the loading and transporting of material for off-site disposal. Since Site activities could generate dust which may potentially contain elevated concentrations of lead the following objectives have been set for the Site air monitoring program:

- Establish Site-Specific Action Levels for dust/Site contaminants;
- Continuously monitor dust particulate concentrations in air to ensure that off-site migration of contaminants remains below the Site-Specific Action Levels;
- Collect confirmation air samples for lead to ensure that levels of this contaminant are below acceptable risk-based levels; and
- Establish corrective actions to be taken in the event that temporary exceedances of Site-Specific Action Levels are experienced.

This Site-Specific CAMP outlines the air quality monitoring and sampling procedures to be followed to protect on-site personnel and the surrounding community from potential airborne contaminant releases during the implementation of the Removal Action.

2.0 PERIMETER AND COMMUNITY AIR MONITORING

2.1 Air Monitoring Procedures

Air monitoring activities will be conducted in accordance with the procedures outlined within the EPA guidance document entitled, "Superfund Program Representative Sampling Guidance, Volume 2: Air (Short-Term Monitoring), Interim Final. 1995. EPA 540/R-95/140. (OSWER Directive 9360.4-09, PB 96-963206)." Appropriate activities as outlined within this document include the monitoring necessary to ensure appropriate Health & Safety levels for protection of on-site personnel and to ensure that the surrounding community is not exposed to Site-related constituents at concentrations above the Site-Specific Action Levels.

Real-time particulate air monitors (*e.g.*, DustTraks or equivalent) equipped with $PM_{2.5}$ (particulate matter smaller than 2.5 microns in diameter) detectors will be used to monitor dust levels throughout the duration of the Removal Action. The monitors will be operated each workday and will measure $PM_{2.5}$ dust concentrations in real time. The monitors are calibrated by the equipment manufacturer prior to being used at the Site. When the monitors are turned on daily, the instrument is self-calibrating. Once turned on, the monitors record dust concentrations on a 15-minute time-weighted average (TWA). Meteorological data consisting of wind speed, wind direction, temperature, and barometric pressure will be recorded each day and used to determine the ordinal positioning of the monitoring equipment (*i.e.,* determining upwind and downwind locations). All air monitoring data with time, current activity, and the locations of monitoring equipment will be recorded in the on-site files and will be available for review. Meteorological data will be obtained from Weather Underground (http://www.wunderground.com/) and recorded daily in the Site logbook. EPA's MyEnvironment (http://www.epa.gov/myenvironment) will also be reviewed to determine if any area sources are present in the area that could impact on-site activities.

Perimeter air monitoring will consist of continuous real-time air quality monitoring and data collection at up to five air monitoring stations established around the area of intrusive activities. Monitoring locations will be upwind, downwind, and in an ordinal direction around areas of intrusive site activity (refer to Attachment A, Figure 1 for the Example Air Monitoring/Sampling Station Layout Map). The monitoring stations will be linked via a Netronics system (a wireless network-based communications system) which will provide instantaneous real-time air quality readings through a computer server which will be monitored throughout each days intrusive activities to ensure that the Site-Specific Action Level for $PM_{2.5}$ particulates are not exceeded (refer to Section 2.2). The air monitoring data generated will help determine if dust suppression activities are effective at maintaining dust levels below the Site-Specific Action Levels. Although air monitoring data from each monitoring station is automatically being stored real-time in a computer server, to ensure that the daily documentation of particulate monitoring is captured, the air monitoring data will also be downloaded from each DustTrak unit to a computer or electronic data storage device at the end of each workday.

Table 2-1: Air Monitoring Specifications

Direct Reading Instrumentation	Monitoring Locations	Monitored Parameters
DustTraks	• Perimeter monitoring • Workspace monitoring	Total $PM_{2.5}$ Particulates

2.2 Basis for Establishing the Air Monitoring Action Levels

The community air monitoring program at the Site consists of a combination of perimeter and community monitoring for particulates (dust). The first step in developing the Site-Specific Action Level for $PM_{2.5}$ particulates was to evaluate the on-site soil sample lead validated data for all historical samples collected from the areas of proposed intrusive activities (included 487 total soil samples). This data set was averaged which generated a lead concentration in soil of 790

mg/kg (refer to Attachment B for the averaged data set). This average lead value in soil was inputted into the Chemical Dust Action Level (CDAL) calculation as follows:

CDAL Action Level ($\mu g/m^3$) =

$$\frac{\text{(Risk-Based Action Concentration (using the RSL/NAAQS/NJAAQS value of 0.15 } \mu g/m^{3*})}{\text{[(Csoil = average concentration in soil - mg/kg)/1,000,000 mg/kg]}}$$

$$\frac{0.15\ \mu g/m^3}{(790\ mg/kg/100{,}000{,}000\ mg/kg) = 189.9\ \mu g/m^3}$$

* The Regional Screening Level (RSL) for residential air and the National Ambient Air Quality Standard/New Jersey Ambient Air Quality Standard (NAAQS/NJAAQS) value is considered protective of public health, including "sensitive" populations such as asthmatics, children and the elderly

CDAL	= Chemical Dust Action Level
RSL	= EPA Regional Screening Level
NAAQS	= EPA National Ambient Air Quality Standards
NJAAQS	= New Jersey Ambient Air Quality Standards
$\mu g/m^3$	= Micrograms per cubic meter
mg/m^3	= Milligrams per cubic meter

The calculated CDAL Action Level (189.9 $\mu g/m^3$) is less conservative than the New York State Department of Environmental Conservation (NYSDEC) standard particulate action level of 150 $\mu g/m^3$ [there is no established New Jersey Department of Environmental Protection (NJDEP) particulate action level which is why the NYSDEC standard is referenced]. Therefore, to ensure that the most protective action level for $PM_{2.5}$ particulates is utilized for the Removal Action to be completed at the Site, a Site-Specific Action Level of 150 $\mu g/m^3$ [0.15 milligrams per cubic meter (mg/m^3)] has been established. This standard will serve as the Site-Specific Action Level for the duration of the Removal Action. See Table 2-2 for the air monitoring Site-Specific Action Levels for particulates at the Site.

Table 2-2: Community Air Monitoring Action Levels for Particulates (Direct Reading Instrumentation)

Parameter	Monitoring Locations and Interval	Action Levels (Above Upwind)	Response Activity
Dust ($PM_{2.5}$)	Perimeter and community monitoring locations with dust readings every 60 seconds, calculate 15-minute average during Removal Action activities.	< 100 $\mu g/m^3$	• Continue monitoring.
		≥ 100 $\mu g/m^3$	• Continue monitoring. • Begin dust suppression measures. • Notify field crew that early warning alert level has been reached.
		≥ 150 $\mu g/m^3$	• Cease activities; re-evaluate dust suppression measures. • Analyze collected air samples for the contaminant of concern. • If during transport and disposal of hazardous waste, commence community air monitoring.

2.3 Non-working Hours

No release of contaminants above background levels is anticipated during non-working hours, therefore, no monitoring will be conducted during that time period.

2.4 Equipment Maintenance and Calibration

All air monitoring equipment will be maintained in accordance with applicable manufacturer recommendations. All pertinent data will be logged in a health and safety logbook (or equivalent) and maintained on site for the duration of site activities. All direct-reading instrumentation will be calibrated in accordance with the manufacturer's instructions.

2.5 Engineering Controls

Dust suppression measures, utilizing a water fog, will be the primary engineering control used during all site intrusive activities. It will be implemented as necessary to prevent the generation of dust during excavation and material handling operations. Water will be used to wet the surfaces of all contaminated stockpiles, loading areas, access roads, and areas being excavated.

3.0 AIR SAMPLING

3.1 Air Sampling Procedures

In addition to real-time dust monitoring, each monitoring station will be equipped with a low flow air sampling pump (Gilian GilAir® programmable pumps, or equivalent) for sample collection. Air samples will be collected in accordance with the National Institute of Occupational Safety and Health (NIOSH) Method 7300 or the EPA/Contract Laboratory Program (CLP) equivalent (refer to Attachment C). Air samples will be collected using a solid sorbent tube (0.8-µm, cellulose ester membrane, or 5.0-µm, polyvinyl chloride membrane) at flow rates between 1.0 and 4.0 liters per minute (L/min). Air samples will be collected daily from perimeter and community air monitoring locations (refer to Attachment A, Figure 1 for the Example Air Monitoring/Sampling Station Layout Map). For five days during the initial intrusive activities to be conducted at the Site, air samples will be submitted for lead laboratory analysis with a 24 hour turnaround time to ensure that the concentrations of lead in air are below the established Site-Specific Action Levels (refer to Table 3-1). If the air samples collected as part of the initial five day sampling period indicate concentrations below the air sampling Site-Specific Action Level then the Site-Specific Action Level for $PM_{2.5}$ particulates will be used as a guide to ensure that the Occupational Safety and Health Administration (OSHA) Permissible Exposure Level (PEL) is not being exceeded. Therefore, following the initial five day sampling period, it is anticipated that the air samples will only be submitted for laboratory analysis if particulate concentrations exceed 150 $\mu g/m^3$.

The samples will be analyzed in accordance with NIOSH Method 7300 or the EPA/CLP equivalent. The work zone activities include, but are not limited to, soil excavation and handling, road clearing/construction, as well as activities involving the loading and transporting of material off-site. Dust control measures will be the primary engineering control during all Site activities.

The OSHA has set a PEL of 0.5 mg/m^3 (50 µg/m^3) for lead dust. That is the level at which OSHA Rule does not allow a "worker" to be exposed over an 8 hour period. The PEL is an 8 hour TWA sample.

Table 3-1: NIOSH Sampling Procedures

Analyte	Sampling Method	Sampling Media	Recommended Flow Rate (Liters per Minute)*	Total Volume	Site-Specific Action Level
Lead	NIOSH Method 7300	MCE Filters (0.8-µm , cellulose ester membrane, or 5.0-µm, polyvinyl chloride membrane)	1.0 to 4.0 L/min	> 500 Liters	50 µg/m^3

Notes:

* Actual flow rates will be determined in the field based on prevailing Site conditions. Humidity conditions and precipitation events may require air sampling activities to be cancelled for the day.

For the purposes of air sampling, the OSHA Action Level for lead that will be utilized is 30 µg/m^3 to begin dust suppression measures. If the Action Level of 50 µg/m^3 is reached or exceeded, all on-site work activities will be stopped with an evaluation conducted on the need for any additional off-site sampling and/or monitoring. See Table 3-1 for the air sampling Site-Specific Action Levels established for the Removal Action at the Site.

Table 3-2: Community Air Sampling Action Levels

Parameter	Sampling Interval and Locations	Action Levels (Above Background)	Response Activity
Contaminant of Concern	Upon initiating intrusive activities and periodically; at perimeter and community monitoring locations	<30 µg/m^3 – Lead	• Continue monitoring $PM_{2.5}$.
		>30 µg/m^3 – Lead	• Begin dust suppression measures.
		>50 µg/m^3 – Lead	• Cease activities; investigate cause. • Re-evaluate dust suppression measures. • Consider additional off-site air monitoring/sampling. • Evaluate site conditions for other engineering control options.

3.2 Non-working Hours

No release of contaminants above background levels is anticipated during non-working hours; therefore, no air sampling will be conducted during that time period.

4.0 REPORTING OF AIR MONITORING AND SAMPLING RESULTS

4.1 Community Notification Procedures

The specific community notification procedures will be at the discretion of the EPA OSC. The exact notification procedures will be developed based on the most feasible means of getting

information to the surrounding community in an effective, useful, and timely manner and will involve utilizing a call down list to notify potentially impacted parties.

4.2 On-Site Reporting Procedures

The Site Health and Safety Representative will maintain a sample log and report airborne levels on a daily basis to the EPA OSC. Elevated results (above Site-Specific Action Levels) will be reported immediately to the EPA OSC so that appropriate engineering controls can be implemented to reduce airborne levels.

4.3 Reporting Procedures for Site Employees

Where personal sampling for on-site workers is performed, the Contractor will be responsible for informing employees and subcontractors of their monitoring results to comply with OSHA regulations and good occupational health practices. Within five working days after the receipt of monitoring results, the Contractor will notify each employee of the results representing that employee's level of exposure.

Whenever the results indicate that employee exposure exceeds the OSHA PELs, notification shall be provided to the affected employee stating that the OSHA PEL was exceeded and providing a description of the corrective action taken to reduce exposures to a level below the OSHA PELs.

4.4 Reporting Procedures for the Analytical Laboratory

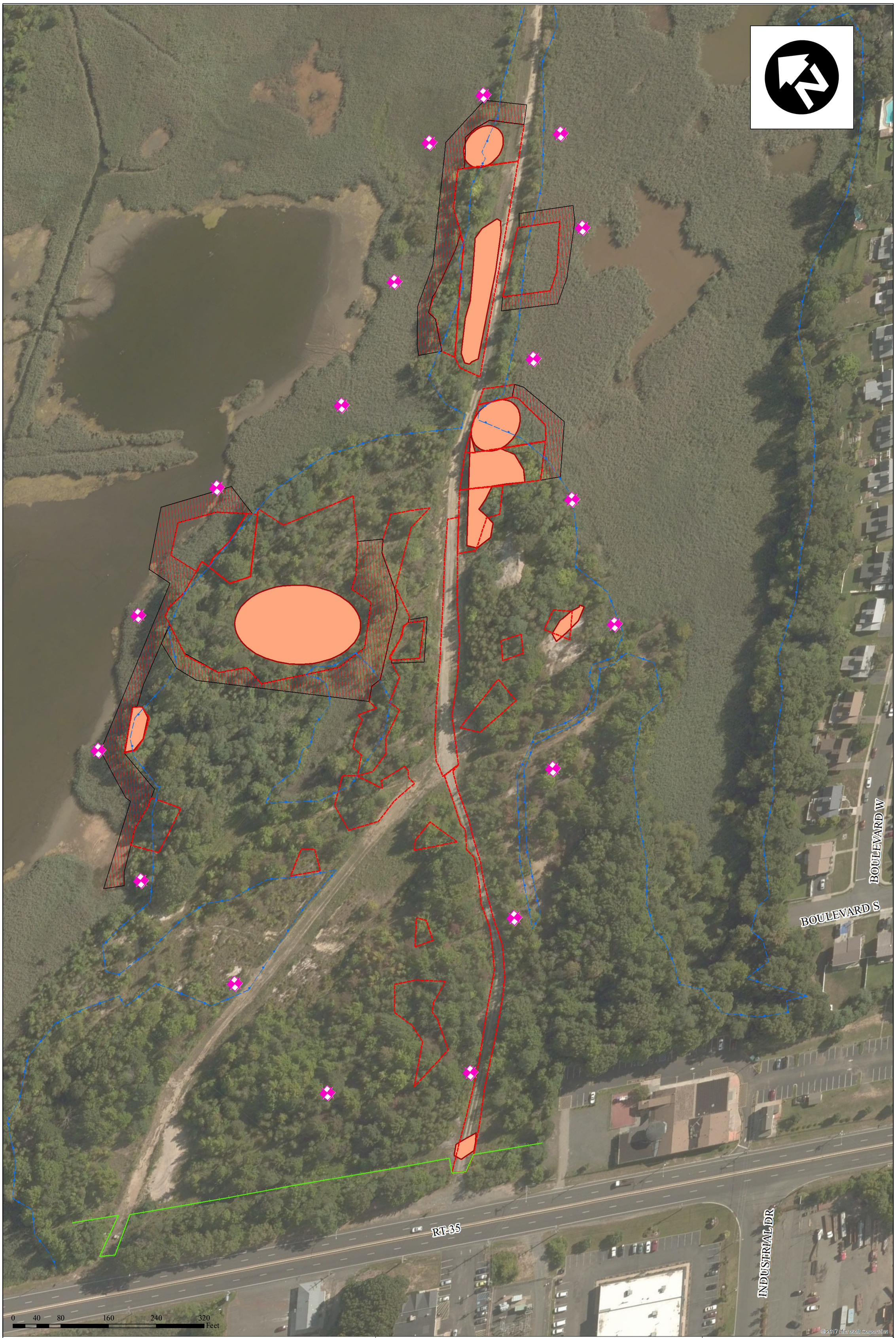
Chain-of-custody (COC) procedures will be followed during sample handling and transport to the accredited laboratory. Areas sampled, tasks performed, duration, volumes, and laboratory results will be provided in a letter report format within the established timeline determined by the EPA OSC. Sampling and analysis will be performed in accordance with the appropriate NIOSH method under the direction of the EPA OSC.

4.5 Data Review and Interpretation

The general public will be able to review the captured data for the Site once the air sampling data has been validated and finalized, and based upon the EPA OSC’s authorization for release of the information. Monitoring records will be maintained on site.

Attachment A

Figure 1: Example Air Monitoring/Sampling Station Layout Map



LEGEND

- Pre-Established Air Monitoring/Sampling Station*
- Fenceline
- Wetland Area
- Documented Slag Area

Proposed Scope of Work Area

- Proposed Excavation Area
- Proposed Secondary Excavation Area

Notes:

1.) * = Actual locations will be based on the size of the work area and prevailing wind direction.
2.) This figure represents the example air monitoring/sampling station layout.
3.) Up to five air monitoring/sampling stations will be established daily around the current intrusive work area.
4.) The stations will be established to represent upwind, downwind, and ordinal locations and will be protective of any potential community receptors.

Weston Solutions, Inc.
Federal East Division

In Association With
Scientific and Environmental Associates, Inc.,
Environmental Compliance Consultants, Inc.,
Avatar Environmental, LLC, On-Site Environmental, Inc., and Sovereign Consulting, Inc.

Figure 1: Example Air Monitoring/ Sampling Station Layout Map

RARITAN BAY SLAG SITE
OLD BRIDGE, NEW JERSEY

U.S. ENVIRONMENTAL PROTECTION AGENCY
REMOVAL SUPPORT TEAM 3
CONTRACT # EP-S2-14-01

DRAWN BY:	T. BENTON
EPA OSC:	A. CONFORTINI
RST SPM:	M. LANG
PROJECT #:	30400.031.007.3124

DATE MODIFIED: 2/23/17

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Attachment B

Data Set Used to Calculate Site-Specific Particulate Action

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
A9-6B-002-3036-01	M	200
A9-6B-002-4248-01	M	66
A9-AB-SS001-3036-01	B	3
A9-AB-SS001-3642-01	B	26
A9-AB-SS001-4248-01	B	10
A9-AB-SS002-3036-01	B	6
A9-AB-SS002-3642-01	B	4
A9-AB-SS002-4248-01	B	2
A9-AM-SS001-0006-01	M	350
A9-AM-SS001-0006-02	M	230
A9-AM-SS001-1218-01	M	18
A9-AM-SS001-2430-01	M	8
A9-AM-SS002-0006-01	M	140
A9-AM-SS002-1218-01	M	32
A9-AM-SS002-2340-01	M	10
A9-AM-SS003-0006-01	M	190
A9-AM-SS003-1218-01	M	100
A9-AM-SS003-2430-01	M	54
A9-AS-SS001-0006-01	S	180
A9-AS-SS001-1218-01	S	130
A9-AS-SS001-2430-01	S	78,000
A9-AS-SS001-3642-01	S	960
A9-AS-SS001-4854-01	S	280
A9-AS-SS002-0006-01	S	140
A9-AS-SS002-1218-01	S	45
A9-AS-SS002-2430-01	S	15
A9-AS-SS002-3642-01	S	26
A9-AS-SS002-4854-01	S	6
A9-AS-SS003-0006-01	S	4,800
A9-AS-SS003-1218-01	S	36,000
A9-AS-SS003-2430-01	S	29,000
A9-AS-SS003-3642-01	S	20,000
A9-AT-SS001-0006-01	T	53
A9-AT-SS001-0612-01	T	34
A9-AT-SS001-0612-02	T	18
A9-AT-SS002-0006-01	T	80
A9-AT-SS002-0612-01	T	32
A9-AT-SS003-0006-01	T	100
A9-AT-SS003-0612-01	T	25
PHD-SS001-0002-01	Y2	68
PHD-SS002-0002-01	Y2	140
PHD-SS003-0002-01	Hand Dig*	51
PHD-SS003-0002-02	Hand Dig*	49
PHD-SS004-0002-01	Hand Dig*	95
PHD-SS005-0002-01	Hand Dig*	70
PHD-SS006-0002-01	Hand Dig*	78
PHD-SS007-0002-01	Hand Dig*	50
PHD-SS008-0002-01	Hand Dig*	27
PHD-SS009-0002-01	Hand Dig*	34
PHD-SS010-0002-01	Hand Dig*	50
PHD-SS011-0002-01	Y2	170
PHD-SS012-0002-01	Y2	1,900
PHD-SS013-0002-01	Y2	380
PHD-SS014-0002-01	Hand Dig*	17
PHD-SS015-0002-01	Y1	16
PHD-SS016-0002-01	Hand Dig*	19
PHD-SS017-0002-01	Hand Dig*	29
PHD-SS018-0002-01	Hand Dig*	35
PHD-SS019-0002-01	Hand Dig*	10
PHD-SS020-0002-01	Hand Dig*	36
PHD-SS021-0002-01	Hand Dig*	270
PHD-SS022-0002-01	Y1	24
PHD-SS022-0002-02	Y1	24
PHD-SS023-0002-01	Y1	430
PHD-SS024-0002-01	Y1	42
PHD-SS025-0002-01	X1	38
PHD-SS026-0002-01	Hand Dig*	15
PHD-SS027-0002-01	Hand Dig*	17
PHD-SS028-0002-01	Hand Dig*	19
PHD-SS029-0002-01	X2	370

No. of Samples **487**
Average **790**

Notes
* Associated with Areas X1, X2, and X3
** Associated with Areas M, N, and Z
Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
PHD-SS030-0002-01	X2	720
PHD-SS031-0002-01	X2	190
PHD-SS032-0002-01	Hand Dig*	43
PHD-SS033-0002-01	Hand Dig*	150
PHD-SS034-0002-01	X2	230
PHD-SS035-0002-01	Hand Dig*	170
PHD-SS036-0002-01	X1	190
PHD-SS037-0002-01	Hand Dig*	300
PHD-SS038-0002-01	Hand Dig*	27
PHD-SS039-0002-01	Hand Dig*	89
PHD-SS040-0002-01	Hand Dig*	140
PHD-SS040-0002-02	Hand Dig*	130
PHD-SS041-0002-01	X1	120
PHD-SS042-0002-01	X1	900
PHD-SS043-0002-01	X1	110
PHD-SS044-0002-01	Hand Dig*	82
PHD-SS045-0002-01	Hand Dig*	76
PHD-SS046-0002-01	X1	77
PHD-SS047-0002-01	X1	720
PHD-SS048-0002-01	X1	170
PHD-SS049-0002-01	X1	130
PHD-SS050-0002-01	Hand Dig*	48
PHD-SS051-0002-01	Hand Dig**	54
PHD-SS052-0002-01	Hand Dig**	37
PHD-SS053-0002-01	Hand Dig**	200
PHD-SS054-0002-01	Hand Dig**	22
PHD-SS055-0002-01	Z	20
PHD-SS056-0002-01	Z	600
PHD-SS057-0002-01	Z	72
PHD-SS058-0002-01	Hand Dig**	48
PHD-SS059-0002-01	Hand Dig**	59
PHD-SS059-0002-02	Hand Dig**	42
PHD-SS060-0002-01	Hand Dig**	66
PHD-SS061-0002-01	Hand Dig**	7
PHD-SS062-0002-01	Z	260
PHD-SS063-0002-01	Z	630
PHD-SS064-0002-01	Z	190
PHD-SS065-0002-01	Hand Dig**	16
PHD-SS066-0002-01	Hand Dig**	67
PHD-SS067-0002-01	Hand Dig**	110
PHD-SS068-0002-01	Hand Dig**	13
PHD-SS069-0002-01	Z	73
PHD-SS070-0002-01	Hand Dig**	230
PHD-SS071-0002-01	Hand Dig**	17
PHD-SS072-0002-01	Hand Dig**	64
PHD-SS073-0002-01	N	73
PHD-SS074-0002-01	N	28
PHD-SS075-0002-01	Hand Dig**	120
PHD-SS076-0002-01	Hand Dig**	9
PHD-SS077-0002-01	N	140
PHD-SS078-0002-01	Hand Dig**	28
PHD-SS078-0002-02	Hand Dig**	34
PHD-SS079-0002-01	Hand Dig**	24
PHD-SS080-0002-01	Hand Dig**	43
PHD-SS081-0002-01	N	150
PHD-SS082-0002-01	Hand Dig**	64
PHD-SS083-0002-01	Hand Dig**	310
PHD-SS084-0002-01	Hand Dig**	93
PHD-SS084-0002-02	Hand Dig**	100
PHD-SS085-0002-01	Hand Dig**	59
PHD-SS086-0002-01	Hand Dig**	30
PHD-SS087-0002-01	Hand Dig**	69
PHD-SS088-0002-01	Hand Dig**	35
PHD-SS089-0002-01	Hand Dig**	41
PHD-SS090-0002-01	Hand Dig**	180
PHD-SS091-0002-01	Hand Dig**	79
PHD-SS092-0002-01	Hand Dig**	180
PHD-SS093-0002-01	Hand Dig**	60
PHD-SS094-0002-01	Hand Dig**	110
PHD-SS095-0002-01	X3	64

No. of Samples **487**
Average **790**

Notes

* Associated with Areas X1, X2, and X3

** Associated with Areas M, N, and Z

Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
PHD-SS096-0002-01	X3	520
PHD-SS097-0002-01	X1	410
PHD-SS098-0002-01	X1	56
PHD-SS099-0002-01	X1	150
PHD-SS100-0002-01	X1	440
PHD-SS100-0002-02	X1	420
PHD-SS101-0002-01	Hand Dig*	210
PHD-SS102-0002-01	Y2	41
PHD-SS103-0002-01	Hand Dig*	170
PHD-SS104-0002-01	Hand Dig*	30
PHD-SS105-0002-01	Y1	56
A9-AI-SS001-0002-01	I	530
A9-AI-SS001-0612-01	I	29
A9-AI-SS002-0002-01	I	11,000
A9-AI-SS002-0612-01	I	18
A9-AI-SS003-0002-01	I	48
A9-AI-SS003-0612-01	I	44
A9-AI-SS004-0002-01	I	150
A9-AI-SS004-0612-01	I	38
A9-AI-SS005-0002-01	I	170
A9-AI-SS005-0612-01	I	73
A9-AI-SS006-0002-01	I	160
A9-AI-SS006-0612-01	I	76
A9-AI-SS007-0002-01	I	280
A9-AI-SS007-0612-01	I	150
A9-AI-SS008-0002-01	I	670
A9-AI-SS008-0612-01	I	440
A9-AI-SS008-1218-01	I	27
A9-AI-SS009-0002-01	I	18
A9-AI-SS009-0612-01	I	7
A9-AI-SS010-0002-01	I	78
A9-AI-SS010-0612-01	I	13
A9-AI-SS010-1218-01	I	11
A9-AI-SS011-0002-01	I	110
A9-AI-SS011-0612-01	I	6
A9-AI-SS011-1218-01	I	8
A9-PS33-0612-01	I	280
A9-PS33-1218-01	I	44
A9-AK-SS001-0002-01	K	170
A9-AK-SS001-0612-01	K	130
A9-AK-SS002-0002-01	K	170
A9-AK-SS002-0612-01	K	140
A9-AK-SS003-0002-01	K	240
A9-AK-SS003-0612-01	K	190
A9-AK-SS003-1218-01	K	340
A9-AK-SS003-1824-01	K	150
A9-AK-SS003-2430-01	K	28
A9-AK-SS003-2430-02	K	29
A9-AK-SS003-3036-01	K	51
A9-AK-SS003-3642-01	K	36
A9-AK-SS003-4248-01	K	17
A9-AK-SS003-4854-01	K	10
A9-AK-SS004-0002-01	K	170
A9-AK-SS004-0612-01	K	120
A9-AK-SS005-0002-01	K	140
A9-AK-SS005-0612-01	K	110
A9-AK-SS006-0002-01	K	240
A9-AK-SS006-0612-01	K	29
A9-AK-SS007-0002-01	K	210
A9-AK-SS007-0612-01	K	29
A9-AK-SS008-0002-01	K	190
A9-AK-SS008-0612-01	K	31
A9-AK-SS009-0002-01	K	120
A9-AK-SS009-0612-01	K	330
A9-AK-SS009-1218-01	K	14
A9-AK-SS010-0002-01	K	65
A9-AK-SS010-0612-01	K	60
A9-AK-SS011-0002-01	K	2,100
A9-AK-SS011-0612-01	K	140
A9-AK-SS012-0002-01	K	550

No. of Samples **487**
Average **790**

Notes

* Associated with Areas X1, X2, and X3

** Associated with Areas M, N, and Z

Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
A9-AK-SS012-0612-01	K	150
A9-AK-SS013-0002-01	K	870
A9-AK-SS013-0612-01	K	500
A9-AK-SS013-1218-01	K	41
A9-AK-SS014-0002-01	K	130
A9-AK-SS014-0612-01	K	31
A9-AK-SS015-0002-01	K	190
A9-AK-SS015-0612-01	K	71
A9-AK-SS016-0002-01	K	90
A9-AK-SS016-0612-01	K	56
A9-AK-SS017-0002-01	K	180
A9-AK-SS017-0612-01	K	22
A9-AK-SS017-0612-02	K	26
A9-AK-SS018-0002-01	K	160
A9-AK-SS018-0612-01	K	190
A9-AK-SS019-0002-01	K	130
A9-AK-SS019-0612-01	K	71
A9-AK-SS020-0002-01	K	140
A9-AK-SS020-0612-01	K	140
A9-AK-SS021-0002-01	K	190
A9-AK-SS021-0612-01	K	150
A9-AK-SS022-0002-01	K	300
A9-AK-SS022-0612-01	K	56
A9-AK-SS023-0002-01	K	220
A9-AK-SS023-0612-01	K	24
A9-AK-SS024-0002-01	K	230
A9-AK-SS024-0612-01	K	120
A9-AK-SS025-0002-01	K	110
A9-AK-SS025-0612-01	K	31
A9-AK-SS026-0002-01	K	140
A9-AK-SS026-0612-01	K	27
A9-AK-SS027-0006-18-01	K	45
A9-AK-SS027-0612-24-01	K	7
A9-AK-SS027-1218-30-01	K	25
A9-AK-SS027-1824-36-01	K	12
A9-AK-SS027-2430-42-01	K	24
A9-AK-SS027-3036-48-01	K	10
A9-42-0002-01	N	59
A9-42-0612-01	N	17
A9-42-1218-01	N	16
A9-PS41-0612-01	N	14
A9-PS41-0612-02	N	14
A9-PS41-1218-01	N	17
A9-AT-SS004-0002-01	T	100
A9-AT-SS004-0612-01	T	110
A9-AT-SS004-1218-01	T	140
A9-AT-SS005-0002-01	T	80
A9-AT-SS005-0612-01	T	98
A9-AT-SS005-1218-01	T	21
A9-16-0002-01	U	300
A9-16-0612-01	U	14
A9-16-0612-02	U	27
A9-16-1218-01	U	6
A9-AU-SS001-0002-01	U	690
A9-AU-SS001-0612-01	U	400
A9-AU-SS001-1218-01	U	240
A9-AU-SS002-0002-01	U	450
A9-AU-SS002-0612-01	U	97
A9-AU-SS003-0002-01	U	130
A9-AU-SS003-0612-01	U	19
A9-AU-SS004-0002-01	U	78
A9-AU-SS004-0612-01	U	26
A9-AU-SS005-0002-01	U	320
A9-AU-SS005-0612-01	U	750
A9-AU-SS005-1218-01	U	19
A9-AU-SS006-0002-01	U	140
A9-AU-SS006-0612-01	U	65
A9-AU-SS007-0002-01	U	77
A9-AU-SS007-0612-01	U	50
A9-AU-SS008-0002-01	U	360

No. of Samples **487**
Average **790**

Notes
* Associated with Areas X1, X2, and X3
** Associated with Areas M, N, and Z
Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
A9-AU-SS008-0612-01	U	390
A9-AU-SS008-1218-01	U	260
A9-PS25-0612-01	U	40
A9-PS25-0612-02	U	24
A9-PS25-1218-01	U	18
A9-PS25-C-0002-01	U	16
A9-PS25-C-0612-01	U	18
A9-PS25-C-1218-01	U	27
A9-PS25-S-0002-01	U	100
A9-PS25-S-0612-01	U	35
A9-PS25-S-1218-01	U	24
A9-PS25-S-1218-02	U	32
A9-PS25-W-0002-01	U	68
A9-PS25-W-0612-01	U	160
A9-PS25-W-1218-01	U	210
A9-PS27-0612-01	U	23
A9-PS27-1218-01	U	13
A9-AW-SS001-0002-01	W	72
A9-AW-SS001-0612-01	W	23
A9-AW-SS002-0002-01	W	210
A9-AW-SS002-0612-01	W	49
A9-AW-SS003-0002-01	W	240
A9-AW-SS003-0612-01	W	18
A9-AW-SS004-0002-01	W	35
A9-AW-SS004-0612-01	W	11
A9-AW-SS005-0002-01	W	380
A9-AW-SS005-0612-01	W	27
A9-AW-SS006-0002-01	W	640
A9-AW-SS006-0612-01	W	21
A9-AW-SS007-0002-01	W	180
A9-AW-SS007-0612-01	W	23
A9-AW-SS008-0002-01	W	54
A9-AW-SS008-0612-01	W	14
A9-AW-SS009-0002-01	W	180
A9-AW-SS009-0612-01	W	41
A9-AW-SS010-0002-01	W	610
A9-AW-SS010-0612-01	W	610
A9-AW-SS010-1218-01	W	5,900
A9-AW-SS010-1824-01	W	320
A9-AW-SS011-0002-01	W	22
A9-AW-SS011-0612-01	W	53
A9-AW-SS011-0612-02	W	40
A9-AW-SS012-0002-01	W	130
A9-AW-SS012-0612-01	W	26
A9-AW-SS013-0002-01	W	100
A9-AW-SS013-0612-01	W	37
A9-AW-SS014-0002-01	W	86
A9-AW-SS014-0612-01	W	33
A9-AW-SS015-0002-01	W	340
A9-AW-SS015-0612-01	W	130
A9-AW-SS015-0612-02	W	130
A9-AW-SS016-0002-01	W	58
A9-AW-SS016-0612-01	W	20
A9-AW-SS017-0002-01	W	36
A9-AW-SS017-0612-01	W	9
A9-AW-SS018-0002-01	W	84
A9-AW-SS018-0612-01	W	15
A9-AW-SS018-1218-01	W	8
A9-AW-SS019-0002-01	W	150
A9-AW-SS019-0612-01	W	12
A9-AW-SS019-1218-01	W	15
A9-AW-SS020-0002-01	W	53
A9-AW-SS020-0612-01	W	22
A9-AW-SS020-0612-02	W	26
A9-AW-SS020-1218-01	W	24
A9-AW-SS021-0002-01	W	520
A9-AW-SS021-0612-01	W	14
A9-AW-SS021-1218-01	W	17
PHD-SS042-0612-01	X1	45
PHD-SS047-0612-01	X1	340

No. of Samples **487**
Average **790**

Notes
* Associated with Areas X1, X2, and X3
** Associated with Areas M, N, and Z
Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
PHD-SS047-1218-01	X1	60
PHD-SS097-0612-01	X1	36
PHD-SS100-0612-01	X1	280
PHD-SS106-0002-01	X1	270
PHD-SS107-0002-01	X1	160
PHD-SS116-0002-01	X1	260
PHD-SS030-0612-01	X2	93
PHD-SS108-0002-01	X2	120
A9-PS56-0612-01	X3	19
PHD-SS096-0612-01	X3	42
PHD-SS023-0612-01	Y1	56
PHD-SS023-0612-02	Y1	62
PHD-SS109-0002-01	Y1	21
PHD-SS110-0002-01	Y1	74
CH-RD-04-005-1218-01	Y2	1,500
CH-RD-04-005-1824-01	Y2	690
CH-RD-04-005-1824-02	Y2	830
CH-RD-04-005-2430-01	Y2	18
PHD-SS012-0612-01	Y2	78
PHD-SS012-1218-01	Y2	25
PHD-SS111-0002-01	Y2	330
PHD-SS111-0612-01	Y2	47
PHD-SS111-1218-01	Y2	24
PHD-SS112-0002-01	Y2	710
PHD-SS112-0612-01	Y2	360
PHD-SS112-1218-01	Y2	29
PHD-SS113-0002-01	Y2	670
PHD-SS113-0612-01	Y2	160
PHD-SS113-1218-01	Y2	8
PHD-SS056-0612-01	Z	160
PHD-SS063-0612-01	Z	460
PHD-SS063-1218-01	Z	34
PHD-SS063-1824-01	Z	56
PHD-SS063-1824-02	Z	72
PHD-SS114-0002-01	Z	170
PHD-SS115-0002-01	Z	150
A9-PS77-0006-01	C	140
A9-PS77-0612-01	C	320
A9-AC-SS001-0006-01	C	260
A9-AC-SS001-0612-01	C	240
A9-AC-SS002-0006-01	C	120
A9-AC-SS002-0612-01	C	220
A9-AC-SS003-0006-01	C	110
A9-AC-SS003-0612-01	C	290
A9-AC-SS004-0006-01	C	110
A9-AC-SS004-0612-01	C	240
A9-AI-SS012-0002-01	I	87
A9-AI-SS012-0612-01	I	21
A9-AI-SS013-0002-01	I	240
A9-AI-SS013-0612-01	I	58
A9-AI-SS014-0002-01	I	200
A9-AI-SS014-0612-01	I	15
A9-AK-SS028-0002-01	K	2,300
A9-AK-SS028-0612-01	K	63
A9-AK-SS029-0002-01	K	820
A9-AK-SS029-0612-01	K	24
A9-AK-SS030-0002-01	K	3,400
A9-AK-SS030-0612-01	K	20
A9-AK-SS031-0002-01	K	2,800
A9-AK-SS031-0612-01	K	30
A9-AK-SS032-0002-01	K	180
A9-AK-SS032-0612-01	K	77
A9-AK-SS032-0612-02	K	68
A9-AK-SS033-0002-01	K	220
A9-AK-SS034-0002-01	K	120
A9-AK-SS035-0002-01	K	300
A9-AU-SS009-0002-01	U	460
A9-AU-SS009-0612-01	U	120
A9-AU-SS010-0002-01	U	49
A9-AU-SS010-0612-01	U	58

No. of Samples **487**
Average **790**

Notes
* Associated with Areas X1, X2, and X3
** Associated with Areas M, N, and Z
Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Raritan Bay Slag Site
Data Set Used to Calculate Site-Specific Particulate Action Levels

Sample No.	Area	Validated Lead Result
July 2016 through January 2017 Data		
A9-AV-SS001-0002-01	V	82
A9-AV-SS001-0612-01	V	12
A9-AV-SS002-0002-01	V	68
A9-AV-SS002-0612-01	V	16
A9-AV-SS002-0612-02	V	23
A9-AW-SS022-0002-01	W	99
A9-AW-SS022-0612-01	W	12
A9-AW-SS022-0612-02	W	10
A9-AW-SS023-0002-01	W	73
A9-AW-SS023-0612-01	W	23
Pre-RAB Data		
A9-PS25-0002	U	3,400
A9-16-B	U	403
A9-16-C	U	93
A9-16-E	U	23
A9-16-F	U	11
A9-23-B	S	100
A9-23-C	S	185
A9-23-E	S	690
A9-23-F	S	509
A9PS27-E-2430-001	S	3,900
A9PS27-N-2430-001	V	2,500
A9PS27-C-1824-001	V	66,000
A9PS27-C-2430-001	V	4,100
A9PS27-S-2430-001	V	12,000
A9-PS27-0002	W	3,100
A9-PS30-0002	Q	1,100
A9-A5B-019-1218-01	P	3,200
A9-A5B-019-2430-01	P	160
A9-A5B-018-1218-01	P	420
A9-A5B-018-2430-01	P	210
A9-A6B-002-0002-01	M	540
A9-A6B-002-1218-01	M	4,600
A9-A6B-002-2430-01	M	790
A9-PS41-0002	N	420
A9-42-B	N	697
A9-42-C	N	330
A9-42-E	N	27
A9-42-F	N	33
A9-PS33-0002	I	1,700
A9-34-B	J	143
A9-34-C	J	42
A9-34-E	J	510
A9-34-F	J	883
A9-PS47-C-2430-001	Y2	400
CH-RD-04-005-0612-01	Y2	1,200
A9-48-B	X3	438
A9-48-C	X3	74
A9-48-E	X3	24
A9-48-F	X3	214
A9-PS56-0002	X3	1,900
A9-110-B	H	169
A9-110-C	H	100
A9-110-E	H	599
A9-110-F	H	381
A9-19-B	H	15
A9-19-C	H	50
A9-19-E	H	30
A9-19-F	H	604
A9-PS36-0002	G	690
A9-97-A	F	564
A9-97-C	F	236
A9-97-D	F	297
A9-97-F	F	44
A9-24-B	D	308
A9-24-C	D	6,610
A9-24-E	D	1,760
A9-24-F	D	86

No. of Samples **487**
Average **790**

Notes
* Associated with Areas X1, X2, and X3
** Associated with Areas M, N, and Z
Note: Hand Dig samples are located adjacent to the excavation area and will be disturbed during excavation activities.

Attachment C

NIOSH Analytical Methods

Esta página en Español

ELEMENTS by ICP (Nitric/Perchloric Acid Ashing) 7300

MW: Table 1 CAS: Table 2 RTECS: Table 2

METHOD: 7300, Issue 3 **EVALUATION: PARTIAL** **Issue 1: 15 August 1990**
Issue 3: 15 March 2003

OSHA: Table 2
NIOSH: Table 2
ACGIH: Table 2

PROPERTIES: Table 1

ELEMENTS:

aluminum*	calcium	lanthanum	nickel	strontium	tungsten*
antimony*	chromium*	lithium*	potassium	tellurium	vanadium*
arsenic	cobalt*	magnesium	phosphorus	tin	yittrium
barium	copper	manganese*	selenium	thallium	zinc
beryllium*	iron	molybdenum*	silver	titanium	zirconium*
cadmium	lead*				

*Some compounds of these elements require special sample treatment.

SAMPLING

SAMPLER: FILTER (0.8-µm, cellulose ester membrane, or 5.0-µm, polyvinyl chloride membrane)

FLOWRATE: 1 to 4 L/min

VOL-MIN: Table 1
-MAX: Table 1

SHIPMENT: routine

SAMPLE STABILITY: stable

BLANKS: 2 to 10 field blanks per set

ACCURACY

RANGE STUDIED: not determined

BIAS: not determined

OVERALL PRECISION ($\hat{S}_{rT}$): not determined

ACCURACY: not determined

MEASUREMENT

TECHNIQUE: INDUCTIVELY COUPLED ARGON PLASMA, ATOMIC EMISSION SPECTROSCOPY (ICP-AES)

ANALYTE: elements above

ASHING REAGENTS: conc. HNO_3/ conc. $HClO_4$ (4:1), 5 mL; 2mL increments added as needed

CONDITIONS: room temperature, 30 min; 150 °C to near dryness

FINAL SOLUTION: 4% HNO_3, 1% $HClO_4$, 25 mL

WAVELENGTH: depends upon element; Table 3

BACKGROUND CORRECTION: spectral wavelength shift

CALIBRATION: elements in 4% HNO_3, 1% $HClO_4$

RANGE: varies with element [1]

ESTIMATED LOD: Tables 3 and 4

PRECISION ($\bar{S}$): Tables 3 and 4

APPLICABILITY: The working range of this method is 0.005 to 2.0 mg/m^3 for each element in a 500-L air sample. This is simultaneous elemental analysis, not compound specific. Verify that the types of compounds in the samples are soluble with the ashing procedure selected.

INTERFERENCES: Spectral interferences are the primary interferences encountered in ICP-AES analysis. These are minimized by judicious wavelength selection, interelement correction factors and background correction [1-4].

OTHER METHODS: This issue updates issues 1 and 2 of Method 7300, which replaced P&CAM 351 [3] for trace elements. Flame atomic absorption spectroscopy (e.g., Methods 70XX) is an alternate analytical technique for many of these elements. Graphite furnace AAS (e.g., 7102 for Be, 7105 for Pb) is more sensitive.

REAGENTS:

1. Nitric acid (HNO_3), conc., ultra pure.
2. Perchloric acid ($HClO_4$), conc., ultra pure.*
3. Ashing acid: 4:1 (v/v) HNO_3:$HClO_4$. Mix 4 volumes conc. HNO_3 with 1 volume conc. $HClO_4$.
4. Calibration stock solutions, 1000 µg/mL. Commercially available, or prepared per instrument manufacturer's recommendation (see step 12).
5. Dilution acid, 4% HNO_3, 1% $HClO_4$. Add 50 mL ashing acid to 600 mL water; dilute to 1 L.
6. Argon.
7. Distilled,deionized water.

* See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: cellulose ester membrane filter, 0.8-µm pore size; or polyvinyl chloride membrane, 5.0-µm pore size; 37-mm diameter, in cassette filter holder.
2. Personal sampling pump, 1 to 4 L/min, with flexible connecting tubing.
3. Inductively coupled plasma-atomic emission spectrometer, equipped as specified by the manufacturer for analysis of elements of interest.
4. Regulator, two-stage, for argon.
5. Beakers, Phillips, 125-mL, or Griffin, 50-mL, with watchglass covers.**
6. Volumetric flasks, 10-, 25-,100-mL., and 1-L**
7. Assorted volumetric pipets as needed.**
8. Hotplate, surface temperature 150 °C.

** Clean all glassware with conc. nitric acid and rinse thoroughly in distilled water before use.

SPECIAL PRECAUTIONS: All perchloric acid digestions are required to be done in a perchloric acid hood. When working with concentrated acids, wear protective clothing and gloves.

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Sample at an accurately known flow rate between 1 and 4 L/min for a total sample size of 200 to 2000 L (see Table 1) for TWA measurements. Do not exceed a filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

3. Open the cassette filter holders and transfer the samples and blanks to clean beakers.
4. Add 5 mL ashing acid. Cover with a watchglass. Let stand 30 min at room temperature.
   NOTE: Start a reagent blank at this step.
5. Heat on hotplate (120 °C) until ca. 0.5 mL remains.
   NOTE 1: Recovery of lead from some paint matrices may require other digestion techniques. See Method 7082 (Lead by Flame AAS) for an alternative hotplate digestion procedure or Method 7302 for a microwave digestion procedure.
   NOTE 2: Some species of Al, Be, Co, Cr, Li, Mn, Mo, V, and Zr will not be completely solubilized by this procedure. Alternative solubilization techniques for most of these elements can be found elsewhere [5-10]. For example, aqua regia may be needed for Mn [6,12].
6. Add 2 mL ashing acid and repeat step 5. Repeat this step until the solution is clear.
7. Remove watchglass and rinse into the beaker with distilled water.
8. Increase the temperature to 150 °C and take the sample to near dryness (ca. 0.5 mL).
9. Dissolve the residue in 2 to 3 mL dilution acid.
10. Transfer the solutions quantitatively to 25-mL volumetric flasks.
11. Dilute to volume with dilution acid.
    NOTE: If more sensitivity is required, the final sample volume may be held to 10 mL.

CALIBRATION AND QUALITY CONTROL:

12. Calibrate the spectrometer according to the manufacturers recommendations.
    NOTE: Typically, an acid blank and 1.0 µg/mL multielement working standards are used. The following multielement combinations are chemically compatible in 4% HNO_3/1% $HClO_4$:
    a. Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, La, In, Na
    b. Ag, K, Li, Mg, Mn, Ni, P, Pb, Se, Sr, Tl, V, Y, Zn, Sc
    c. Mo, Sb, Sn, Te, Ti, W, Zr
    d. Acid blank
13. Analyze a standard for every ten samples.
14. Check recoveries with at least two spiked blank filters per ten samples.

MEASUREMENT:

15. Set spectrometer to conditions specified by manufacturer.
16. Analyze standards and samples.
    NOTE: If the values for the samples are above the range of the standards, dilute the solutions with dilution acid, reanalyze and apply the appropriate dilution factor in the calculations.

CALCULATIONS:

17. Obtain the solution concentrations for the sample, C_s (µg/mL), and the average media blank, C_b (µg/mL), from the instrument.
18. Using the solution volumes of sample, V_s (mL), and media blank, V_b (mL), calculate the concentration, C (mg/m^3), of each element in the air volume sampled, V (L):

$$C = \frac{CsVs - CbVb}{V}, mg/m^3$$

NOTE: µg/L ≡ mg/m^3

EVALUATION OF METHOD:

Issues 1 and 2
Method, 7300 was originally evaluated in 1981 [2,3]. The precision and recovery data were determined at 2.5 and 1000 µg of each element per sample on spiked filters. The measurements used for the method evaluation in Issues 1 and 2 were determined with a Jarrell-Ash Model 1160 Inductively Coupled Plasma Spectrometer operated according to manufacturer's instructions.

Issue 3
In this update of NIOSH Method 7300, the precision and recovery data were determined at approximately 3x and 10x the instrumental detection limits on commercially prepared spiked filters [12] using 25.0 mL as the final sample volume. Tables 3 and 4 list the precision and recovery data, instrumental detection limits, and analytical wavelengths for mixed cellulose ester (MCE) and polyvinyl chloride (PVC) filters. PVC Filters which can be used for total dust measurements and then digested for metals measurements were tested and found to give good results. The values in Tables 3 and 4 were determined with a Spectro Analytical Instruments Model End On Plasma (EOP)(axial) operated according to manufacturer's instructions.

REFERENCES:

[1] Millson M, Andrews R [2002]. Backup data report, Method 7300, unpublished report, NIOSH/DART.
[2] Hull RD [1981]. Multielement Analysis of Industrial Hygiene Samples, NIOSH Internal Report, presented at the American Industrial Hygiene Conference, Portland, Oregon.
[3] NIOSH [1982]. NIOSH Manual of Analytical Methods, 2nd ed., V. 7, P&CAM 351 (Elements by ICP), U.S. Department of Health and Human Services, Publ. (NIOSH) 82-100.
[4] NIOSH [1994]. Elements by ICP: Method 7300, Issue 2. In: Eller PM, Cassinelli ME, eds., NIOSH Manual of Analytical Methods, 4th ed. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-113.
[5] NIOSH [1994]. Lead by FAAS: Method 7082. In: Eller PM, Cassinelli ME, eds., NIOSH Manual of Analytical Methods, 4th ed. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-113.
[6] NIOSH [1977]. NIOSH Manual of Analytical Methods, 2nd ed., V. 2, S5 (Manganese), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-B.
[7] NIOSH [1994]. Tungsten, soluble/insoluble: Method 7074. In: Eller PM, Cassinelli ME, eds., NIOSH Manual of Analytical Methods, 4th ed. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-113.
[8] NIOSH [1979]. NIOSH Manual of Analytical Methods, 2nd ed., V. 5, P&CAM 173 (Metals by Atomic Absorption), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 79-141.
[9] NIOSH [1977]. NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S183 (Tin), S185 (Zirconium), and S376 (Molybdenum), U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C.
[10] ISO [2001]. Workplace air - Determination of metals and metalloids in airborne particulate matter by inductively coupled plasma atomic emission spectrometry - Part 2: Sample preparation. International Organization for Standardization. ISO 15202-2:2001(E).
[11] ASTM [1985]. 1985 Annual Book of ASTM Standards, Vol. 11.01; Standard Specification for Reagent Water; ASTM, Philadelphia, PA, D1193-77 (1985).
[12] Certification Inorganic Ventures for spikes.

METHOD REVISED BY:

Mark Millson and Ronnee Andrews, NIOSH/DART.

Method originally written by Mark Millson, NIOSH/DART, and R. DeLon Hull, Ph.D., NIOSH/DSHEFS, James B. Perkins, David L. Wheeler, and Keith Nicholson, DataChem Labortories, Salt Lake City, UT.

TABLE 1. PROPERTIES AND SAMPLING VOLUMES

Element (Symbol)	Properties: Atomic Weight	Properties: MP, °C	Air Volume, L @ OSHA PEL: MIN	Air Volume, L @ OSHA PEL: MAX
Silver (Ag)	107.87	961	250	2000
Aluminum (Al)	26.98	660	5	100
Arsenic (As)	74.92	817	5	2000
Barium (Ba)	137.34	710	50	2000
Beryllium (Be)	9.01	1278	1250	2000
Calcium (Ca)	40.08	842	5	200
Cadmium (Cd)	112.40	321	13	2000
Cobalt (Co)	58.93	1495	25	2000
Chromium (Cr)	52.00	1890	5	1000
Copper (Cu)	63.54	1083	5	1000
Iron (Fe)	55.85	1535	5	100
Potassium (K)	39.10	63.65	5	1000
Lanthanum	138.91	920	5	1000
Lithium (Li)	6.94	179	100	2000
Magnesium (Mg)	24.31	651	5	67
Manganese (Mn)	54.94	1244	5	200
Molybdenum (Mo)	95.94	651	5	67
Nickel (Ni)	58.71	1453	5	1000
Phosphorus (P)	30.97	44	25	2000
Lead (Pb)	207.19	328	50	2000
Antimony (Sb)	121.75	630.5	50	2000
Selenium (Se)	78.96	217	13	2000
Tin (Sn)	118.69	231.9	5	1000
Strontium (Sr)	87.62	769	10	1000
Tellurium (Te)	127.60	450	25	2000
Titanium (Ti)	47.90	1675	5	100
Thallium (Tl)	204.37	304	25	2000
Vanadium (V)	50.94	1890	5	2000
Tungsten (W)	183.85	3410	5	1000
Yttrium (Y)	88.91	1495	5	1000
Zinc (Zn)	65.37	419	5	200
Zirconium (Zr)	91.22	1852	5	200

TABLE 2. EXPOSURE LIMITS, CAS #, RTECS

Element (Symbol)	CAS #	RTECS	Exposure Limits, mg/m³ (Ca = carcinogen) OSHA	NIOSH	ACGIH
Silver (Ag)	7440-22-4	VW3500000	0.01 (dust, fume, metal)	0.01 (metal, soluble)	0.1 (metal) 0.01 (soluble)
Aluminum (Al)	7429-90-5	BD0330000	15 (total dust) 5 (respirable)	10 (total dust) 5 (respirable fume) 2 (salts, alkyls)	10 (dust) 5 (powders, fume) 2 (salts, alkyls)
Arsenic (As)	7440-38-2	CG0525000	varies	C 0.002, Ca	0.01, Ca
Barium (Ba)	7440-39-3	CQ8370000	0.5	0.5	0.5
Beryllium (Be)	7440-41-7	DS1750000	0.002, C 0.005	0.0005, Ca	0.002, Ca
Calcium (Ca)	7440-70-2	--	varies	varies	varies
Cadmium (Cd)	7440-43-9	EU9800000	0.005	lowest feasible, Ca	0.01 (total), Ca 0.002 (respir.), Ca
Cobalt (Co)	7440-48-4	GF8750000	0.1	0.05 (dust, fume)	0.02 (dust, fume)
Chromium (Cr)	7440-47-3	GB4200000	0.5	0.5	0.5
Copper (Cu)	7440-50-8	GL5325000	1 (dust, mists) 0.1 (fume)	1 (dust) 0.1 (fume)	1 (dust, mists) 0.2 (fume)
Iron (Fe)	7439-89-6	NO4565500	10 (dust, fume)	5 (dust, fume)	5 (fume)
Potassium (K)	7440-09-7	TS6460000	--	--	--
Lanthanum	7439-91-0	--	–	–	--
Lithium (Li)	7439-93-2	--	--	--	--
Magnesium (Mg)	7439-95-4	OM2100000	15 (dust) as oxide 5 (respirable)	10 (fume) as oxide	10 (fume) as oxide
Manganese (Mn)	7439-96-5	OO9275000	C 5	1; STEL 3	5 (dust) 1; STEL 3 (fume)
Molybdenum (Mo)	7439-98-7	QA4680000	5 (soluble) 15 (total insoluble)	5 (soluble) 10 (insoluble)	5 (soluble) 10 (insoluble)
Nickel (Ni)	7440-02-0	QR5950000	1	0.015, Ca	0.1 (soluble) 1 (insoluble, metal)
Phosphorus (P)	7723-14-0	TH3500000	0.1	0.1	0.1
Lead (Pb)	7439-92-1	OF7525000	0.05	0.05	0.05
Antimony (Sb)	7440-36-0	CC4025000	0.5	0.5	0.5
Selenium (Se)	7782-49-2	VS7700000	0.2	0.2	0.2
Tin (Sn)	7440-31-5	XP7320000	2	2	2
Strontium (Sr)	7440-24-6	–	–	–	--
Tellurium (Te)	13494-80-9	WY2625000	0.1	0.1	0.1
Titanium (Ti)	7440-32-6	XR1700000	--	--	--
Thallium (Tl)	7440-28-0	XG3425000	0.1 (skin) (soluble)	0.1 (skin) (soluble)	0.1 (skin)
Vanadium (V)	7440-62-2	YW240000	--	C 0.05	--
Tungsten	7440-33-7	–	5	5 10 (STEL)	5 10 (STEL)
Yttrium (Y)	7440-65-5	ZG2980000	1	N/A	1
Zinc (Zn)	7440-66-6	ZG8600000	–	--	--
Zirconium (Zr)	7440-67-7	ZH7070000	5	5, STEL 10	5, STEL 10

TABLE 3. MEASUREMENT PROCEDURES AND DATA [1].
Mixed Cellulose Ester Filters (0.45 µm)

Element (a)	wavelength nm	Est. LOD µg/ Filter	LOD ng/mL	Certified 3x LOD (b)	% Recovery (c)	Percent RSD (N=25)	Certified 10x LOD (b)	% Recovery (c)	Percent RSD (N=25)
Ag	328	0.042	1.7	0.77	102.9	2.64	3.21	98.3	1.53
Al	167	0.115	4.6	1.54	105.4	11.5	6.40	101.5	1.98
As	189	0.140	5.6	3.08	94.9	2.28	12.9	93.9	1.30
Ba	455	0.005	0.2	0.31	101.8	1.72	1.29	97.7	0.69
Be	313	0.005	0.2	0.31	100.0	1.44	1.29	98.4	0.75
Ca	317	0.908	36.3	15.4	98.7	6.65	64.0	100.2	1.30
Cd	226	0.0075	0.3	0.31	99.8	1.99	1.29	97.5	0.88
Co	228	0.012	0.5	0.31	100.8	1.97	1.29	98.4	0.90
Cr	267	0.020	0.8	0.31	93.4	16.3	1.29	101.2	2.79
Cu	324	0.068	2.7	1.54	102.8	1.47	6.40	100.6	0.92
Fe	259	0.095	3.8	1.54	103.3	5.46	6.40	98.0	0.95
K	766	1.73	69.3	23.0	90.8	1.51	96.4	97.6	0.80
La	408	0.048	1.9	0.77	102.8	2.23	3.21	100.1	0.92
Li	670	0.010	0.4	0.31	110.0	1.91	1.29	97.7	0.81
Mg	279	0.098	3.9	1.54	101.1	8.35	6.40	98.0	1.53
Mn	257	0.005	0.2	0.31	101.0	1.77	1.29	94.7	0.73
Mo	202	0.020	0.8	0.31	105.3	2.47	1.29	98.6	1.09
Ni	231	0.020	0.8	0.31	109.6	3.54	1.29	101.2	1.38
P	178	0.092	3.7	1.54	84.4	6.19	6.40	82.5	4.75
Pb	168	0.062	2.5	1.54	109.4	2.41	6.40	101.7	0.88
Sb	206	0.192	7.7	3.08	90.2	11.4	12.9	**41.3**	32.58
Se	196	0.135	5.4	2.3	87.6	11.6	9.64	84.9	4.78
Sn	189	0.040	1.6	0.77	90.2	18.0	3.21	**49**	21.79
Sr	407	0.005	0.2	0.31	101.0	1.55	1.29	97.3	0.65
Te	214	0.078	3.1	1.54	102.0	2.67	6.40	97.4	1.24
Ti	334	0.050	2.0	0.77	98.4	2.04	3.21	93.4	1.08
Tl	190	0.092	3.7	1.54	100.9	2.48	6.40	99.1	0.80
V	292	0.028	1.1	0.77	103.2	1.92	3.21	98.3	0.84
W	207	0.075	3.0	1.54	**72.2**	10.1	6.40	**57.6**	14.72
Y	371	0.012	0.5	0.31	100.5	1.80	1.29	97.4	0.75
Zn	213	0.310	12.4	4.60	102.2	1.87	19.3	95.3	0.90
Zr	339	0.022	0.9	0.31	88.0	19.4	1.29	**25**	57.87

(a) Bold values are qualitative only because of low recovery.
(b) Values are certified by Inorganic Ventures INC. at 3x and 10x the approximate instrumental LOD
(c) Values reported were obtained with a Spectro Analytical Instruments EOP ICP; performance may vary with instrument and should be independently verified.

TABLE 4. MEASUREMENT PROCEDURES AND DATA [1].
Polyvinyl Chloride Filter (5.0 µm)

Element (c)	wavelength nm	Est. LOD µg per filter	LOD ng/mL	Certified 3x LOD (b)	% Recovery (a)	Percent RSD (N=25)	Certified[17] 10x LOD (b)	% Recovery (a)	Percent RSD (N=25)
Ag	328	0.042	1.7	0.78	104.2	8.20	3.18	81.8	18.9
Al	167	0.115	4.6	1.56	77.4	115.24	6.40	92.9	20.9
As	189	0.140	5.6	3.10	100.7	5.13	12.70	96.9	3.2
Ba	455	0.005	0.2	0.31	102.4	3.89	1.270	99.8	2.0
Be	313	0.005	0.2	0.31	106.8	3.53	1.270	102.8	2.1
Ca	317	0.908	36.3	15.6	**68.1**	12.66	64.00	96.8	5.3
Cd	226	0.0075	0.3	0.31	105.2	5.57	1.27	101.9	2.8
Co	228	0.012	0.5	0.31	109.3	4.67	1.27	102.8	2.8
Cr	267	0.020	0.8	0.31	109.4	5.31	1.27	103.4	4.1
Cu	324	0.068	2.7	1.56	104.9	5.18	6.40	101.8	2.4
Fe	259	0.095	3.8	1.56	88.7	46.82	6.40	99.1	9.7
K	766	1.73	69.3	23.4	96.4	4.70	95.00	99.2	2.2
La	408	0.048	1.9	0.78	**45.5**	4.19	3.18	98.8	2.6
Li	670	0.010	0.4	0.31	107.7	4.80	1.27	110.4	2.7
Mg	279	0.098	3.9	1.56	**54.8**	20.59	6.40	**64.5**	5.7
Mn	257	0.005	0.2	0.31	101.9	4.18	1.27	99.3	2.4
Mo	202	0.020	0.8	0.31	106.6	5.82	1.27	98.1	3.8
Ni	231	0.020	0.8	0.31	111.0	5.89	1.27	103.6	3.2
P	178	0.092	3.7	1.56	101.9	17.82	6.40	86.5	10.4
Pb	168	0.062	2.5	1.56	109.6	6.12	6.40	103.2	2.9
Sb	206	0.192	7.7	3.10	**64.6**	22.54	12.70	**38.1**	30.5
Se	196	0.135	5.4	2.30	83.1	26.23	9.50	76.0	17.2
Sn	189	0.040	1.6	0.78	85.7	27.29	3.18	**52.0**	29.4
Sr	407	0.005	0.2	0.31	**71.8**	4.09	1.27	81.2	2.7
Te	214	0.078	3.1	1.56	109.6	7.49	6.40	97.3	3.8
Ti	334	0.050	2.0	0.78	101.0	9.46	3.18	92.4	5.5
Tl	190	0.092	3.7	1.56	110.3	4.04	6.40	101.9	2.0
V	292	0.028	1.1	0.78	108.3	3.94	3.18	102.5	2.6
W	207	0.075	3.0	1.56	**74.9**	15.79	6.40	**44.7**	19.6
Y	371	0.012	0.5	0.31	101.5	3.63	1.27	101.4	2.5
Zn	213	0.310	12.4	4.70	91.0	68.69	19.1	101.0	9.6
Zr	339	0.022	0.9	0.31	**70.7**	54.20	1.27	**40.4**	42.1

(a) Values reported were obtained with a Spectro Analytical Instruments EOP ICP; performance may vary with instrument and should be independently verified.
(b) Values are certified by Inorganic Ventures INC. at 3x and 10x the approximate instrumental LOD [12].
(c) Bold values are qualitative only because of low recovery. Other digestion techniques may be more appropriate for these elements and their compounds.