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REMEDIAL DESIGN REPORT
100% Remedial Design

QUARRY 3
PHASE 2

CRATER RESOURCES SUPERFUND SITE
Upper Merion Township, Montgomery County, Pennsylvania

Prepared For:

CRATER RESOURCES COOPERATING RESPONDENT GROUP

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

Project Number 2001-847-16
July 8, 2009

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September 10, 2009

2001-847-17

Mr. Joseph McDowell, USEPA
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Crater Resources Superfund Site
Quarry 3 Remedial Action – Phase 2 100% RD

Dear Mr. McDowell:

On behalf of our client, the Crater Resources Cooperating Respondent Group, we are pleased to submit the final copy of the 100% Remedial Design for Quarry 3, Phase Two prepared by Advanced GeoServices Corp dated July 8, 2009.

Please note that several sections of the Appendices for the Phase 2 100% RD are the same as the Appendices included in the previously approved Phase 1 100% RD submission on January 16, 2009, therefore they have not been included with this package. Only those Appendices which were modified/revised during the Phase 2 review process have been included with the Phase 2 100% RD.

If you have any questions, please contact me at 610-840-9162.

Very truly yours,

ADVANCED GEOSERVICES CORP.

Thomas M. Legel, P.E.
Supervising Contractor

TML:car

Enclosure

cc: Distribution:

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CRATER RESOURCES SUPERFUND SITE
100% REMEDIAL DESIGN
QUARRY 3 – PHASE 2

REMEDIAL DESIGN REPORT
100% Remedial Design

QUARRY 3
PHASE 2

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Upper Merion Township, Montgomery County, Pennsylvania

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Prepared By:

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1.0 INTRODUCTION

Advanced GeoServices Corp. (Advanced GeoServices) has prepared this 100% Remedial Design Report (RDR), on behalf of The Crater Resources Cooperating Respondent Group, for remedial actions at Quarry 3 (OU-3) of the Crater Resources Superfund Site (Site). The Site is located in Upper Merion Township, Montgomery County, Pennsylvania. The Site covers over 50 acres and consists of multiple parcels of previously developed and undeveloped lands, including four abandoned quarries. The Quarry 3 Remedial Design focuses on the design and construction activities related to the removal of impacted sediment and soil in Quarry 3 and restoring the Quarry floor to provide storm water drainage to the adjacent drainage channel east of the Quarry. This RDR focuses only on Phase 2 of the Quarry 3 work, which includes removal of impacted soils and Plateau Area material in Quarry 3 and filling the remaining Quarry floor area, including Pond 2, with clean soil to a level that establishes a uniform grade, and provides for proper drainage of storm water.

Over the past 35 years, the Site has been thoroughly assessed and investigated by federal, state, and local environmental regulatory agencies, the Crater Resources Participating Parties Group and the Crater Resources Cooperating Respondent Group. A Remedial Investigation (RI) was performed by the Crater Resources Participating Parties Group and that investigation is summarized in a document titled "Remedial Investigation Report, Crater Resources Superfund Site", dated June 4, 1999. Following approval of the RI Report, the Crater Resources Participating Parties Group prepared a Feasibility Study (FS) for the site title "Feasibility Study for the Crater Resources Superfund Site, Upper Merion Township, Pennsylvania, dated February 29, 2000. The United States Environmental Protection Agency (USEPA) modified and then approved the FS on June 16, 2000. The USEPA issued a Record of Decision (ROD) for the Site on September 27, 2000, which set forth the remedial requirements for the Site. Subsequent to issuance of the ROD, Advanced GeoServices completed additional pre-design investigations within Quarry 3 on behalf of the Crater Resources Cooperating Respondent Group. The Crater Resources Cooperating Respondent Group is hereinafter referred to as the Group.

1.1 OVERALL SITE REMEDY

This Remedial Action is being conducted in accordance with the remedy specified in the ROD and the Crater Resources Superfund Site Administrative Order (Order) for "Remedial Design and Remedial Action", Docket No. 3-2001-0009, dated April 30, 2001. The USEPA is the lead regulatory agency at the Site, with support being provided by the Pennsylvania Department of Environmental Protection (PADEP) and the Upper Merion Township Board of Supervisors. Completion of the remedial action at the Site is the responsibility of the Group.

Based on the ROD, the selected remedy for the entire Site includes the following:

- Removal of impacted soils and sediment, in Quarry 3.
- Construction of a cap to prevent infiltration of surface water into the impacted soils of Quarries 1, 2, and 4 and other impacted soil areas.

- Implementation of Monitored Natural Attenuation (MNA) of the groundwater.
- Further investigation and removal of the former WAL pipeline.
- Institutional Controls.

Remediation of several areas of the Site is being and has been completed by other parties in cooperation with the Group and those areas are addressed in other remedial design documents. This Remedial Design Report (RDR) focuses on the second phase of remedial activities to be performed in Quarry 3.

2.0 QUARRY 3 REMEDIAL DESIGN

2.1 QUARRY 3 REMEDIAL ACTION DESCRIPTION

The Quarry 3 Remedial Action focuses on the planned engineering and design for the removal of impacted soils and sediment in Quarry 3 and filling the Quarry with clean soil to a level that establishes a uniform grade and proper drainage of storm water as required by the ROD.

- Phase 1: The first phase includes the removal of sediment and surface water from the three Ponds in Quarry 3 and filling the Ponds with clean soil to the surrounding grade. Construction of the proposed access road, installation of office trailers, clearing, and construction material lay-down areas would also be completed during this phase. .

- Phase 2: The second phase, which is planned to be performed in 2009, will include removal of impacted soils and Plateau Area material in Quarry 3 and filling the remaining Quarry floor area with clean soil to a level that establishes a uniform grade, and provides for proper drainage of storm water.

This RDR focuses specifically on Phase 2. The anticipated construction phasing is presented in the Design Drawings and Construction Specifications in Appendix D and E.

2.2 PERFORMANCE STANDARDS

The Performance Standards for this Site are presented in the ROD and include the ARARs presented in Table 14 of the ROD. Some ROD standards have been or are in the process of being modified by USEPA based on the results of the pre-design analyses discussed below. The Performance Standards include the following:

- Surface Water – Surface water in the Ponds will be treated on-site and discharged to Matsunk Creek. The treatment standards for discharge to Matsunk Creek have been provided by PADEP and are presented in Table 2-1. Recent and historical surface water data is presented in Table 2-2.

- Plateau Area Material – The Plateau Area material will be excavated down to the bedrock surface or until the remaining soil meets all of the following criterion as demonstrated by confirmation sampling:

  - the 95% upper confidence limit (UCL) on the mean concentration of each residual soil PAH constituent is below the ROD standard;
  - the inorganic constituents are consistent with background concentrations or applicable ROD standard, as appropriate; and,
  - the 95% upper confidence limit (UCL) on the mean concentration of naphthalene is below 48 mg/kg.

- Remaining Impacted Soils in Quarry 3 – The remaining impacted soils in Quarry 3 will be excavated at the locations identified in the statistical analyses discussed below (see Table 2-3), as demonstrated by confirmatory sampling, until the limits necessary to meet the following criterion are accomplished:

  - the 95% upper confidence limit (UCL) on the mean concentration of each residual soil PAH constituent is below the ROD standard; and
  - the inorganic constituents are consistent with background concentrations or applicable ROD standard, as appropriate; and
  - the 95% upper confidence limit (UCL) on the mean concentration of naphthalene is below 48 mg/kg.

- Sediment, Soil and Plateau Area Material Disposal – All materials to be sent off-site for disposal have been tested for waste profiling purposes to determine the presence of RCRA Characteristic Wastes and no Characteristic Wastes have been identified at this time. Therefore, it is anticipated that all materials will be disposed of in accordance with the PA Residual Waste Regulations, PA Code 299. A waste profile has been accepted for Sediment, Soil, and Plateau Area Material disposal at Waste Management's GROWS landfill/Tullytown RR facility. A PADEP Form U has also been prepared and accepted by the PADEP for this material. The Form U and Waste Management application packet, including material analytical data, and documentation of acceptance is provided in Appendix K. No additional analytical sampling or analysis of these materials will be required for the anticipated 40,000 tons of material anticipated in the Form U Application. Wastes can be excavated, dewatered/conditioned as necessary, and loaded into transport vehicles, without the need to wait for laboratory data. If additional material requires disposal, additional sampling will be performed at a frequency consistent with selected disposal facility and PADEP requirements. If materials are encountered that differ in nature from those previously sampled, they will be sampled and analyzed for RCRA hazardous characteristics. If hazardous wastes are encountered, they will be handled in accordance with 25 PA Code, Chapters 262, 263 and 264 and 40 CFR Part 268.

- Backfill of the Quarry – The Quarry will be backfilled with soil that meets the excavation performance criterion. This soil may include Quarry 3 soil that meets the criterion or soil imported from off-site. The Quarry will be graded to drain out the east end of the Quarry into the adjacent drainage ditch. An approximately 200 foot long storm pipe will be used to convey water through the Quarry 3 dam. Backfill soils will be compacted to minimize the potential for subsidence.

- Erosion and Sediment Control – All excavation and backfill activities will be performed in accordance with PADEP's Bureau of Soil and Water Conservation Erosion and Sediment Pollution Control Manual and the Montgomery County Soil Conservation policy.

- Restoration – Disturbed areas will be covered with topsoil and vegetated with native plant material. The vegetation will be monitored and revegetated until a viable cover is established.

- Storm water – Storm water will be managed on-site to control excessive runoff during and after construction.

- Air Emissions – Fugitive dust and other air emissions will be closely monitored and control measures will be implemented as necessary.

2.3 PRE-DESIGN ACTIVITIES

In order to prepare for the design of the Quarry 3 remediation, several pre-design activities were performed, as described below:

2.3.1 Site Survey

A topographic survey of Quarry 3 was performed in 2003 by James A. Stewart, Inc., a Pennsylvania licensed surveyor. Additional survey work was completed by Advanced GeoServices Corp. in January 2008.

2.3.2 Pre-Design Investigations

A Pre-Design Investigation in Quarry 3 was performed by the Group from June 16 to September 15, 2003 in accordance with the approved Remedial Design Work Plan for Quarry 3. The results of that investigation are described in a report titled "Crater Resources Superfund Site, Quarry 3, Operable Unit 3, Pre-Design Investigation Summary Report", dated March 2004. Additional investigation work for the purpose of characterizing the surface water, soil and sediment waste for disposal was performed in March 2008. These investigations provided valuable data for the design, which included:

- A better understanding of the distribution and volume of impacted soil within the Quarry.

- A better understanding of the distribution and volume of sediment within the three Ponds at the bottom of the Quarry.

- A better understanding of the volume and quality of surface water within the three Ponds at the bottom of the Quarry.

- As assessment of whether portions of the Plateau Area material are currently stable enough to support transport in commercial trucks and whether the remaining material can be stabilized using the drier Plateau Area materials to accommodate transportation.

2.3.3 Statistical Analyses

2.3.3.1 **Inorganic Background Concentrations**

Performance Standards for soil removal are presented in Table 12 of the ROD, but the ROD also indicates that if inorganic background concentrations are higher than the Table 12 Standards, then the inorganic constituents in soils remaining after remediation must be consistent with background concentrations. The Group performed a statistical analysis of background soil inorganic constituents that established the inorganic background conditions for the Site. This analysis was presented to USEPA in a letter dated March 27, 2003 and approved by USEPA in a letter dated April 14, 2003. Copies of this analysis and the approval letter were presented in the Phase 1 Remedial Design Report.

2.3.3.2 **ROD Compliance Using the 95% Upper Confidence Limit**

In November 2004, the Group's consultants met with USEPA and discussed the methods that could be used to demonstrate compliance with the ROD cleanup standards. At that meeting, USEPA indicated that the ROD standards will be considered met if the 95% upper confidence limit (UCL) on the mean concentration of each residual soil constituent is below the ROD standard. The Group subsequently prepared a document titled "Statistical Analysis of Quarry 3 Soils, Crater Resources Superfund Site" (RBR, 2005). This analysis employed the existing 2003 data for soil and calculated the 95% UCL for soil constituents that have a ROD standard. The analyst then successively removed the highest concentrations of constituents from the data set and recalculated a residual 95% UCL. In this manner, the soils requiring removal to achieve the 95% UCL compliance with the ROD standard for each substance was identified. USEPA provided comments on this analysis in a letter dated August 8, 2005. This document was revised to address USEPA's comments and submitted to USEPA on March 25, 2008. A copy of this document was presented in the Phase 1 Remedial Design Report. Subsequent comments were received from USEPA on June 4, 2008, which were responded to on July 31, 2008 and again on November 12, 2008, which were responded to on December 18 , 2008. Table 2-3 presents a list of the samples representing the soils targeted for removal to meet the 95% UCL.

As the initial excavation is completed in each area, data from the remaining soil samples collected during the 2003 investigation, plus confirmation samples collected from the selected excavations, will be used to calculate the 95% UCL to verify that ROD soil cleanup standards are met. The Group will evaluate sample results as received and perform statistical analysis to determine if an area meets the cleanup standards. Areas represented by samples that meet cleanup standards may be backfilled as directed by the Group. The process for evaluating sample data is summarized in Section 2.5 of this RDR and presented fully as Appendix M.

2.3.3.3 **Revised Naphthalene Standard**

The June 2005, analysis discussed above resulted in the apparent need for significant soil removal in peripheral soils (those along the Quarry 3 slopes) in order to meet the 95% UCL for the ROD standard for naphthalene of 0.2 mg/kg. The Group discussed this issue with the USEPA and USEPA indicated that the Group could develop an alternative remediation standard

for naphthalene in soil through numerical vadose zone fate and transport modeling. This modeling was performed and presented to USEPA in a document titled "Technical Memorandum – Development of Target Naphthalene Concentrations in Quarry 3 Soils, Crater Resources Superfund Site" (Key, 2006). The document has been finalized and was submitted to USEPA on March 25, 2008. It was also presented in the Phase 1 Remedial Design Report. The final version uses a slightly higher Dilution Attenuation Factor (DAF) of 16.8 vs. 16.3 previously used, in order to be consistent with the hydraulic conductivity value for the site agreed upon in USEPA's letter dated April 17, 2007. The resulting naphthalene remediation goal is 48 mg/kg as the 95% UCL concentration.

2.3.3.4 **Statistical Analysis of Arsenic Concentrations**

The background analysis described in Section 2.3.3.1 above demonstrated that the ROD cleanup standard for arsenic was several orders of magnitude less than naturally occurring background levels, therefore, in accordance with the ROD, a statistical background analysis was completed for arsenic in Quarry 3, to identify soil areas that require removal such that the arsenic concentrations in the remaining soil are consistent with background concentrations. This analysis was presented in a document titled "Draft Technical Memorandum – Statistical Analysis of Arsenic in Quarry 3 Soils, Crater Resources Superfund Site" (RBR, 2006). USEPA provided comments on this document in a letter dated March 9, 2007. The Group incorporated these comments into the 95% UCL statistical analysis report submitted to USEPA on March 25, 2008 and presented in the Phase 1 Remedial Design Report.

2.3.4 Surface Water Evaluation

The surface water in the Ponds does not pose a risk to human health but must be removed to allow for remediation of the sediments in the base of the Ponds. The ROD currently specifies that the surface water contained within the three Ponds in Quarry 3 be transported to an off-site facility for treatment. The Group has performed an evaluation of the surface water in the Ponds and has determined that, based upon the data we have accumulated that indicates low or absent concentrations of site constituents in the Pond water, on-site treatment with subsequent discharge to Matsunk Creek is a more appropriate treatment method than trucking and off-site disposal at a POTW. The Group requested approval from USEPA in a letter dated January 10, 2008 to utilize this alternative treatment method in accordance with PADEP requirements. Discussions with PADEP in this regard have resulted in a favorable response. The Group feels that this alternative treatment method is equally effective at treating the water, is more easily and readily implemented, safer and more cost effective, will have less traffic impact on the surrounding community and will conserve natural resources. USEPA responded to the Group's request in a letter dated February 21, 2008, requesting a Focused Feasibility Study (FFS) to justify the selected disposal method. The Group prepared the FFS and submitted it to USEPA on April 16, 2008. USEPA provided comments on the FFS on April 30, 2008 and the Group submitted a revised FFS on May 28, 2008. The FFS was approved by USEPA on July 24, 2008.

2.4 DESIGN ELEMENTS

The design elements discussed below are addressed in the calculations, specifications, drawings and element specific work plans that comprise the Appendices of this 100% Remedial Design for Phase 2.

2.4.1 Site Access

Access to Quarry 3 will be via an access road to be constructed during Phase 1 to the east of Quarry 2 which extends from Renaissance Blvd. southward to the north rim of Quarry 3, then turns eastward, paralleling the quarry rim and entering the Quarry at it's eastern end. The access road is shown on Drawing E201. The road will be constructed with compacted stone and geotextile and will be approximately 24 feet wide. This access road may be extended or modified by the contractor to facilitate staging of transport trucks and materials. Any modifications to the access roads proposed by the Contractor will be handled through the submittal process and will be subject to approval of the Group and the appropriate landowners.

A vehicle and pedestrian traffic safety plan for off-site vehicle and pedestrian traffic control is presented in Appendix F. Real-time traffic control will include road signs, flag-men and lane-restrictions as necessary. Pedestrian walking traffic in the vicinity of the access gate will be re-directed to the opposite side of the street.

Access to the Quarry 3 work area will be controlled by physical barriers and personnel security procedures. An existing 8 foot high chain link fence will control access from Renaissance Blvd. and the adjacent properties to the north, east and west. A natural steep slope provides sufficient access control from the adjacent private golf course, as entry to the golf course is limited to club employees, members and their guests. The access gate located at Renaissance Boulevard will be locked at the end of each day. All site visitors will be directed to the construction office by site construction personnel.

2.4.2 Site Preparation

Site preparation activities will include evaluating the Phase 1 exclusion and decontamination zones and re-delineating if necessary, and remobilizing the Contractor's Phase 1 equipment, as necessary, and any new equipment required for Phase 2.

The limits of the exclusion zone will be defined by the Contractor in the Remedial Action Work Plan. Vehicles and equipment will enter and exit the Quarry via the access road. A vehicle decontamination station will be constructed during Phase 1 on the access road, as shown on Drawing E201. Additional or alternate locations for vehicle and/or personnel decontamination may be established by the Contractor as necessary. Alternate decontamination stations may be established within Quarry 3 by the Contractor as work progresses. Ultimately, all decontamination liquids will be directed to the surface water treatment system.

Portions of the property above and surrounding Quarry 2 will be available for use as a support zone for use as material lay-down areas, stockpile areas, and other support zone uses. It is anticipated that office and equipment trailers will be mobilized by the Contractor. These trailers, materials and equipment will be staged within the support zone at the start of work. The Contractor will identify use of the Quarry 2 area in the RAWP. The RAWP will provide detailed layout and description of the Contractors use of the support area.

2.4.3 Health and Safety

The Contractor is required to prepare a site-specific Hazardous Waste Operations Health and Safety Plan (HASP) that meets Occupational Safety and Health Administration (OSHA) requirements as specified in 29 CFR 1910.120 (See specification Section 01545). The Phase 1 and Phase 2 HASPs will be combined in a single HASP. The Contractor's HASP will provide specific procedures to address the following health and safety-related controls:

- Monitoring of the physical health of employees
- Exclusion zone locations and boundaries
- Air monitoring
- Dust controls
- Construction worker (equipment operators, laborers, inspectors,) personal protective equipment (PPE)
- Construction equipment and dump-truck decontamination procedures
- Spill response and contingency planning

A health and safety officer designated by the Contractor will be onsite at all times during work. In addition to his/her other duties onsite, the health and safety officer will monitor the work zone for particulates, VOC/SVOC emissions, and odors. The Group's Construction Quality Assurance (CQA) official will also perform perimeter monitoring for particulates, VOC/SVOC emissions, and odors in accordance with the SAP. When necessary, appropriate measures as outlined in Specification 02117 (work stoppage, wetting soils, surface foams and spray on shells, etc) will be taken to prevent excessive particulates, emissions, and odors from potentially affecting neighboring properties.

2.4.4 Surface Water Treatment and Discharge

Precipitation events during remedial activities will generate surface water. Storm water that comes in contact with impacted soil or Plateau material will be directed to Pond 2. Water that accumulates in Pond 2 will be pumped out and treated onsite using the treatment system installed during Phase 1, which will include granulated activated carbon units to remove VOCs and SVOCs and if necessary, ion-exchange units to remove the inorganic constituents. Treated water will be discharged to Matsunk Creek. The treatment standards for discharge to Matsunk Creek have been provided by PADEP and are presented in Table 2-1. Water will be pumped and discharged at a maximum rate of approximately 250 GPM through a 2000 foot long HDPE discharge pipe.

2.4.5 Plateau Material Removal and Disposal

As much as 12,600 CY (18,900 Tons) of material will be excavated from the Plateau Area defined on drawing E203. When Ponds 1 and 3 are backfilled, the entire bottom area of Quarry 3 will be available as a working area with the exception of Pond 2. It is anticipated that work areas established on the backfilled ponds would be limited to activities such as stockpiling additional imported fill/topsoil, staging of construction equipment and materials, or relocation of the haul road. None of these activities are anticipated to have significant potential for cross contamination.

It is anticipated that soil removal work will begin in the Plateau Area of Quarry 3 located at the west end of the quarry. The soils in the Plateau Area are a layered mix of dark organic soil material interbedded with natural appearing soils.

It is anticipated that the plateau materials would be most efficiently and safely removed by performing the excavation in layers. This will allow the bedrock sidewalls and Pond 1 to serve as the excavation sidewalls and eliminate the need for designed slopes/benching of the softer Plateau Materials. Material would be excavated in even lifts and then mixed and loaded from a designated location; likely on the east side of the Plateau. Because the dark organic soil materials have the potential to be soft and wet they will be mixed with the interbedded soil layers to produce a blended material that is soil-like and stable for truck transport. If the blended Plateau Materials are too wet for transport the Contractor will add a conditioning agent to the material to stabilize it for transport. Conditioning agents such as crushed limestone would be suitable for this purpose. It is anticipated that such a conditioning agent would be added at a rate of 0-5% by weight and mixed into the blended material using a large excavator. Depending on soil conditions and the timing of operations the Contractor could also utilize Peripheral Soils (Section 2.4.6) to stabilize moist Plateau Materials, or utilize Plateau Materials to stabilize pond sediments.

The Plateau Area material is suitable for disposal at a non-hazardous landfill. A waste profile for Plateau has been accepted at the Waste Management GROWS landfill/Tullytown RRF with corresponding PADEP Form U acceptance. The Contractor may use this facility or seek approval at an alternate facility.

The Plateau Area is well defined by the Quarry walls on three sides and Pond 1 on the remaining side. These limits will initially define the excavation area. Geoprobe borings indicate that there may be several feet of potentially un-impacted soil between the bottom of the dark organic soil material and the top of the bedrock over at least a portion of the Plateau Area. The initial excavation depth will be limited at the surface of this soil layer. Once this bottom soil layer has been exposed the Group's QA Official will inspect the appearance to determine if the bottom soils appear un-impacted. If the bottom soils appear to be un-impacted the Contractor will perform test pits to determine the soil thickness. If the soil thickness and area is determined to be of significant volume the QA Official will perform investigatory sampling (Section 3.3.1 of the SAP). The results of the investigatory sampling will be used to determine if the bottom soils can remain in place. Bottom soil that meets the Quarry 3 clean-up limits may remain in place.

If un-impacted soil appears to be present along the Quarry sidewalls between the dark organic soil material and the rock walls, then investigatory sampling will also be used to determine when the lateral limits have been reached. Root material encountered in the excavation will be disposed of along with the excavated soil.

If investigatory sampling indicates that bottom soils must be excavated then post excavation confirmatory sampling (Section 3.3.2 of the SAP) will be performed to determine when excavation is complete.

2.4.6 Peripheral Soils Removal and Disposal

There are several other soil areas that also require minor excavation (see Table 2-3 and Drawing E203). These areas have been defined based on the statistical analyses performed during the pre-design activities and include a large shallow excavation area defined by several contiguous samples collected in the 0" to 6" horizon and several smaller deeper excavation areas. The shallow excavation area will be excavated to a depth of 9" to 12". The deeper excavation areas are initially defined as a 10 foot square around the selected sample locations. Excavation depths for the deeper locations will be as shown on drawing E203. The initial excavation limits for both shallow and deep excavations will be confirmed by samples and additional excavation will be performed if necessary. Confirmatory sampling and statistical analysis procedures outlined in Section 2.5 will be used to demonstrate that the remaining soils meet the following criterion:

- the 95% upper confidence limit (UCL) on the mean concentration of each residual soil PAH constituent identified in the ROD is below the ROD standard;
- the inorganic constituents are consistent with background concentrations or ROD Standards, whichever are greater; and,
- The 95% upper confidence limit (UCL) on the mean concentration of naphthalene is below 48 mg/kg.

Material excavated from these other areas will also be transported offsite for disposal. Root material encountered in the excavation will be disposed of along with the excavated soil. These soils are suitable for disposal at a non-hazardous landfill and will be transported to the same facility as the Plateau Area material. Depending on the timing of Peripheral Soils excavation, they could be blended with excavated Plateau Materials for transport and disposal.

With the approval of the Group and USEPA, Peripheral soils could also be excavated during Phase 1B work and blended with Pond Sediments for offsite transport; or used as part of the access ramps into the Ponds.

2.4.7 Quarry 3 Soil Backfill

If the Plateau Area material is removed down to bedrock, it will be backfilled as soon as possible to minimize the accumulation of surface water. If bottom soils are left in place at the Plateau Area, and in the Peripheral Soils excavation areas, backfill will be performed after investigatory/confirmatory sampling results are received and approved by USEPA.

Since it is anticipated that there will be no future development in Quarry 3, the backfill will not need to support applied loads and merely needs to be stable and self supporting. Therefore, the fill material can be any natural soil (i.e. clay, silt, sand or loam) that is free of excessive organic matter. Fill material will meet the PADEP Clean Fill criteria and the Quarry 3 soil performance standards for contaminant constituents. Fill will be placed in 18" lifts and compacted to 90% of maximum dry density. This compactive effort is appropriate for non-load bearing fills. The Quarry excavations will be backfilled and the entire Quarry bottom will be graded to direct water to a sediment basin on the eastern end of the Quarry and then to the adjacent drainage ditch via subsurface pipe. Minimum slopes will be 1%. The Construction Specifications are provided as Appendix D.

2.4.8 Restoration

2.4.8.1 **Topsoil**

The topsoil layer was selected to be sufficiently thick to retain water in order to sustain vegetation. The topsoil provides a minimum of 4 inches of soil with an organic content, pH and grain size that will support vegetative growth. Like imported fill materials, imported topsoil will satisfy the PADEP Clean Fill criteria and Quarry 3 Clean Up Standards. In addition, testing for total organic content, nutrients, and pH which will be used to provide recommendations for, fertilizer type and quality, and lime type and quality, and application rates. The specific material requirements for topsoil are provided in Specification 02936 and Section 3.2.3 of the SAP.

2.4.8.2 **Vegetative Cover**

Disturbed areas will be hydroseeded to restore vegetative cover. The permanent vegetative cover will utilize quick germinating, fast growing vegetation which is capable of self-regeneration and plant succession and of stabilizing the soil surface from erosion. Seeding and planting of disturbed areas is required to occur no later than the first normal period for favorable planting after final grading.

The seed mixture and appropriate time for planting were selected to be consistent with the Penn State College of Agricultural Sciences Erosion Control and Conservation Plantings on Noncropland, as required by the PADEP Erosion and Sediment Pollution Control Program Manual, and the PADEP Storm water Best Management Practices Manual. The seed mixture was also selected based on temperature and drought resistance.

Successful vegetation will be defined as 90 percent surface area coverage of live, growing species from the seed mix, with the largest individual surface area not meeting the 90 percent coverage requirement not to exceed 100 square feet.

Trees, shrubs, or deep rooted plants will not be planted in the Quarry, however, mature trees at the top of the Quarry create a visual buffer along the perimeter and they will be preserved to the extent possible.

2.4.8.3 **Post-RA Restoration and Confirmation Outside of Quarry 3**

Areas outside of the Quarry that are used for support of the Quarry 3 remediation will be restored to pre-Quarry 3 RA conditions as described in the Phase 2 RAWP. Decon pads, haul roads, transfer areas, and other support zones will be removed and the areas will be re-covered in stone or seeded. Portions of the support zone that were inside the exclusion zone or otherwise potentially subject to cross contamination during the Quarry 3 RA will be sampled in accordance with Section 3.8 of the SAP to confirm that the soils beneath those support areas have not been impacted. Sampling will be performed in a similar manner to post excavation confirmation sampling. Samples will be collected from the surface materials to a depth of 6". One sample will be collected for every 2,500 SF of disturbed area. For the haul road one sample will be collected for every 100 LF of road (assuming 24' wide road). Impacted soils will be removed and the areas re-sampled.

2.4.9 Water Management

This Section describes both temporary (during construction) and permanent surface water management features for the Site.

2.4.9.1 **Surface Water Management During Construction**

During Phase 2 excavation activities, diversion berms and swales will be used to direct surface water runoff that contacts impacted soil or Plateau Area material toward Pond 2. This will prevent cross-contamination of areas which do not require remediation and areas where excavation has been completed. Surface water which accumulates in the active excavation areas will be allowed to percolate into the ground surface. In cases when surface water accumulations prevent continued work activities, the water may be transferred to Pond 2. Non-contact surface water may be directed to Pond 2 or collected separately and used for dust control or pumped to the adjacent storm water basin, depending on Site conditions.

When all excavations have been completed and verified by confirmation sampling, the storm water drainage pipe will be constructed through the eastern embankment. The drainage pipe will consist of 200 feet of 18" diameter HDPE piping to convey storm water to the adjacent drainage ditch located east of the Quarry on the adjacent property. The storm water pipe has been designed to handle a 100 year storm event. See Appendix I for the storm water calculations. Following installation of the drainage pipe, Pond 2 will be backfilled, and the Quarry bottom will be finish graded to drain toward the drainage pipe.

2.4.9.2 **Surface Water Management Following Restoration**

The permanent storm water management system consists of a storm water management basin and the HDPE drainage pipe discussed above. Infiltration at a basin is typically required by the PADEP BMP Manual, however, since the Quarry bottom will be constructed with compacted soil, infiltration will be minimal and due to the limestone formations beneath the site, significant infiltration is not desirable.

Storm water run-off from Quarry 3 was evaluated for the Group by Momenee Associates during the land development process for 2501 and 2901 Renaissance Blvd. for discharge into the adjacent storm water basin. Momenee used the area of drainage that contributed to Quarry 3 surface water (7.6 Ac) and using computer software determined the peak flow that would be generated for 2, 5, 10, 25, 50, and 100 year 24-hour storm events. The Momenee calculations assumed a 36" pipe discharging to the sediment basin O'Neill has constructed adjacent to the east end of the Site (Basin 2). Calculations are provided in Appendix I.

In order to minimize the amount of soil fill needed to be imported into Quarry 3, storm water will be discharged directly into the drainage ditch north of the storm water basin instead of the basin itself. The rate of discharge to the drainage ditch will be controlled by an orifice plate installed on the outlet structure within Quarry 3. The orifice plate has been designed to manage the 2 through 100-year, 24-hour storm events such that post-construction peak flows from Quarry 3 do not exceed the rates allocated for it in the storm water calculations prepared for the adjacent retention basin by Momenee Associates. The storm water management system was designed and will be constructed in accordance with the PADEP Erosion and Sediment Pollution Control Program Manual.

2.4.10 Erosion, Sediment and Dust Control

Erosion and sediment (E&S) control measures, consisting primarily of a temporary sediment basin, silt fencing, hay bales, construction entrances, and temporary diversion channels and berms will be installed in accordance with the Drawings and Specifications and the PADEP Erosion and Sediment Pollution Control Manual. The E&S control measures will be implemented to control sediment in runoff from impacting non-contaminated areas and to control surface water from impacting construction operations. To the extent practicable, all sediment generated by runoff within the Quarry will remain in the Quarry. Sediments collected during construction in filter bags and other E&S features will be spread out to dry and used as fill. E&S control measures are shown on the Design Drawings provided in Appendix E.

Dust control measures will be used to prevent off-site wind-blown migration of soil during remedial activities. Dust control will be provided using water spray. Air monitoring for dust will be conducted as discussed in the Sampling and Analysis Plan (SAP) during all phases of soil disturbance to ensure that the surrounding community is protected. The SAP is provided in Appendix G. Conditions which require implementation of additional dust control or stoppage of work are discussed in the Specifications. The Construction Specifications are provided as Appendix D. Treated surface water may be used for dust control within excavation areas.

2.4.10.1 **Temporary Sediment Basins**

Pond 2 will serve as a sediment basin during construction activities until the drainage pipe is installed. Pond 2 will have a storage capacity of approximately 27,279 CF, which meets the PADEP Erosion and Sediment Pollution Control Manual, that requires 1,000 CF of sediment storage and 5,000 CF of settling volume per disturbed acre. The accumulated sediment within Pond 2 at the completion of excavation activities will be sampled for Quarry 3 clean-up standards. It is not anticipated that a large volume of material accumulate in Pond 2 during its

use as a sediment basin. Therefore only one sample will be collected from this material. If the sediment complies with the standards, it will be spread on the fill surface, if it does not comply; it will be disposed off-site with the other impacted soil.

Following construction of the storm water discharge pipe, the east end of the Quarry will serve as the temporary sediment control basin. The outlet structure for the temporary sediment control basin will consist of a skimmer connected to the proposed permanent outlet structure. The basin will dewater through the skimmer in approximately 3-4 days. A 18-inch diameter corrugated polyethylene pipe with smooth interior will discharge flow to the existing channel which drains to Matsunk Creek. The rip rap apron at the outlet structure will provide protection against erosion in accordance with the allowable discharge velocity limits presented in the PADEP Erosion and Sediment Pollution Control Manual. Calculations are provided in Appendix I. Sediment within the basin will be removed when sediment has accumulated to approximately elevation 128.02 ft MSL. The temporary sediment control basin will be converted to a permanent storm water management basin once vegetation has established. Conversion activities will include backfilling the basin to a bottom elevation of 127.0 ft MSL, removing the skimmer, and replacing the temporary bottom orifice plate with the permanent bottom orifice plate.

2.4.11 Decontamination Water Management During Construction

Water generated during decontamination of equipment will be collected and treated in the on-site treatment system.

2.4.12 Air Monitoring During Construction

Air monitoring will be conducted during construction during all phases of soil disturbance to ensure that Site workers and the surrounding community are protected. Three types of air monitoring will be conducted: Site perimeter, near field real-time and work zone personal monitoring.

Site perimeter monitoring performed by the Group's QA Official, will consist of ambient air monitoring for particulates, arsenic, mercury, VOCs and SVOC's using area samplers. The sampling will document whether site constituents of concern (COCs) are being emitted from the Site. Site perimeter monitoring is presented in the SAP in Appendix G. The modifications to field activities based on monitoring results is provided in the SAP as well as Specification 02117 in Appendix D.

Near field air monitoring performed by the Group's QA Official, will determine if dust is migrating outside of the immediate work area so that additional dust control measures can be implemented when necessary. This monitoring will consist of continuous, real-time particulate (dust) monitoring using aerosol monitors and photo ionizing detectors (PID) equipped with data loggers. Real-time air monitoring is presented in the SAP in Appendix G. The modifications to field activities based on monitoring results is provided in the SAP as well as Specification 02117 in Appendix D.

Personal air monitoring will be performed by the Contractors Health and Safety Coordinator, to determine if Site workers are wearing appropriate personal protective equipment. The monitoring will be time-weighted average air monitoring for COC exposure. The frequency of personal air monitoring and how results will affect personal protective equipment will be presented in the Contractor's Health and Safety Plan prepared at the start of construction.

2.4.13 Construction Quality Assurance

Construction Quality Assurance will be performed in accordance with the Construction Quality Assurance Plan (Appendix H).

2.5 DEMONSTRATION OF COMPLIANCE WITH STANDARDS

This section summarizes the proposed approach to post-excavation verification of compliance which was previously submitted on November 5, 2008. The document has been subsequently revised and is included in this RDR as Appendix M.

2.5.1 Approach for Evaluation of Potentially Carcinogenic PAHs

As outlined in the "Technical Memorandum: Statistical Analysis of Quarry 3 Soils" (RBR/AGC, March 2008), the following potentially carcinogenic PAHs were identified for mitigation based on the results of a preliminary statistical analysis: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. (It should be noted that other PAHs, including 2-methylnaphthalene, had individual sample results exceeding the ROD standard, but the preliminary statistical analysis indicated that no further evaluation was required). The analytical results for the soil samples were evaluated to determine which samples contained the highest concentrations of constituents that were resulting in representative concentrations which exceeded the ROD cleanup standards. The goal of the evaluation was to determine the minimum number of samples with the minimum volume of soil that would need to be mitigated in order to meet the ROD standards.

The evaluation was performed by iteratively removing data associated with samples having the highest concentrations, and re-calculating representative concentrations [based on 95% upper confidence limits (UCLs)], until the representative concentrations met the ROD standards. Using this approach, the analysis indicated that soil associated with ten samples from eight locations should be mitigated to address the potentially carcinogenic PAHs. These samples are listed in Table 2.

Soil associated with these sample locations is targeted for excavation. As each excavation is completed, confirmatory samples will be collected from the sidewalls and/or bottom of the excavation. Upon receipt of confirmatory data, a statistical evaluation will be completed as follows:

1. Soil analytical results that are associated with samples collected from excavated areas will be removed from the post-excavation database. This will include results that exceeded ROD standards and were the original basis of the excavation

activity, as well as results that may have been less than ROD standards, but which no longer represent that area.

2. Soil analytical results that are associated with confirmatory samples will be added to the post-excavation database.

3. 95% UCL concentrations will be calculated for the potentially carcinogenic PAHs identified above using the post-excavation soil database. The USEPA (2008) statistical software, ProUCL Version 4.00.02, will be utilized for calculation of 95% UCLs.

4. The 95% UCL concentrations will be compared to the ROD standards for each constituent. If the 95% UCL for any one constituent exceeds the ROD standard, the sample or samples that are driving the 95% UCL to exceed the ROD standard will be identified for further mitigation.

5. The data will be assessed to insure that hot spots are not erroneously included with a different population.

Upon completion of subsequent mitigation activities, if any, additional confirmatory samples will be collected and analyzed, and the 95% UCL concentrations will be recalculated and tested for compliance in a manner consistent with the steps outlined above. If the 95% UCL concentration for each constituent is lower than its respective ROD standard, the constituents will be deemed to be in compliance with the ROD standards, and soil will require no further excavation.

2.5.2 Approach for Evaluation of Naphthalene

For naphthalene, a subsurface soil cleanup standard of 0.2 mg/kg was originally presented in the ROD (USEPA, 2000). Based on an evaluation of migration from soil to groundwater (Key Environmental, Inc., 2008), this standard has been revised to 48.0 mg/kg. Compliance with this standard is determined based on a comparison to the 95% UCL concentration for naphthalene.

An evaluation of the analytical data for Quarry 3 indicates that there are no existing subsurface soil samples with naphthalene concentrations greater than the leaching-based value. However, post-excavation confirmatory samples will be analyzed for naphthalene to ensure compliance with the leaching-based value. Upon receipt of confirmatory data, a statistical evaluation will be completed as follows:

1. Soil analytical results for naphthalene that are associated with samples collected from excavated areas will be removed from the post-excavation database.

2. Soil analytical results that are associated with confirmatory samples will be added to the post-excavation database.

3. The 95% UCL concentration will be calculated for naphthalene using the post-excavation soil database (subsurface soil data only). ProUCL (USEPA, 2008) will be utilized for calculation of the 95% UCL concentration.

4. The 95% UCL concentration will be compared to the leaching-based value of 48.0 mg/kg. If the 95% UCL exceeds the leaching-based value, the sample or samples that are driving the concentration to exceed the leaching-based value will be identified for further mitigation.

5. The data will be assessed to insure that hot spots are not erroneously included with a different population.

Upon completion of subsequent mitigation activities, if any, additional confirmatory samples will be collected and analyzed, and the 95% UCL concentration will be recalculated and tested for compliance in a manner consistent with the steps outlined above. If the 95% UCL concentration of naphthalene is lower than the leaching-based value, naphthalene will be deemed to be in compliance with the established standard, and soil will require no further excavation.

2.5.3 Approach for Evaluation of Arsenic

As outlined in the "Technical Memorandum: Statistical Analysis of Quarry 3 Soils" (RBR/AGC, March 2008), the 95% UCL concentrations of arsenic in surface and subsurface soil were greater than the ROD standards. Since the ROD cleanup standards for arsenic were below naturally occurring background levels, the benchmark was adjusted to background based on a study of site-specific background concentrations. A subsequent statistical evaluation was performed to determine if the site data sets were significantly greater than background data. The analysis applied statistical methodologies to compare the post-mitigation soil data set (i.e., the soil data set excluding results associated with the 10 samples identified for mitigation based on potentially carcinogenic PAHs) with site-specific background concentrations [as documented in correspondence from AGC (2003)]. The data were evaluated using the null hypothesis that site concentrations of arsenic were not greater than background concentrations.

The statistical background analysis indicated that the site data for arsenic do not exceed background (RBR/AGC, March 2008). However, mitigation of soil associated with one outlier sample and the sample located physically above the outlier was recommended. In addition, to comply with USEPA's request for mitigation of additional samples, mitigation of soil associated with two additional sample locations was recommended. These samples are listed in Table 2.

Soil associated with these sample locations is targeted for excavation. As each excavation is completed, confirmatory samples will be collected from the sidewalls and/or bottom of the excavation. Upon receipt of confirmatory data, a statistical background analysis will be completed as follows:

1. Soil analytical results for arsenic that are associated with samples collected from excavated areas will be removed from the post-excavation database. These results will be replaced with a randomly generated concentration within the range of 0 to

13.1 mg/kg [representing the upper tolerance limit (UTL) of arsenic concentrations in 18 site-specific background samples, as per AGC (2003)]. This approach is consistent with the statistical analysis completed by RBR/AGC (2008). If actual data from the imported soils are available in sufficient sample size, these data will be used in preference to the randomly generated numbers.

2. Soil analytical results that are associated with confirmatory samples will be added to the post-excavation database.

3. Walsh's test will be conducted on the post-excavation data set to analyze the data for possible outliers. Outliers at the upper end of the distribution may be considered "hot spots" (USEPA, 2006) and may also warrant mitigation.

4. The data sets will be evaluated using the Wilcoxon-Mann-Whitney (WMW) Test (utilizing ProUCL) to determine whether a difference exists between the two population distributions (i.e., site and background). The level of significance (α) used for the background evaluation will be 0.1, consistent with the statistical analysis completed by RBR/AGC (2008).

5. If the results of the WMW Test indicate that the site data set is significantly greater than background, the sample or samples with the highest arsenic concentrations will be identified for further mitigation.

6. The data will be assessed to insure that hot spots are not erroneously included with a different population.

Upon completion of subsequent mitigation activities, if any, additional confirmatory samples will be collected and analyzed, and the background evaluation will be repeated in a manner consistent with the steps outlined above. If the site data set does not exceed background, arsenic will be deemed to be in compliance with the established standard, and soil will require no further excavation.

2.5.4 Excavation Process

The excavation process will proceed until complete for all areas of Quarry 3. Upon completion, all analytical results associated with excavated sample locations will have been removed from the database, and all analytical results associated with confirmatory samples will have been added to the database. This approach would combine confirmatory samples underlying the plateau area as well as all relevant post-excavation samples from peripheral soil areas. The statistical evaluations will be conducted as described above. If the need for further mitigation is identified, the following approaches will be followed.

- To conduct additional mitigation for a sidewall sample, the excavation would be widened by five feet from the midpoint between the failing and compliant samples in the sidewall.

- To conduct additional mitigation for a bottom sample, the excavation would be deepened by six inches over the area defined by the midpoints between the failing sample and the surrounding compliant samples.

The Group will delay backfilling excavations for each area until compliance with ROD standards and/or other standards can be verified based on the statistical analyses. However, the Group proposes to backfill excavations immediately if each confirmatory datum for an excavation is lower than its respective comparison value.

The estimated time for excavation and sampling for the peripheral areas is three to five days, and for the plateau area is one to two months. For the peripheral area, sampling will occur every two days or as often as is appropriate when a suitable area is available for sampling. For the plateau area, sampling will occur approximately every week.

A final post-excavation confirmatory report will be submitted to USEPA to document the results of the excavation and confirmatory sampling activities and the associated statistical evaluations. The final report may be a stand-alone document or a component of the Remedial Action Completion Report.

3.0 PERMITTING

This section discusses federal, state, regional and local permits and approvals required for the implementation of Phase 2 of the Quarry 3 Remedy. A discussion of the application requirements and timeline for each item is provided below.

3.1 FEDERAL PERMITS

The existing Ponds are not regulated waters of the United States per 33 CFR 323.2(b) and are required by the ROD to be filled. Therefore, there are no U.S. Army Corps of Engineers permits required for filling the ponds.

3.2 STATE AND COUNTY PERMITS

3.2.1 Individual National Pollutant Discharge Elimination System (NPDES) Permit for Storm water Discharges Associated with Construction Activities

During the remediation of the Quarry 3, work activities will take place inside and outside the Quarry 3 rim. Work outside the Quarry 3 rim will be performed in the support zone established above Quarry 2. Although this area is already included within the area of disturbance for O'Neill's remediation of Quarry 2 and future development of 2501 Renaissance; the Group and/or the Remedial Contractor will obtain a permit equivalent for earth disturbance activities associated with the Quarry 3 remedial work.

During remedial activities, all surface water and soil erosion within the rim of Quarry 3 will be contained within the Quarry in Pond 2. The water will be pumped, treated, and discharged to Matsunk Creek in a controlled manner in accordance with the PADEP letter of authorization for temporary discharge.

Once the remediation work is completed and the restoration process begins, water and soils within the Quarry will be controlled in accordance with PA Code. Per 25 PA Code Section 102.5, construction activities involving earth disturbance of 1 to 5 acres require an individual NPDES Permit for storm water discharges associated with construction activities. Since the Quarry 3 Remedy is not anticipated to include greater than 5 acres of new earth disturbance, an application for an Individual NPDES Permit was submitted to the Montgomery County Conservation District (MCCD) and a letter of Adequacy was received from the MCCD on March 27, 2009.

The NPDES Permit application package was prepared by the Group. The Contractor will be made a co-permittee. The application included the following:

- Current Permit Application Form;
- General Information Form (GIF);
- Permit filing fee of $250 payable to the Commonwealth of Pennsylvania, Clean Water Fund;
- Location Map;

- Erosion and Sediment (E&S) Control Plan;

  - Topographic features
  - Information on soils (type, depth, slope, locations and limitations)
  - Proposed alterations
  - Amount of runoff
  - Staging of earthmoving activities
  - Temporary and permanent control measures
  - Maintenance program
  - Drawings and narratives
  - Sequence of Best Management Practice (BMP) installation and removal

- Post Construction Storm water Management Plan;

  - Written narrative
  - Location of BMPs showing final contours
  - Drawings of permanent stabilization
  - Drawings of BMPs
  - Operation and maintenance procedures
  - Supporting calculations or measurements
  - Design frequency storm rainfall amount
  - Area of impervious surface
  - Curve number or Runoff Coefficient
  - Runoff from the design frequency storm
  - Volume of water infiltrated through BMPs
  - Peak discharge rate for the design frequency storm

- PPC Plan;
- Completed Pennsylvania Natural Diversity Inventory (PNDI) Search form and search receipt(s);
- Notifications to the county and municipality for discharge under the NPDES permit and proof of receipt;
- Cultural Resource Notice including Pennsylvania Historic and Museum Commission (PHMC) response letter or certified mail receipt (required for all projects 10 acres or more);
- Interim Water Quality Analysis Module (Sections A and B only); and,
- Checklist.

A Notice of Termination (NOT) form will be submitted to the MCCD following completion of construction. A copy of the approved NPDES Construction Discharge Permit Equivalent will be maintained at the Site at all times during construction.

3.2.2 General Permit BDWM-GP-4

A General Permit BDWM-GP-4 (GP-4) is required by PADEP for any intake and outfall structures across or projecting into the regulated waters of Pennsylvania. This permit would also

cover any storm water discharge into the waters of Pennsylvania via pipe outfalls 36 inches in diameter or less. The permit authorization is pursuant to Section 7 of the Dam Safety and Encroachments Act, and the rules and regulations promulgated thereunder in 25 PA Code Section 105.441.

3.2.3 Discharge Permit

A letter of Authorization is required from the PADEP to authorize the temporary discharge of treated surface water to Matsunk Creek. The Group has obtained that letter of authorization.

3.2.4 Air Permit

A PADEP Bureau of Air Quality Operating Permit is not required.

3.2.5 Solid Waste

There are no required waste permits, licenses, or approvals for implementation of the Quarry 3 Phase 2 Remedy. Wastes to be disposed off-site require acceptance of a Form U by PADEP. The Form U for this waste has been approved by PADEP for disposal at the Waste Management GROWS/TRRF Facility.

4.0 INSTITUTIONAL CONTROLS AND ACCESS AGREEMENTS

This Section outlines institutional controls proposed for the Site following completion of the Remedy including title notices, easements, access requirements and security controls. These measures are proposed to protect the integrity of the Site and the Remedy.

4.1 INSTITUTIONAL CONTROLS

Institutional controls will be established in accordance with the Institution Controls Work Plan that has been prepared for the entire Site; however, the Group and any other third parties, will comply with the following use restrictions for the Site as required by the ROD:

- The Site may not be used in any manner that would interfere with or adversely affect the integrity or protectiveness of the remedial measures;
- The Site may not be used for any purpose which might interfere with, obstruct, or disturb the performance, support, or supervision of the Work, including any Operation & Maintenance activities;
- No drilling, construction and/or placement of new groundwater wells at the Site for the purposes of (i) drinking, bathing, washing or any other human contact and (ii) no commercial or industrial uses of groundwater shall be permitted without the prior written approval of USEPA and PADEP;
- Any anticipated land use changes that may affect the Remedy shall be submitted to USEPA and PADEP for approval at least 30 days prior to the commencement of such land use changes; and,
- No construction, excavation or regrading shall take place in Quarry 3 except as approved by USEPA and PADEP.

4.2 ACCESS AGREEMENTS

Access agreements have been executed with the Gulph Mills Golf Club and O'Neill Properties Group for implementation of the Quarry 3 Phase 2 remedy. Copies of pertinent sections of existing access agreements are located in Appendix L.

4.3 EASEMENTS

O'Neill Properties Group has provided a 50 foot wide easement for access to Quarry 3, and a drainage easement for the lower storm water management basin property. The Gulph Mills Golf Club has provided a drainage easement for construction of drainage features as necessary. A copy of existing easements is included in Appendix L.

4.4 SECURITY CONTROLS

At the completion of the Phase 2 Remedy, existing temporary security fence which will be in-place around Quarry 3 during construction will be removed. All other security fence located on the 2501 Renaissance Blvd. property, including the fence around Quarry 2, will be returned to pre-Quarry 3 remediation condition, unless directed otherwise by the owner. A Six foot high

chain link fence will be installed along the northern rim of Quarry 3 to prevent access to the steep rock walls of the Quarry. Since the Quarry will no longer present any direct contact risks there is no need to construct a permanent fence along the southern rim, where the Quarry slopes are less steep and no other security measures are necessary.

5.0 OPERATIONS AND MAINTENANCE

The Group will inspect the Quarry periodically to confirm that the drainage system and erosion and sediment control features are operating properly, the fill surface is uniform and the vegetation is growing. The USEPA will be notified of the inspection date 10 days in advance, in order to give them the opportunity to participate in the inspection.

Operation and maintenance activities associated with Phase 2 will consist of inspecting the vegetative cover in Quarry 3, fertilizing and reseeding until 90% coverage is achieved. Areas of poor or no vegetative growth will be re-seeded and mulched within 45 days, weather permitting. The outlet structure will be inspected and cleaned as necessary and ECOR will be notified of any repairs required under their 1-year warranty coverage. Repairs to the erosion and sediment control features will be performed as necessary.

Inspections and maintenance for Quarry 3 will be performed in accordance with the following schedule:

If permanent seeding cannot be performed at the completion of final grading activities due to the allowable planting dates, the Quarry will be inspected monthly until permanent seeding is performed. The following items will be inspected:

- Check for excessive erosion. Areas where mulch has washed away and the surface is eroding shall be remulched. Ruts greater than 6" deep shall be filled and mulched.

- The sedimentation basin area should be inspected for sediment accumulation. Remove sediment in accordance with E&SC Plan.

- Check skimmer for proper operation, repair as necessary.

Permanent operations and maintenance activities will begin one month after permanent seeding of the Quarry bottom is completed as follows:

Month 1:

- Check for seed germination, new grass sprouts should be visible over most of the Quarry fill surfaces. If areas larger than 25' x 25' remain bare, have contractor reseed bare areas.

- Check for excessive erosion, have contractor fill ruts in excess of 6" and reseed.

- Check skimmer for proper operation, repair as necessary.

- The sedimentation basin area should be inspected for sediment accumulation. Remove sediment in accordance with E&SC Plan.

Month 2

- Check for seed germination, a thin grass cover should be visible over most of the Quarry fill surfaces. If areas larger than 25' x 25' remain bare, have contractor reseed bare areas.

- Check for excessive erosion, have contractor fill ruts in excess of 6" and reseed.

- Check skimmer for proper operation, repair as necessary.

- The sedimentation basin area should be inspected for sediment accumulation. Remove sediment in accordance with E&SC Plan.

Month 3

- Check vegetative cover, a moderate grass cover should be visible over most of the Quarry fill surfaces. If areas larger than 15' x 15' remain bare, have contractor reseed bare areas.

- Check for excessive erosion, have contractor fill ruts in excess of 6" and reseed.

- Check skimmer for proper operation, repair as necessary.

- The sedimentation basin area should be inspected for sediment accumulation. Remove sediment in accordance with E&SC Plan.

Month 4

- Check vegetative cover, a moderate grass cover should be visible over all of the Quarry fill surfaces. The vegetative cover should achieve a 90% coverage by this time, as determined by visual observation and agreement between the Group's supervising contractor and USEPA.

- If 90% coverage is achieved, remove skimmer and apply seed and mulch to the accumulated sediment. If 90% coverage is not achieved, repeat monthly inspections until it is achieved.

- Check for excessive erosion, have contractor fill ruts in excess of 6" and reseed.

Months 6, 8, 10 and 12

- Check vegetative cover, a full grass cover should be visible over all of the Quarry fill surfaces. Reseed bare spots as necessary.

- Check for excessive erosion, have contractor fill ruts in excess of 6" and reseed.

- Check outlet structure and remove all debris at inlet. Check rip-rap at discharge end of pipe. Repair as necessary.

After 1 year perform the following activities quarterly for one year and semi-annually thereafter, unless frequent problems are observed during the first year. Repairs after the warranty period will be contracted directly by the Group.

- Check for excessive erosion, have contractor fill ruts in excess of 6" and reseed.

- Check outlet structure and remove all debris at inlet. Check rip-rap at discharge end of pipe. Repair as necessary.

A site inspection report will be submitted to USEPA within 30 days of each inspection.

6.0 SCHEDULE

A Remedial Action Schedule is provided in Appendix C. In general, the Phase 1 work is expected to begin as soon as USEPA approves the Final Design for Phase 1. It is anticipated that work would begin in January 2009 and Phase 1 would be completed by Spring 2009. Phase 2 would begin late in the spring of 2009, as soon as weather permits. Phase 2 is anticipated to be completed in October of 2009.

TABLES

TABLE 2-1
CRATER RESOURCES SUPERFUND SITE
PADEP Discharge Criteria to Matsunk Creek

Discharge Parameter*	Average Monthly Limits (ug/L unless noted)	Daily Maximum (ug/L unless noted)
Benzene	1.0	2.0
Total BETX**	100	200
Ethylbenzene	Monitor	Monitor
Toluene	Monitor	Monitor
Total Xylenes	Monitor	Monitor
2,4-Dimethylphenol	184	368
Acenaphthene	24	48
Acetone	4,945	9,890
Aluminum	679	1,358
Arsenic	71	142
Barium	3,391	6,782
Benzo (a) anthracene	0.14	0.28
Cobalt	27	54
Copper	24	48
Cyanide, Free	7.3	14.6
Fluoranthene	57	114
Lead	11	22
Manganese	1,413	2,826
Mercury	0.07	0.14
Napthalene	61	122
Nickel	132	264
P-Cresol (4-Methylphenol)	226	452
Phenanthrene	1.4	2.8
Selenium, Total	15	30
Selenium, Dissolved	Monitor	Monitor
Thallium	2.4	4.8
Total Iron	2,119	4,238
Vanadium	141	282
Zinc	195	390
Total Dissolved Solids	1,000	2,000
$CBOD_5$ (mg/L)	50	100
Chemical Oxygen Demand (mg/L)	Monitor	Monitor
Ammonia as Nitrogen (mg/L)	3.0	6.0
Total Suspended Solids (mg/L)	30	60
pH	Within Limits of 6.0 - 9.0 standard units at all times	

* Metals are "total recoverable" except where noted.

** Total BETX shall be measured as the sum of Benzene, Ethylbenzene, Tolune, and Xylene

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample ID		POND_WAT-1			POND_WAT-2			Pond_Wat-3		
Lab Sample No.		902175			902174			902050		
Sampling Date		2/29/2008 0:00			2/29/2008 0:00			2/28/2008 0:00		
Matrix		WATER			WATER			WATER		
PARAMETER	UNITS	RESULT	Q	RL	RESULT	Q	RL	RESULT	Q	RL
Volatile Organic Compounds										
1,1,1-Trichloroethane	µg/L		U	0.4		U	0.4		U	0.4
1,1,2,2-Tetrachloroethane	µg/L		U	0.4		U	0.4		U	0.4
1,1,2-Trichloroethane	µg/L		U	0.2		U	0.2		U	0.2
1,1-Dichloroethane	µg/L		U	0.3		U	0.3		U	0.3
1,1-Dichloroethene	µg/L		U	0.5		U	0.5		U	0.5
1,2-Dichloroethane	µg/L		U	0.3		U	0.3		U	0.3
1,2-Dichloropropane	µg/L		U	0.5		U	0.5		U	0.5
2-Chloroethyl Vinyl Ether	µg/L		U	0.2		U	0.2		U	0.2
Acrolein	µg/L		U	6.6		U	6.6		U	6.6
Acrylonitrile	µg/L		U	3.1		U	3.1		U	3.1
Benzene	µg/L		U	0.2		U	0.2		U	0.2
Bromodichloromethane	µg/L		U	0.2		U	0.2		U	0.2
Bromoform	µg/L		U	0.2		U	0.2		U	0.2
Bromomethane	µg/L		U	0.4		U	0.4		U	0.4
Carbon Tetrachloride	µg/L		U	0.3		U	0.3		U	0.3
Chlorobenzene	µg/L		U	0.2		U	0.2		U	0.2
Chloroethane	µg/L		U	0.4		U	0.4		U	0.4
Chloroform	µg/L		U	0.2		U	0.2		U	0.2
Chloromethane	µg/L		U	0.4		U	0.4		U	0.4
cis-1,2-Dichloroethene	µg/L		U	0.3		U	0.3		U	0.3
cis-1,3-Dichloropropene	µg/L		U	0.1		U	0.1		U	0.1
Dibromochloromethane	µg/L		U	0.3		U	0.3		U	0.3
Ethylbenzene	µg/L		U	0.4		U	0.4		U	0.4
Methylene Chloride	µg/L		U	0.4		U	0.4		U	0.4
Tetrachloroethene	µg/L		U	0.4		U	0.4		U	0.4
Toluene	µg/L		U	0.3		U	0.3		U	0.3
trans-1,2-Dichloroethene	µg/L		U	0.4		U	0.4		U	0.4
trans-1,3-Dichloropropene	µg/L		U	0.2		U	0.2		U	0.2
Trichloroethene	µg/L		U	0.4		U	0.4		U	0.4
Trichlorofluoromethane	µg/L		U	0.4		U	0.4		U	0.4
Vinyl Chloride	µg/L		U	0.2		U	0.2		U	0.2
Xylene (Total)	µg/L		U	0.4		U	0.4		U	0.4
Semivolatile Organic Compounds										
1,2,4-Trichlorobenzene	µg/L		U	1		U	1.4		U	0.9
1,2-Dichlorobenzene	µg/L		U	1.2		U	1.7		U	1.1
1,3-Dichlorobenzene	µg/L		U	1.1		U	1.5		U	1
1,4-Dichlorobenzene	µg/L		U	1		U	1.4		U	0.9
2,3,7,8-TCDD (screen)	µg/L		U	1.1		U	1.5		U	1
2,4,6-Trichlorophenol	µg/L		U	2.4		U	3.4		U	2.2
2,4-Dichlorophenol	µg/L		U	1.6		U	2.2		U	1.5
2,4-Dimethylphenol	µg/L		U	2.3		U	3.1		U	2.1
2,4-Dinitrophenol	µg/L		U	1		U	1.4		U	0.9
2,4-Dinitrotoluene	µg/L		U	1.3		U	1.8		U	1.2
2,6-Dinitrotoluene	µg/L		U	1.4		U	2		U	1.3
2-Chloronaphthalene	µg/L		U	1.2		U	1.6		U	1.1
2-Chlorophenol	µg/L		U	1.2		U	1.7		U	1.1
2-Nitrophenol	µg/L		U	1.8		U	2.4		U	1.6
3,3'-Dichlorobenzidine	µg/L		U	5.5		U	7.6		U	5.1
4,6-Dinitro-2-methylphenol	µg/L		U	1.4		U	1.9		U	1.3
4-Bromophenyl-phenylether	µg/L		U	1.3		U	1.8		U	1.2
4-Chloro-3-methylphenol	µg/L		U	1.8		U	2.5		U	1.7
4-Chlorophenyl-phenylether	µg/L		U	1.2		U	1.6		U	1.1
4-Nitrophenol	µg/L		U	1		U	1.3		U	0.9
Acenaphthene	µg/L		U	0.2		U	0.2		U	0.1
Acenaphthylene	µg/L		U	0.1		U	0.2		U	0.1
Anthracene	µg/L		U	0.1		U	0.2		U	0.1
Benzidine	µg/L		U	8.1		U	11		U	7.4

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample ID		POND_WAT-1			POND_WAT-2			Pond_Wat-3		
Lab Sample No.		902175			902174			902050		
Sampling Date		2/29/2008 0:00			2/29/2008 0:00			2/28/2008 0:00		
Matrix		WATER			WATER			WATER		
PARAMETER	UNITS	RESULT	Q	RL	RESULT	Q	RL	RESULT	Q	RL
Benzo(a)anthracene	µg/L		U	0.056		U	0.077		U	0.052
Benzo(a)pyrene	µg/L		U	0.067		U	0.092		U	0.062
Benzo(b)fluoranthene	µg/L		U	0.2		U	0.2		U	0.1
Benzo(g,h,i)perylene	µg/L		U	0.1		U	0.1		U	0.093
Benzo(k)fluoranthene	µg/L		U	0.1		U	0.1		U	0.093
bis(2-Chloroethoxy)methane	µg/L		U	1		U	1.3		U	0.9
bis(2-Chloroethyl)ether	µg/L		U	1		U	1.3		U	0.9
bis(2-chloroisopropyl)ether	µg/L		U	1		U	1.3		U	0.9
bis(2-Ethylhexyl)phthalate	µg/L	1.2			2.5				U	1.1
Butylbenzylphthalate	µg/L		U	1.2		U	1.6		U	1.1
Chrysene	µg/L		U	0.2		U	0.3		U	0.2
Dibenz(a,h)anthracene	µg/L		U	0.1		U	0.2		U	0.1
Diethylphthalate	µg/L		U	0.9		U	1.2		U	0.8
Dimethylphthalate	µg/L		U	1.2		U	1.7		U	1.1
Di-n-butylphthalate	µg/L		U	1.1		U	1.6		U	1
Di-n-octylphthalate	µg/L		U	1.1		U	1.5		U	1
Fluoranthene	µg/L		U	0.2		U	0.2		U	0.1
Fluorene	µg/L		U	0.2		U	0.2		U	0.2
Hexachlorobenzene	µg/L		U	0.4		U	0.5		U	0.3
Hexachlorobutadiene	µg/L		U	0.7		U	0.9		U	0.6
Hexachlorocyclopentadiene	µg/L		U	0.7		U	1		U	0.6
Hexachloroethane	µg/L		U	1		U	1.4		U	0.9
Indeno(1,2,3-cd)pyrene	µg/L		U	0.09		U	0.1		U	0.082
Isophorone	µg/L		U	1		U	1.4		U	1
Naphthalene	µg/L		U	0.2		U	0.3		U	0.2
Nitrobenzene	µg/L		U	1.1		U	1.5		U	1
N-Nitrosodimethylamine	µg/L		U	0.8		U	1.1		U	0.8
N-Nitroso-di-n-propylamine	µg/L		U	0.8		U	1.1		U	0.8
N-Nitrosodiphenylamine	µg/L		U	1.2		U	1.6		U	1.1
Pentachlorophenol	µg/L		U	2.3		U	3.2		U	2.1
Phenanthrene	µg/L		U	0.09		U	0.1		U	0.082
Phenol	µg/L		U	0.7		U	0.9		U	0.6
Pyrene	µg/L		U	0.2		U	0.2		U	0.1
Pesticides/PCBs										
4,4'-DDD	µg/L	0.01	U		0.01	U		0.01	U	
4,4'-DDE	µg/L	0.01	U		0.01	U		0.01	U	
4,4'-DDT	µg/L	0.01	U		0.01	U		0.01	U	
Aldrin	µg/L	0.01	U		0.01	U		0.01	U	
alpha-BHC	µg/L	0.02	U		0.02	U		0.02	U	
beta-BHC	µg/L	0.01	U		0.01	U		0.01	U	
Chlordane	µg/L	0.2	U		0.2	U		0.2	U	
delta-BHC	µg/L	0.01	U		0.01	U		0.01	U	
Dieldrin	µg/L	0.01	U		0.01	U		0.01	U	
Endosulfan I	µg/L	0.01	U		0.01	U		0.01	U	
Endosulfan II	µg/L	0.01	U		0.01	U		0.01	U	
Endosulfan sulfate	µg/L	0.01	U		0.01	U		0.01	U	
Endrin	µg/L	0.01	U		0.01	U		0.01	U	
Endrin aldehyde	µg/L	0.01	U		0.01	U		0.01	U	
gamma-BHC (Lindane)	µg/L	0.01	U		0.01	U		0.01	U	
Heptachlor	µg/L	0.01	U		0.01	U		0.01	U	
Heptachlor epoxide	µg/L	0.01	U		0.01	U		0.01	U	
Toxaphene	µg/L	0.3	U		0.3	U		0.3	U	
Aroclor-1016	µg/L	0.2	U		0.2	U		0.2	U	
Aroclor-1221	µg/L	0.3	U		0.3	U		0.3	U	
Aroclor-1232	µg/L	0.3	U		0.3	U		0.3	U	
Aroclor-1242	µg/L	0.3	U		0.3	U		0.3	U	
Aroclor-1248	µg/L	0.3	U		0.3	U		0.3	U	
Aroclor-1254	µg/L	0.3	U		0.3	U		0.3	U	

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample ID		POND_WAT-1			POND_WAT-2			Pond_Wat-3		
Lab Sample No.		902175			902174			902050		
Sampling Date		2/29/2008 0:00			2/29/2008 0:00			2/28/2008 0:00		
Matrix		WATER			WATER			WATER		
PARAMETER	**UNITS**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**
Aroclor-1260	µg/L	0.2	U		0.2	U		0.2	U	
Aroclor-1262	µg/L	0.3	U		0.3	U		0.3	U	
Aroclor-1268	µg/L	0.3	U		0.3	U		0.3	U	
Metals										
Arsenic	µg/L	4.5	J	3.2	11.6		3.2	4.5	J	3.2
Beryllium	µg/L		U	0.3		U	0.3		U	0.3
Cadmium	µg/L		U	0.4		U	0.4		U	0.4
Chromium	µg/L		U	1.6		U	1.6		U	1.6
Copper	µg/L		U	3.7		U	3.7		U	3.7
Lead	µg/L		U	2.7		U	2.7		U	2.7
Mercury	µg/L		U	0.1		U	0.1		U	0.1
Molybdenum	µg/L		U	1.8		U	1.8		U	1.8
Nickel	µg/L		U	2.4		U	2.4		U	2.4
Selenium	µg/L		U	4.2	23.8		4.2	7.2		4.2
Silver	µg/L		U	1.4		U	1.4		U	1.4
Zinc	µg/L		U	5.8		U	5.8		U	5.8
Conventionals										
Ammonia as Nitrogen	mg/L	1.1			0.1			0.1		
CBOD-5	mg/L	5	U		5	U		7.5		
Nitrate as Nitrogen	mg/L	0.1	U		0.1	U		0.14		
Total Cyanide	mg/L	0.2			0.8			0.083		
Total Dissolved Solids	mg/L	226			339			188		
Total Phenols	mg/L	0.05	U		0.05	U		0.05	U	
Total Phosphate as P	mg/L	0.068			0.16			0.12		
Total Suspended Solids	mg/L	10	U		12			10	U	
pH		7.54			7.69			7.32		

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample Location		POND-1-A-3			POND-1-A-6			POND-1-A-3/6			POND-1-A-Bottom			POND-1-B-3		
Lab ID		449210			449211			449212			449213			449214		
Sample Date		8/6/2003			8/6/2003			8/6/2003			8/6/2003			8/6/2003		
Matrix		Surface Water			Surface Water			Surface Water			Surface Water			Surface Water		
Parameter	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																
Acetone	ug/L	65	UJ	5	82	UJ	5		NA		27	UJ	5	3200	UJ	120
Benzene	ug/L		U	1		U	1		NA		44		1		U	25
Carbon Disulfide	ug/L		U	5		U	5		NA			U	5		U	120
Ethylbenzene	ug/L		U	4		U	4		NA		3.5	J	4		U	100
Toluene	ug/L		U	5		U	5		NA		15		5		U	120
Xylene (Total)	ug/L		U	5		U	5		NA		4.7	J	5		U	120
Semivolatiles																
2,4-Dimethylphenol	ug/L		NA			NA			U	10	89		11		NA	
2-Methylnaphthalene	ug/L		NA			NA			U	10	1.1	J	11		NA	
4-Methylphenol	ug/L		NA			NA			U	10	150		11		NA	
Acenaphthylene	ug/L		NA			NA		0.7	J	10	4	J	11		NA	
Anthracene	ug/L		NA			NA		0.6	J	10	2.5	J	11		NA	
Benzo(a)anthracene	ug/L		NA			NA		0.7	J	1	4		1.1		NA	
Benzo(a)pyrene	ug/L		NA			NA		1	J	1	5.9		1.1		NA	
Benzo(b)fluoranthene	ug/L		NA			NA		0.8	J	1	5.1		1.1		NA	
Benzo(g,h,i)perylene	ug/L		NA			NA		1	J	10	4.9	J	11		NA	
Benzo(k)fluoranthene	ug/L		NA			NA		1.2	J	1	6	J	1.1		NA	
bis(2-Ethylhexyl)phthalate	ug/L		NA			NA			U	10	2.3	J	11		NA	
Carbazole	ug/L		NA			NA		0.2	J	10	2.5	J	11		NA	
Chrysene	ug/L		NA			NA		0.8	J	10	4.3	J	11		NA	
Dibenz(a,h)anthracene	ug/L		NA			NA			U	1	1.1	J	1.1		NA	
Dibenzofuran	ug/L		NA			NA			U	10	0.6	J	11		NA	
Fluoranthene	ug/L		NA			NA		1	J	10	6.4	J	11		NA	
Fluorene	ug/L		NA			NA			U	10	1	J	11		NA	
Indeno(1,2,3-cd)pyrene	ug/L		NA			NA		0.9	J	1	4.4		1.1		NA	
Naphthalene	ug/L		NA			NA			U	10	67		11		NA	
Phenanthrene	ug/L		NA			NA		0.2	J	10	2.4	J	11		NA	
Pyrene	ug/L		NA			NA		1	J	10	6.2	J	11		NA	
Total Metals																
Aluminum	ug/l		NA			NA		445		77.4	681		77.4		NA	
Arsenic	ug/l		NA			NA		12		1.2	30.5		1.2		NA	
Barium	ug/l		NA			NA		12	J	1.3	21.3	J	1.3		NA	
Calcium	ug/l		NA			NA		63,000		74.5	116,000		74.5		NA	
Cobalt	ug/l		NA			NA			U	3.5		U	3.5		NA	
Copper	ug/l		NA			NA		2.2	J	2.1	7.6	J	2.1		NA	
Iron	ug/l		NA			NA		1040		39.7	7,380		39.7		NA	
Lead	ug/l		NA			NA			U	2.2	6.5		2.2		NA	
Magnesium	ug/l		NA			NA		9,650		70	16,700		70		NA	
Manganese	ug/l		NA			NA		328		2.9	1,630		2.9		NA	
Mercury	ug/l		NA			NA		0.11	J	0.1	0.68		0.1		NA	
Nickel	ug/l		NA			NA			U	3.9	5.9	J	3.9		NA	
Potassium	ug/l		NA			NA		2,720	J	106	2,990	J	106		NA	
Selenium	ug/l		NA			NA		9.9		2.2	7		2.2		NA	
Sodium	ug/l		NA			NA		1,310	J	361	1,870	J	361		NA	
Thallium	ug/l		NA			NA			U	1.8	2.4	J	1.8		NA	
Vanadium	ug/l		NA			NA			U	1.5	2.1	J	1.5		NA	
Zinc	ug/l		NA			NA		17	U	5.8	29.7	U	5.8		NA	
Conventionals																
Alkalinity - Bicarbonate	mg/l		NA			NA		173		5	388		5		NA	
BOD	mg/l		NA			NA			U	5	53.1		5		NA	
COD	mg/l		NA			NA		79.9		10	133		10		NA	
Hardness (Titrimetric)	mg/l		NA			NA		212		0.5	400		0.5		NA	
Total Cyanide	mg/l		NA			NA		0.52		0.01	0.95		0.01		NA	
Total Dissolved Solids	mg/l		NA			NA		253		10	428		10		NA	
Total Organic Carbon	mg/l		NA			NA		19.1		1	29.3		1		NA	
Total Suspended Solids	mg/l		NA			NA		22		10	72		10		NA	

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample Location		POND-1-B-6			POND-1-B-3/6			POND-2-A-1.5			POND-2-A-3			POND-2-A-1.5/3			POND-2-A-Bottom		
Lab ID		449215			449216			448816			448817			448818			448819		
Sample Date		8/6/2003			8/6/2003			8/5/2003			8/5/2003			8/5/2003			8/5/2003		
Matrix		Surface Water			Surface Water			Surface Water			Surface Water			Surface Water			Surface Water		
Parameter	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																			
Acetone	ug/L	45	UJ	5		NA			UJ	5		UJ	5		NA			UJ	5
Benzene	ug/L	1.3		1		NA			U	1		U	1		NA		0.6	J	1
Carbon Disulfide	ug/L		U	5		NA			U	5		U	5		NA		1.9	J	5
Ethylbenzene	ug/L		U	4		NA			U	4		U	4		NA			U	4
Toluene	ug/L	1	J	5		NA			U	5	6.7		5		NA		5.7		5
Xylene (Total)	ug/L		U	5		NA			U	5		U	5		NA			U	5
Semivolatiles																			
2,4-Dimethylphenol	ug/L		NA			U	10		NA			NA			U	10		U	50
2-Methylnaphthalene	ug/L		NA			U	10		NA			NA			UJ	10		UJ	50
4-Methylphenol	ug/L		NA			U	10		NA			NA			UJ	10	520	J	50
Acenaphthylene	ug/L		NA		0.9	J	10		NA			NA			UJ	10		UJ	50
Anthracene	ug/L		NA		0.8	J	10		NA			NA		0.5	J	10		UJ	50
Benzo(a)anthracene	ug/L		NA				1		NA			NA			U	1		U	5
Benzo(a)pyrene	ug/L		NA		1.5		1		NA			NA			U	1		U	5
Benzo(b)fluoranthene	ug/L		NA		1.2		1		NA			NA			UJ	1		UJ	5
Benzo(g,h,i)perylene	ug/L		NA		1.5	J	10		NA			NA			U	10		U	50
Benzo(k)fluoranthene	ug/L		NA		1.4	J	1		NA			NA			U	1		U	5
bis(2-Ethylhexyl)phthalate	ug/L		NA			U	10		NA			NA			UJ	10		UJ	50
Carbazole	ug/L		NA		0.3	J	10		NA			NA		0.4	J	10		U	50
Chrysene	ug/L		NA		1.2	J	10		NA			NA			U	10		U	50
Dibenz(a,h)anthracene	ug/L		NA			U	1		NA			NA			UJ	1		UJ	5
Dibenzofuran	ug/L		NA			U	10		NA			NA			U	10		U	50
Fluoranthene	ug/L		NA		1.4	J	10		NA			NA			UJ	10		UJ	50
Fluorene	ug/L		NA			U	10		NA			NA			UJ	10		UJ	50
Indeno(1,2,3-cd)pyrene	ug/L		NA		1.2		1		NA			NA			U	1		U	5
Naphthalene	ug/L		NA			U	10		NA			NA		0.9	J	10	2.9	J	50
Phenanthrene	ug/L		NA		0.3	J	10		NA			NA			UJ	10		UJ	50
Pyrene	ug/L		NA		1.4	J	10		NA			NA			UJ	10		UJ	50
Total Metals																			
Aluminum	ug/l		NA		72		77.4		NA			NA		86.8	J	77.4	91.9	J	77.4
Arsenic	ug/l		NA		13.5		1.2		NA			NA		25.1		1.2	42.3		1.2
Barium	ug/l		NA		11.7	J	1.3		NA			NA		32	J	1.3	47.9	J	1.3
Calcium	ug/l		NA		63,200		74.5		NA			NA		116,000		74.5	154,000		74.5
Cobalt	ug/l		NA			U	3.5		NA			NA			U	3.5		U	3.5
Copper	ug/l		NA		4.2	J	2.1		NA			NA			U	2.1		U	2.1
Iron	ug/l		NA		1,550		39.7		NA			NA		1,230		39.7	1,910		39.7
Lead	ug/l		NA		2.8	J	2.2		NA			NA			U	2.2		U	2.2
Magnesium	ug/l		NA		9,400		70		NA			NA		8,480		70	11,800		70
Manganese	ug/l		NA		354		2.9		NA			NA		804		2.9	1200		2.9
Mercury	ug/l		NA		0.12	J	0.1		NA			NA			U	0.1	0.2		0.1
Nickel	ug/l		NA		4.7	J	3.9		NA			NA			U	3.9		U	3.9
Potassium	ug/l		NA		2,830	J	106		NA			NA		2,160	J	106	3,850	J	106
Selenium	ug/l		NA		7.2		2.2		NA			NA		13.7		2.2	18.2		2.2
Sodium	ug/l		NA		1,210	J	361		NA			NA		1,390	J	361	1,680	J	361
Thallium	ug/l		NA			U	1.8		NA			NA			U	1.8		U	1.8
Vanadium	ug/l		NA			U	1.5		NA			NA			U	1.5		U	1.5
Zinc	ug/l		NA		49	U	5.8		NA			NA		10.2	U	5.8	11.2	U	5.8
Conventionals																			
Alkalinity - Bicarbonate	mg/l		NA		178		5		NA			NA		294		5	389		5
BOD	mg/l		NA		6.9		5		NA			NA		9.8		5	37.6		5
COD	mg/l		NA		73.6		10		NA			NA		128		10	183		10
Hardness (Titrimetric)	mg/l		NA		204		0.5		NA			NA		328		0.5	520		0.5
Total Cyanide	mg/l		NA		0.64		0.01		NA			NA		2		0.01	2.5		0.01
Total Dissolved Solids	mg/l		NA		290		10		NA			NA		477		10	688		10
Total Organic Carbon	mg/l		NA		20.2		1		NA			NA		51.2		1	60.3		1
Total Suspended Solids	mg/l		NA		28		10		NA			NA		16		10	14		10

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample Location		POND-2-B-1.5			POND-2-B-3			POND-2-B-1.5/3			POND-3-A-3			POND-3-A-6			POND-3-A-3/6		
Lab ID		448820			448821			448822			447750			447751			447752		
Sample Date		8/5/2003			8/5/2003			8/5/2003			7/30/2003			7/30/2003			7/30/2003		
Matrix		Surface Water			Surface Water			Surface Water			SW			SW			SW		
Parameter	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**
Volatiles																			
Acetone	ug/L	45	UJ	5	18	UJ	5		NA			UJ	5		UJ	5		NA	
Benzene	ug/L		U	1		U	1		NA			U	1		U	1		NA	
Carbon Disulfide	ug/L		U	5	1.8	J	5		NA			UJ	5		UJ	5		NA	
Ethylbenzene	ug/L		U	4		U	4		NA			U	4		U	4		NA	
Toluene	ug/L		U	5	5.6		5		NA			U	5		U	5		NA	
Xylene (Total)	ug/L		U	5		U	5		NA			U	5		U	5		NA	
Semivolatiles																			
2,4-Dimethylphenol	ug/L		NA			NA			U	10		NA			NA			U	10
2-Methylnaphthalene	ug/L		NA			NA			UJ	10		NA			NA			U	10
4-Methylphenol	ug/L		NA			NA		0.5	J	10		NA			NA			U	10
Acenaphthylene	ug/L		NA			NA			UJ	10		NA			NA			U	10
Anthracene	ug/L		NA			NA		0.4	J	10		NA			NA			U	10
Benzo(a)anthracene	ug/L		NA			NA			U	1		NA			NA			U	1
Benzo(a)pyrene	ug/L		NA			NA			U	1		NA			NA			U	1
Benzo(b)fluoranthene	ug/L		NA			NA			UJ	1		NA			NA			UJ	1
Benzo(g,h,i)perylene	ug/L		NA			NA			U	10		NA			NA			U	10
Benzo(k)fluoranthene	ug/L		NA			NA			U	1		NA			NA			U	1
bis(2-Ethylhexyl)phthalate	ug/L		NA			NA			UJ	10		NA			NA			UJ	10
Carbazole	ug/L		NA			NA		0.3	J	10		NA			NA			U	10
Chrysene	ug/L		NA			NA			U	10		NA			NA			U	10
Dibenz(a,h)anthracene	ug/L		NA			NA			UJ	1		NA			NA			U	1
Dibenzofuran	ug/L		NA			NA			U	10		NA			NA			U	10
Fluoranthene	ug/L		NA			NA			UJ	10		NA			NA			U	10
Fluorene	ug/L		NA			NA			UJ	10		NA			NA			U	10
Indeno(1,2,3-cd)pyrene	ug/L		NA			NA			U	1		NA			NA			U	1
Naphthalene	ug/L		NA			NA		0.8	J	10		NA			NA			U	10
Phenanthrene	ug/L		NA			NA			UJ	10		NA			NA			UJ	10
Pyrene	ug/L		NA			NA			UJ	10		NA			NA			U	10
Total Metals																			
Aluminum	ug/l		NA			NA		86.9	J	77.4		NA			NA			U	77.4
Arsenic	ug/l		NA			NA		26.2		1.2		NA			NA		4.5	U	1.2
Barium	ug/l		NA			NA		33.4	J	1.3		NA			NA		23.3	J	1.3
Calcium	ug/l		NA			NA		119,000		74.5		NA			NA		60,500		74.5
Cobalt	ug/l		NA			NA			U	3.5		NA			NA			U	3.5
Copper	ug/l		NA			NA			U	2.1		NA			NA		5.3	J	2.1
Iron	ug/l		NA			NA		1,810		39.7		NA			NA		400		39.7
Lead	ug/l		NA			NA			U	2.2		NA			NA			U	2.2
Magnesium	ug/l		NA			NA		8,780		70		NA			NA		5,530		70
Manganese	ug/l		NA			NA		959		2.9		NA			NA		538		2.9
Mercury	ug/l		NA			NA			U	0.1		NA			NA			U	0.1
Nickel	ug/l		NA			NA			U	3.9		NA			NA			U	3.9
Potassium	ug/l		NA			NA		2350	J	106		NA			NA		1,830	J	106
Selenium	ug/l		NA			NA		14.3		2.2		NA			NA		8.9		2.2
Sodium	ug/l		NA			NA		1,330	J	361		NA			NA		1,390	J	361
Thallium	ug/l		NA			NA			U	1.8		NA			NA			U	1.8
Vanadium	ug/l		NA			NA			U	1.5		NA			NA			U	1.5
Zinc	ug/l		NA			NA		13.4	U	5.8		NA			NA		21.6	J	5.8
Conventionals																			
Alkalinity - Bicarbonate	mg/l		NA			NA		294		5		NA			NA		155		5
BOD	mg/l		NA			NA		11.1		5		NA			NA		6.1		5
COD	mg/l		NA			NA		128		10		NA			NA		54.6		10
Hardness (Titrimetric)	mg/l		NA			NA		360		0.5		NA			NA		180		0.5
Total Cyanide	mg/l		NA			NA		2.1		0.01		NA			NA		0.026		0.01
Total Dissolved Solids	mg/l		NA			NA		498		10		NA			NA		260		10
Total Organic Carbon	mg/l		NA			NA		51.8		1		NA			NA		13.3		1
Total Suspended Solids	mg/l		NA			NA		18		10		NA			NA		13		10

TABLE 2-2
CRATER RESOURCES SUPERFUND SITE
SURFACE WATER ANALYTICAL DATA

Sample Location		POND-3-A-Bottom			POND-3-B-3.3			POND-3-B-6.6			POND-3-B-3.3/6.6		
Lab ID		447753			447755			447756			447757		
Sample Date		7/30/2003			7/30/2003			7/30/2003			7/30/2003		
Matrix		SW			SW			SW			SW		
Parameter	**Units**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**	**RESULT**	**Q**	**RL**
Volatiles													
Acetone	ug/L		UJ	5	6900	UJ	500	14	UJ	5		NA	
Benzene	ug/L		U	1		U	100		U	1		NA	
Carbon Disulfide	ug/L		UJ	5		U	500		UJ	5		NA	
Ethylbenzene	ug/L	0.8	J	4		U	400		U	4		NA	
Toluene	ug/L	3.9	J	5		U	500		U	5		NA	
Xylene (Total)	ug/L		U	5		U	500		U	5		NA	
Semivolatiles													
2,4-Dimethylphenol	ug/L		U	10		NA			NA			U	10
2-Methylnaphthalene	ug/L		U	10		NA			NA			U	10
4-Methylphenol	ug/L	11		10		NA			NA			U	10
Acenaphthylene	ug/L		U	10		NA			NA			U	10
Anthracene	ug/L		U	10		NA			NA			U	10
Benzo(a)anthracene	ug/L		U	1		NA			NA			U	1
Benzo(a)pyrene	ug/L		U	1		NA			NA			U	1
Benzo(b)fluoranthene	ug/L	0.2	J	1		NA			NA			UJ	1
Benzo(g,h,i)perylene	ug/L		U	10		NA			NA			U	10
Benzo(k)fluoranthene	ug/L		U	1		NA			NA			U	1
bis(2-Ethylhexyl)phthalate	ug/L		UJ	10		NA			NA			UJ	10
Carbazole	ug/L	0.2	J	10		NA			NA			U	10
Chrysene	ug/L	0.2	J	10		NA			NA			U	10
Dibenz(a,h)anthracene	ug/L		U	1		NA			NA			U	1
Dibenzofuran	ug/L		U	10		NA			NA			U	10
Fluoranthene	ug/L	0.3	J	10		NA			NA			U	10
Fluorene	ug/L		U	10		NA			NA			U	10
Indeno(1,2,3-cd)pyrene	ug/L		U	1		NA			NA			U	1
Naphthalene	ug/L	2.8	J	10		NA			NA			U	10
Phenanthrene	ug/L		UJ	10		NA			NA			UJ	10
Pyrene	ug/L	0.2	J	10		NA			NA			U	10
Total Metals													
Aluminum	ug/l	248		77.4		NA			NA			U	77.4
Arsenic	ug/l	15.6	U	1.2		NA			NA		5.7	U	1.2
Barium	ug/l	75.2	J	1.3		NA			NA		39.1	J	1.3
Calcium	ug/l	95,100		74.5		NA			NA		66,000		74.5
Cobalt	ug/l	4	J	3.5		NA			NA			U	3.5
Copper	ug/l	6.3	J	2.1		NA			NA		2.6	J	2.1
Iron	ug/l	5,560		39.7		NA			NA		506		39.7
Lead	ug/l	2.6	J	2.2		NA			NA			U	2.2
Magnesium	ug/l	8,050		70		NA			NA		5,870		70
Manganese	ug/l	3,450		2.9		NA			NA		2,450		2.9
Mercury	ug/l	0.26		0.1		NA			NA			U	0.1
Nickel	ug/l	4.3	J	3.9		NA			NA			U	3.9
Potassium	ug/l	5,020		106		NA			NA		1,900	J	106
Selenium	ug/l	13.8		2.2		NA			NA		11.8		2.2
Sodium	ug/l	1,570	J	361		NA			NA		1,440	J	361
Thallium	ug/l		U	1.8		NA			NA			U	1.8
Vanadium	ug/l	1.9	J	1.5		NA			NA			U	1.5
Zinc	ug/l	22.8	J	5.8		NA			NA		13.4	J	5.8
Conventionals													
Alkalinity - Bicarbonate	mg/l	281		5		NA			NA		165		5
BOD	mg/l	41.6		5		NA			NA		14.3		5
COD	mg/l	211	J	10		NA			NA		88.4		10
Hardness (Titrimetric)	mg/l	296		0.5		NA			NA		208		0.5
Total Cyanide	mg/l	1.1		0.01		NA			NA		0.69		0.01
Total Dissolved Solids	mg/l	319		10		NA			NA		186		10
Total Organic Carbon	mg/l	20.3	J	1		NA			NA		13.9		1
Total Suspended Solids	mg/l	87		10		NA			NA		24		10

Table 2-3
Crater Resources Superfund Site - Gulph Mills, Pennsylvania
Statistical Analysis Results - Samples Selected For Removal

QUARRY 3 SOILS
NON-PLATEAU AREA

Mitigate for SVOC's				
	Area	Depth	Soil Volume	Soil Volume
Samples To Mitigate	(sq. ft)	(ft.)	(CY)	(Tons)
Initial 12" excavation at areas represented by SB-1, SB-2, SB-5, SB-7, SB-8, SB-17, SB-19	46,142	0 - 1	1,709	2,563
SB-1	100	1 - 4.5	13	19
SB-17	100	1 - 2.5	6	8
SB-20	100	0 - 1	2	3
		Total	1,729	2,594

Mitigate for Arsenic				
	Area	Depth	Soil Volume	
Samples To Mitigate	(sq. ft)	(ft.)	(CY)	
SB-3	100	1 - 2.5*	6	8
SB-7	100	1 - 2.5	6	8
SB-17	100	2.5 - 4.5	7	11
		Total	19	28

TOTAL NON-PLATEAU AREA SOILS	1,748	2,622
PLATEAU AREA	12,600	18,900

TOTAL QUARRY THREE SOILS	14,348	21,522

Note: The 0'-1' interval at SB-3 is removed because of arsenic in the 1'-2' interval. That volume is included in the initinal 12" excavation calculation.

Table 2-4
Crater Resources Superfund Site - Gulph Mills, Pennsylvania
Surface Water and Sediment Volumes

POND SURFACE WATER

Pond	Avg. Water Depth (ft.) 2003	*Avg. Water Depth (ft.) 2008*	Pond Area (SF)	Volume (gals) 2003	*Volume (gals) 2008*
Pond 1	9.5	*11.2*	16,330	1,160,491	*1,363,990*
Pond 2	4.3	*7.1*	4,660	149,895	*247,483*
Pond 3	10	*15.1*	17,590	1,315,824	*1,981,821*
TOTAL				**2,626,210**	***3,593,295***

POND SEDIMENT

Pond	Avg. Sediment Thickness (ft.) 2003	Pond Area (SF)	Inplace Volume (CY) 2003	Inplace Volume (Tons) 2003
Pond 1	13.5	16,330	8,165	12,248
Pond 2	5	4,660	863	1,295
Pond 3 (Northern Half)	7	8,795	2,280	3,420
Pond 3 (Southern Half)	3	8,795	977	1,466
TOTAL			**12,285**	**18,428**

APPENDICES

APPENDIX A

Background Soil Analysis and USEPA Approval Letter Dated April 14, 2003 (Not Included - Provided With 100% Phase 1 RD)

APPENDIX B

Technical Memorandum Statistical Analysis of Quarry 3 Soils (Not Included - Provided With 100% Phase 1 RD)

APPENDIX C

RA Schedule
(Not Included - Provided With 100% Phase 1 RD)

APPENDIX D

Construction Specifications

TABLE OF CONTENTS

DIVISION 1
GENERAL REQUIREMENTS

Section	Title
01010	Summary of Work
01025	Measurement and Payment
01039	Coordination and Meetings
01050	Field Engineering
01300	Submittals
01400	Quality Control
01545	Health and Safety
01550	Construction Facilities and Temporary Controls
01600	Materials and Equipment
01700	Demobilization/Project Closeout

DIVISION 2
SITE WORK

Section	Title
02110	Site Preparation and Clearing
02115	Erosion and Sediment Control Measures
02117	Dust and Odor Control and Air Monitoring
02209	Soil and Material Removal/Handling/Disposal
02210	Earthwork
02500	Roadways and Paths
02715	Water Management (During Construction)
02936	Turf Establishment
15010	Surface Water Treatment
15500	HDPE Pipe Installation

SECTION 01010
SUMMARY OF WORK
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

This section includes the following items:

A. Scope of work
B. Description of Contract Documents
C. Work included
D. Definition of Roles
E. Permits and agency approvals
F. Contractor's use of site and premises
G. Construction Quality Assurance (CQA) requirements
H. Sequence of work
I. Use of subcontractors

1.2 SCOPE OF WORK

Work at the Site shall satisfy the requirements of the United States Environmental Protection Agency (USEPA) Record of Decision (ROD) for the Crater Resources, Inc./Keystone Coke Co./Alan Wood Steel Co. Site, Upper Merion Township, Pennsylvania, dated September 27, 2000, EPA Id: Pad980419097 and the Unilateral Administrative Order issued by USEPA on April 20, 2001 (Docket #3-2001-0009). Work will be performed by the Crater Resources Cooperating Respondent Group (the Group). The Site is located in Upper Merion Township, Montgomery County, Pennsylvania. The work for this contract will take place within the area known as Quarry 3 (Quarry).

The remedial activities required by the ROD include the following:

- Surface Water – Surface water in the ponds will be treated on-site and discharged to Matsunk Creek;

- Sediments – Sediments at the bottom of the ponds will be excavated down to the bedrock surface, dewatered or otherwise conditioned and taken off-site for disposal;

- Plateau Material – The plateau material will be excavated down to the bedrock surface or until the remaining soil meets the clean up criterion as demonstrated by confirmation sampling;

- Remaining Soils in Quarry 3 – The remaining soils in Quarry 3, as identified by the Quarry 3 peripheral soil sampling, will be excavated to the limits necessary to meet the clean up criterion, as demonstrated by confirmation sampling;

- Sediment, Soil and Plateau Material Disposal – All materials to be sent off-site for disposal shall be tested to determine the presence of RCRA characteristic wastes. If hazardous wastes are encountered they will be handled in accordance with 25 PA Code, Chapters 262, 263 and 264 and 40 CFR Part 268. All other waste will be disposed of in accordance with the PA Residual Waste Regulations, PA Code 299;

- Backfill of the Quarry – The Quarry will be backfilled with soil that meets the clean up criterion;

- The Quarry will be graded to drain out the east end and backfill soils will be compacted to minimize the potential for subsidence;

- Erosion and Sediment Control – All excavation and backfill activities will be performed in accordance with PADEP's Bureau of Soil and Water Conservation

Erosion and Sediment Pollution Control Manual and the Montgomery County Soil Conservation District policy;

- Restoration – Disturbed areas will be covered with topsoil and vegetated with native plant material. The vegetation will be monitored and re-vegetated until a viable cover is established;

- Stormwater – Stormwater will be managed on-site to control excessive runoff during construction; and,

- Air Emissions – Fugitive dust and other air emissions will be closely monitored and control measures will be implemented as necessary and as directed by the Group.

1.3 DESCRIPTION OF CONTRACT DOCUMENTS

Contract Documents (Documents) to be followed under this Contract shall be the General Conditions, Bid Requirements, and Final (100%) Design, including all approved drawings (Drawings), specifications (Specifications), Construction Quality Assurance Plan (CQAP) and Sampling and Analysis Plan (SAP). Drawings show the location, details, and dimensions of the work contemplated. There shall be no deviation from the Contract Documents unless approved and authorized in writing by the Group or its representative and USEPA, where required. Bid Requirements include Instruction to Bidders, Bid Form, Experience Questionnaire, Listing of Intended Subcontractors, and Contractor's and Subcontractor's Safety Records.

Wherever references are made to other specifications, standards, or requirements, it shall be understood that the latest version is intended and shall apply, except as otherwise specified or when the specifications, standards or requirements may be in conflict with applicable laws, ordinances, rules or regulations.

WORK INCLUDED

The Contractor shall furnish all methods, expertise, supervision, equipment, materials, and labor necessary for the performance of the work and shall furnish and do everything necessary to make the work satisfactory, complete, neat, and finished. All incidental, minor and miscellaneous items, work, or materials for which no payment is specifically provided and any items, work, or materials not specifically included in the Contract Documents but which are necessary to complete the indicated intent of the project and to maintain and repair the work shall be considered incidental and shall be done and furnished by the Contractor at the Contractor's expense.

The project work includes, but is not limited to, the following major work items to be performed by the Contractor. Note that these items are in general order of the anticipated sequence of work; however, the actual sequence of work shall be proposed by the Contractor in his schedule which will be reviewed and commented on and approved by the Group before implementation. Work is anticipated to begin with mobilization during the summer 2008 and be complete by September 2009, or earlier, with some work possibly being performed over the winter season, weather permitting.

PHASE 1

- Mobilization of all necessary labor, materials, equipment, and field facilities for the proper completion of the work;
- Implementation of a Health and Safety Program including, but not limited to, work area and personnel monitoring;
- Development and implementation of a Construction Quality Control Plan;
- Establishment of vertical and horizontal survey control and surveying of construction operations to establish locations and elevations shown on the Drawings;

- Site preparation activities including the establishment of the support zone and access roads;

- Installation of erosion control measures and dust control measures;

- Site clearing and grubbing;

- Utility location;

- Onsite treatment and offsite local discharge of surface water that has accumulated within three Ponds within Quarry 3. Water will be discharged to Matsunk Creek;

- Removal, dewatering, and offsite disposal of sediments that have accumulated at the bottom of the three Ponds; and,

- Backfilling the three Ponds to satisfy the interim grades required for later soil excavations.

PHASE 2

- Excavation, stabilization and offsite disposal of impacted soils within the Plateau Area of Quarry 3;

- Excavation and offsite disposal of other soils within Quarry 3 that do not meet the site specific remediation criteria;

- Backfill of excavation areas and additional fill placement within Quarry 3 to create positive drainage from West to East into the adjacent drainage channel;

- Site restoration by applying topsoil, seed and mulch to the disturbed areas and maintaining it until an acceptable vegetative cover has been established;

- Compliance/Confirmatory sampling for the following media:

  - soil sampling for selected metals and SVOCs to confirm that the Quarry 3 soil cleanup standards are achieved;
  - waste profile sampling for materials transported and disposed of off-site, as required by the disposal facility; and,
  - Sampling of surface water treated onsite to confirm that the discharged water meets the discharge criteria.

- Backfill and grading of surrounding areas for drainage.

1.4 DEFINITION OF ROLES

Group – The Crater Resources Cooperating Respondent Group is responsible for the Crater Resources Superfund Site Remediation. The Group is responsible for design and construction of the Remedial Action and long-term maintenance and monitoring of the Site in accordance with the ROD. The Group is responsible for ensuring that the Construction Quality Assurance (CQA) Plan is implemented and has the authority to select and dismiss organizations involved with the design, CQA and construction activities. The Group has the authority to accept or reject design plans and specifications, CQA plans, reports and the recommendations of the Design Engineer or QA Official and the materials and workmanship of the Contractor.

Design Engineer - Advanced GeoServices (AGC), an engineering consulting firm located in West Chester, Pennsylvania, is the Design Engineer. As Design Engineer, AGC is responsible for preparing a design that fulfills the operational and performance requirements. At the request of the Group, the Design Engineer is responsible for recommending design changes during construction based on observed field conditions and reviewing submitted documents that would impact the design. AGC has conducted numerous investigations at the Site and is responsible for design of the Remedial Action on the Group's behalf. AGC's Project Coordinator is Thomas Legel.

QA Official - The Quality Assurance (QA) Official is retained by the Group and is the individual or individuals that oversee(s) the Contractor's implementation of the Final (100%) Design and Quality Control Plan. The QA Official documents work activities and approves construction elements on behalf of the Group. The QA Official will be retained by the Group prior to implementation of the Remedial Action. Qualifications will be submitted to USEPA and PADEP, for review and comment.

Contractor - The Remedial Action Contractor (Contractor) will be responsible for construction of the Remedial Action in accordance with the approved Final (100%) Design. The Contractor will be responsible for retaining and overseeing subcontractors, implementing the Quality Control Plan and submitting required documents to the QA Official. The Contractor will be retained by the Group. USEPA and PADEP will be notified of the selected Contractor and their qualifications when available. USEPA and PADEP will have the opportunity to review and approve the Contractor.

1.6 PERMITS AND AGENCY APPROVALS

A copy of all permits shall be maintained on-site and be available for inspection upon request. The Contractor shall be responsible for complying with any and all permits obtained for the work by the Group. These permits shall include, but not be limited to:

- General National Pollutant Discharge Elimination System (NPDES) Permit for Stormwater Discharges Associated with Construction Activities (Phase 2);
- Letter of Authorization for discharge of treated water to Matsunk Creek;
- Trailer Occupancy Permit; and,
- Stormwater Management Plan.

The Contractor shall be required to be a co-permittee of the NPDES permit, or shall be the sole permittee following transfer from the Group. The Contractor shall be responsible for obtaining and complying with the Trailer Occupancy Permit. Additional discussion of permit requirements is provided in the Remedial Design Report.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

The Contractor's access to the Site is limited to the project work area as identified in the Drawings. The Contractor shall use the work area for the sole purpose of performing the specified activities and not for unrelated storage, recreation, non-site related activities, or other unapproved activities. The Contractor shall not enter or use existing buildings for storage or any other purpose without Groups approval. Contractor's access to the Site shall be through access roads and gates defined on the Drawings. Proposed traffic routes for transport of materials to and from the Site are provided on the Drawings. The Contractor shall, at no additional cost to the Group, protect local roads as required by local officials. All work shall be conducted in accordance with these Specifications. Work hours shall be in accordance with local regulations (except for surface water treatment and discharge operations).

1.8 CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS

In addition to the CQC activities defined in the Specifications, all work will be monitored and tested in accordance with the requirements of the CQAP and SAP. The Contractor shall be aware of all testing activities outlined in the CQAP and SAP and shall account for these activities in the construction schedule. The Contractor shall be responsible for cooperating with and assisting the QA Official during all testing and monitoring activities, and when required by these documents, perform required sampling and analysis. The Contractor shall conduct all sampling and analysis required to be conducted by the Contractor in accordance with the SAP, including decontamination procedures, data validation and laboratory selection. Deviations from the CQAP and SAP will not be allowed, unless approved in writing by the Group, USEPA and PADEP. The Contractor shall repair any damage to finished work caused by sampling or testing activities at no additional cost to the Group.

The Contractor (and its subcontractors, suppliers, manufacturers, etc.) shall abide by all qualification requirements identified in the CQAP and SAP.

1.9 SEQUENCE OF WORK

This Specification and the Drawings provide a generalized approach to sequencing of construction activities. A detailed written sequence shall be developed by the Contractor for submission with the bid for review and discussions with the Group and shall be developed in a manner intended to optimize efficiency and quality, and minimize excess handling of material while being sensitive to surrounding environmental and community concerns. The Contractor's schedule and sequencing of construction activities shall be provided to the Group, QA Official, USEPA and PADEP for approval.

1.10 USE OF SUBCONTRACTORS

All Subcontractors shall be submitted for approval by the Group. Subcontractors shall conduct work only when the Contractor's Quality Control personnel and Site Health and Safety Officer are present. Subcontractors are not permitted to conduct work at the Site without the Contractor's supervision.

1.11 COMMUNITY RELATIONS

The Contractor shall be aware that the project has been subject to intensive community comment and involvement. All community questions or complaints shall be forwarded to the Group's Representative. The Contractor shall assist the Group in the address complaints raised by the public.

1.12 DEFINITIONS

The following definitions apply to the Work:

Waste Ammonia Liquor (WAL) – this material was discharged as a result of wastewater handling practices used during the operation of a coke manufacturing facility in the area. WAL was

discharged with the wastewater in varying amounts over the years. The term WAL is sometimes used to describe dark stained sediments/ soils that have accumulated within Quarry 3; however these materials are not actually WAL.

PART 2: PRODUCTS

2.1 REMEDIAL ACTION WORK PLAN

Within 2 days of the contract award the Contractor shall contact the Group and schedule a meeting to begin development of the Remedial Action Work Plan (RAWP). The RAWP will be a collaborative effort utilizing the Group's knowledge of the Site and the Contractor's knowledge of construction practices to generate the most efficient plan of action for the remediation of the Quarry. The Contractor shall be required to meet with members of the Group within 5 days of the award of Contract to discuss the RAWP. Following the meeting the Contractor shall provide the RAWP, which must be completed within 14 days of the award of Contract. The Contractor will provide the Group (5 Copies), and QA Official (two copies). The QA Official will forward two copies to the USEPA and PADEP for their acceptance or approval. The RAWP shall include:

- A description of activities necessary to construct each component of the approved Final Design;
- A narrative describing coordination and sequencing of work activities to facilitate construction in accordance with the approved schedule;
- The Contractor's proposed project team, including key personnel, descriptions of duties and lines of authorities in the management of construction activities;
- A description of the roles and relationships of the Group, Design Engineer, QA Official, Contractor, and Quality Control personnel;
- Lines of communication for discussing and resolving problems;

- Common anticipated remedies to overcome potential construction problems and delays;

- A construction schedule describing potential major scheduling problems or delays and the process to continuously update the project schedule;

- Methods for meeting Quality Control requirements;

- Site Health and Safety Plan (HASP)

- Site security plan;

- Public relations procedures; and,

- Requirements for project closeout.

The Contractor will not be permitted to initiate Site work until comments have been addressed and the RAWP has been accepted.

PART 3: EXECUTION

3.1 GENERAL

The Contractor shall execute all work in accordance with the requirements of the Contract Documents. Any failure of the Contractor to acquaint himself with the available information will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the Work. The Group assumes no responsibility for any conclusions of interpretation made by the Contractor on the basis of the information made available by the Group.

3.2 FAMILIARIZATION

Prior to implementing any work described in these Specifications, the Contractor shall become thoroughly familiar with the Site, existing Site conditions, and all portions of the work falling within the appropriate section of the Specifications. In particular, the Contractor shall become thoroughly familiar with conditions that may affect transportation to and from the Site, handling and storage of materials, availability of labor, water, electric power and roads.

Prior to implementing any of the work, the Contractor shall carefully inspect any previously installed work to verify that the previous work is complete to the point where the installation of succeeding work may commence without adverse impact. If the Contractor has any concerns regarding the previously installed work, he shall immediately notify the QA Official verbally and within 48 hours in writing.

3.3 USE OF EXPLOSIVES

No explosives may be used on this project.

3.4 PROTECTION OF WORK

The Contractor shall use all means necessary to protect all prior work resulting from man-made or natural occurrences, including all materials and completed work of other Sections. In the event of damage to work performed by the Contractor prior to the Group's acceptance of the work, the Contractor shall immediately make all repairs and replacements necessary, to the approval of the Group and the Group's QA Official, at no additional cost to the Group.

3.5 DECONTAMINATION

All equipment, personnel and vehicles shall be decontaminated prior to exiting the exclusion zone. Personnel shall enter and exit the Site via the decontamination zone. Decontamination pads shall be

installed as needed. Decontamination liquids shall be collected and treated in the on-site water treatment system.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Measurement of specific work tasks is included in the applicable sections of the Specifications.

4.2 PAYMENT

Payment of specific work tasks is included in the applicable sections of the Specifications.

SECTION 01025
MEASUREMENT AND PAYMENT
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

This section addresses the general requirements of measurement and payment for the Work. The specific measurement and payment requirements are provided in the applicable sections.

1.2 RELATED SECTIONS

A. All sections of the Contract Documents.

1.3 AUTHORITY

The Contractor is responsible for collecting all measurements for payment. The Contractor shall notify the Group and the Group's QA Official a minimum of three (3) days prior to the collection of any measurement data which will be used for payment purposes. The Contractor shall coordinate with the QA Official so that the QA Official observes all measurement for payment.

1.4 UNIT QUANTITIES

The unit quantities, if specified in the Contract Documents, shall be defined as follows:

1.4.1 Lump Sum

One price shall be provided for completion of the Work as specified in the applicable sections of the Contract Documents.

1.4.2 Unit Price (In-Place Cubic Yard)

A unit price shall be provided on the basis of in-place cubic yards which applies to the removal and placement of material. Measurement of the in-place volumes shall be performed by the Contractor in accordance with Section 01050.

1.4.3 Unit Price (Per Ton)

A unit price shall be provided on the basis of weight (in tons) which applies to transportation or disposal off-site, or import of materials as specified herein. Measurement shall be based on weight tickets from the delivering truck and weighing shall be performed using a weight scale certified by the Commonwealth of Pennsylvania or the state where the disposal facility is located.

1.4.4 Unit Price (In-Place Linear Foot)

A unit price shall be provided on the basis of linear feet installed, which applies to the installation of materials. Measurement of the in-place length shall be performed by the Contractor in accordance with Section 01050.

1.4.5 Unit Price (In-Place Square Yard)

A unit price shall be provided on the basis of square yards installed, which applies to the installation of materials. Measurement of the in-place area shall be performed in accordance with Section 01050.

1.4.6 Unit Price (Per Hour)

A unit price shall be provided on the basis of per hour of operation of equipment or labor by personnel associated with completion of a task. The QA Official shall be notified whenever work being measured on a per hour basis is being performed. Measurement of time shall be rounded to the nearest 0.5 hour increment and shall be counted as agreed upon by the QA Official and Contractor.

1.4.7 Unit Price (Per Gallon)

A unit price shall be provided on the basis of per gallon of liquids, treated and discharged. Measurement shall be performed by a flow measuring and totalizing device or by agreement between the QA Official and Contractor.

1.5 PAYMENT TYPES

1.5.1 Incremental Payment

The Contractor is responsible for developing and submitting, within 14 days of project award, to the Group for approval, a projected payment schedule of those items that are bid as lump sum but that occur throughout the project. This payment schedule shall be based on the length of the Work as outlined in the Bidder's submitted construction schedule and effort expended to date on each item.

1.5.2 Unit Payment

Request for payment for unit price items shall be accompanied by adequate backup substantiating the measurements, units, and requested payment.

1.5.3 Final Payment

Final payment for Work will be made in accordance with the General Conditions of the Contract Documents.

1.6 NON-PAYMENT FOR REJECTED PRODUCTS

Situations for which payment will not be made include, but are not limited to, the following:

- Products wasted or disposed of in a manner that is not acceptable.
- Products determined as unacceptable before or after placement.

- Products not completely unloaded from the transporting vehicle.
- Products placed or excavated beyond the lines and grades of the required Work.
- Loading, hauling, and disposing of rejected products.

PART 2: PRODUCTS

2.1 MEASUREMENT DOCUMENTATION

Documentation in support of measurement of materials for payment shall be clean, legible, accurately reflect the quantities and means of measurement, and shall be certified by the Contractor's on-site representative as accurate to the best of his/her knowledge. If derived from a supplier, the appropriate sections shall be dated and signed by the supplier.

2.2 PAYMENT REQUISITIONS

Monthly payment requisitions shall be in accordance with the General Conditions of the Contract Documents.

2.3 SCHEDULE OF VALUES

As part of the Contractor's initial submittals, within 14 days of contract award, the Contractor shall provide to the Group, for review and approval, an example invoice showing the bid line item breakdowns. Items to be provided shall include, but not be limited to, the following:

- Bid line items
- Units
- Unit Price
- Bid Quantity
- Quantity to Date
- Quantity Previous Invoice
- Quantity this Invoice

- Amount this Invoice
- Total Cost Previous Applications
- Total Invoiced to Date
- Percent Complete

Along with this schedule of values, submission shall include a breakdown on a monthly basis of estimated future payment requests based on the Contractor's most recent construction schedule for cash flow purposes by the Group.

PART 3: EXECUTION

Not applicable.

PART 4: MEASUREMENT AND PAYMENT

Not Used

SECTION 01039
COORDINATION AND MEETINGS
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

This section pertains to the coordination and scheduling of work activities, Construction Quality Assurance (CQA) activities, submittals, and project meetings such that the project is operated in an efficient and orderly manner.

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work
B. Section 01545 - Health and Safety
C. Section 01700 - Contract Closeout

1.3 COORDINATION

The Contractor shall ensure that the schedule of interdependent work activities is performed in an organized manner such that the duration, effectiveness, and safety of the work activities are optimized. Coordination includes, but is not limited to, the proper selection of equipment, materials, and labor to perform the intended task and the coordination of work activities within the Site such that work, traffic, staging, and support areas are utilized effectively and not compromised.

The Contractor shall be aware that CQA monitoring will be required during or at the completion of many of the Contractor's work activities and these monitoring events may impact the anticipated schedule including requiring the Contractor to perform additional work or to remove completed work and replace with acceptable work in accordance with these Specifications and the Construction Quality Assurance Plan.

1.4 PRE-CONSTRUCTION MEETING

Once the Notice of Award is issued, the Group will schedule a pre-construction meeting. The Contractor, subcontractors and suppliers, the Group and Group's QA Official and Group's representatives, USEPA, PADEP and all necessary representatives of each of these parties shall attend the meeting. In addition, representatives of the Upper Merion Township Board of Supervisors, other concerned parties will be given the opportunity to attend.

The agenda for the meeting will be developed by the Group or its designated representative(s) and should include items of significance that could impact the project such as:

1. Designation of responsible personnel;
2. Lines of communication;
3. Construction schedule and work sequencing;
4. Working hours;
5. Construction Quality Control requirements;
6. Construction Quality Assurance (CQA) procedures and protocols
7. Appropriate modifications of the CQA Plan to ensure that site-specific considerations are addressed;
8. Submittal procedures and requirements;
9. Methods for documenting and reporting inspection data;
10. Methods for distributing and storing documents and reports;
11. Work area security and safety protocol;
12. Procedures for processing field decisions and change orders; and,
13. Procedures for processing Applications for Payment.

A Site walk through shall be conducted to verify that the approved Final Design, including design criteria, drawings and specifications, are understood and to review material and equipment storage locations.

The meeting minutes shall be recorded by the Group or its designated representative, with copies of the minutes submitted to all parties in attendance within three (3) days of the meeting.

1.5 PROGRESS MEETINGS

Progress meetings shall be held at the Site with the Contractor, the Group and its representative(s), and the Group's QA Official in the temporary facilities on a weekly basis, or as otherwise determined by the Group and QA Official depending on the nature of the work performed and overall project progress.

The meetings shall review work performed during the previous period and discuss work to be performed during the current period. Any coordination or workmanship problems as well as potential problems and proposed solutions shall be discussed. The meetings shall be run by the Group or its designated representative(s). The Group's QA Official shall prepare a meeting agenda and shall be responsible for making all necessary arrangements for the meetings including, but not limited to, advising all parties of the meeting time and place, and ensuring that adequate meeting facilities are available. The Contractor shall have the ability to conference call participants from remote locations.

No later than five (5) working days after each progress meeting date, the Group's QA Official shall distribute copies of the meeting minutes to each party present and to other parties who should have been present. The minutes shall accurately reflect the topics discussed at the meeting with emphasis on conflicts raised and decisions made. The Group's QA Official and Group shall have the final decision as to the adequacy of the meeting minutes and all parties in attendance shall have the opportunity to rebut any discrepancies in the meeting minutes by submitting said discrepancies to the Group's QA Official in writing within one (1) week of receipt of the meeting minutes or prior to the following meeting, whichever is sooner.

In the event that the frequency of the progress meetings is deemed to be inadequate by the Contractor, the Group's QA Official or the Group, the schedule may be changed to a mutually-acceptable frequency.

1.6 PROBLEM RESOLUTION MEETINGS

These meetings shall be held on the Site as necessary, when the immediate nature of a construction problem precludes discussion at the next scheduled job site meeting. At such a meeting, the problem shall be defined and discussed by all concerned parties. Possible solutions shall be discussed and a solution shall be selected by the Group. The implementation procedures of the chosen solution shall also be discussed and agreed upon. The Group or its representative shall document the meeting and distribute minutes, as necessary.

PART 2: PRODUCTS

Not Used

PART 3: EXECUTION

Not Used

PART 4: MEASUREMENT AND PAYMENT

Not Used

SECTION 01050
FIELD ENGINEERING
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section shall include, but not be limited to, establishing survey control points, surveying existing conditions, surveying soil removal limits, providing survey control during construction, and providing final Project Record (commonly known as "as-built") documentation.

The Contractor shall provide an independent registered Land Surveyor licensed in the Commonwealth of Pennsylvania to provide survey control for each stage of the project and to provide survey documentation (including Project Record Drawings) for various components of the project. The Contractor shall furnish all expertise, supervision, labor, materials, and equipment necessary to perform the project surveying as specified herein, as shown on the Drawings, and in accordance with the CQAP. All surveying shall be conducted in the Pennsylvania state plane coordinate system.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals
B. Section 01700 - Demobilization/Contract Closeout
C. Section 02110 - Site Preparation and Clearing
D. Section 02115 - Erosion and Sediment Control Measures
E. Section 02117 – Dust Control and Air Monitoring
F. Section 02209 - Soil and Waste Removal/Handling/Placement
G. Section 02210 - Earthwork
H. Section 02500 - Roadways and Paths
I. Section 02715 - Water Management (During Construction)

J. Section 02936 - Turf Establishment

1.3 QUALIFICATION OF SURVEYOR

The Contractor shall provide a Land Surveyor licensed in the Commonwealth of Pennsylvania and acceptable to the Group and the Groups QA Official. The Surveyor, in the opinion of the Group and QA Official, shall have a proven record of successful performance on projects of similar magnitude. Prior to acceptance by the Group and QA Official, the Surveyor will be required to submit a resume describing the qualifications of the licensed Surveyor, the survey crew chief, and other key personnel.

1.4 SUBMITTALS

The Contractor shall submit to the Group and the Groups QA Official the name, address, and telephone number of the Surveyor and the Surveyor's qualifications as part of the Bid. The Contractor shall also include in the submittal a Surveying Plan including project staffing, scheduling, and the type of equipment the Surveyor intends to use in the field and in the office (i.e., EDM, computer software) to complete the project for review by the Group and the Groups QA Official prior the start of survey work.

1.5 PROJECT RECORD DRAWINGS

The Contractor or Contractor's surveyor shall maintain a complete and accurate account of survey work as work progresses (Project Record Drawings). This account shall, at a minimum, consist of progress drawings of all work performed throughout the project. The progress drawings shall be a copy of the Drawings with field changes and work progress indicated. The Contractor shall allow the Group and the Groups QA Official to inspect the drawings at any time. At the end of the project, a complete set of the progress drawings and the surveyor's log of control and survey work shall be provided to the QA Official for preparation of the final report of construction activities.

1.6 SURVEY REQUIREMENTS

The Surveyor shall locate survey control points prior to starting site work, and the Contractor shall protect these points at all times during the Project. The Contractor shall immediately report, in writing, to the QA Official any survey control point which is in discrepancy or which is lost, destroyed, or requires relocation. The Contractor shall replace each lost or destroyed permanent survey control point at no additional cost to the Group.

The Surveyor shall locate and clearly mark in the field all utilities. The Surveyor shall immediately notify the QA Official of any discrepancy between utilities shown on the Drawings and the location marked in the Field.

The Surveyor shall provide adequate control points for the Contractor to maintain lines and grades for removal areas, fill areas, measurement of construction quantities, and other work required by the Contract Documents. All work shall be performed utilizing recognized engineering survey practices. A complete and accurate log of control and survey work must be maintained. Also, all survey control points on the Drawings shall be included in the Surveyor's documentation.

The survey instruments used shall be capable of reading to a precision of 0.01 ft and with an angle setting accuracy of 10 seconds.

1.7 MEASUREMENT FOR QUANTITY ESTIMATES

The measurements of construction quantities may be performed by the Contractor, and upon review and acceptance by the Group and the Group's QA Official, shall be used to determine pay quantities for many of the individual work activities. The Contractor shall advise the Group's QA Official when such quantity measurements are to be performed such that all parties may be given the opportunity to monitor the measurements. The Group reserves the right to require measurements by a licensed surveyor if deemed appropriate.

1.8 QUALITY ASSURANCE/QUALITY CONTROL

The Contractor is responsible for assuring the accuracy of the Surveyor's work and that all tasks are completed as stipulated in these Specifications and the Contractor's CQC Plan. During the project, the Group's QA Official may also check the accuracy of the surveyor's work through periodic investigations by an independent licensed Land Surveyor.

PART 2: PRODUCTS

2.1 SURVEYS

The Contractor shall provide, at a minimum, Project Record documentation, signed and sealed by the Surveyor, for the following components.

1. Areas of clearing and disturbance.
2. Layout of site access ways and haul roads.
3. The locations and elevations of waste and soil removal areas before (original ground surface) and after (bottom of excavation) removal.
4. Confirmatory soil sampling locations, identifications and elevations.
5. The final locations and elevations for the restored removal areas.
6. Stormwater basin, pipes, channels, and other management features.
7. All other items that the Contractor requires to complete its work and establish pay quantities.
8. All the reasonable items requested by the Group and the Group's QA Official to verify that the Contractor's work meets the requirements of the Drawings and Specifications.

The Contractor shall submit the Project Record documentation, both as hard copies and electronic (AutoCAD) files, for review to the Group and the Group's QA Official (three copies) with the request for final payment or at the completion of the applicable phase of work.

PART 3: EXECUTION

3.1 CONTROL POINTS

3.1.1 Construction Baseline and Benchmark

The Contractor's surveyor will establish and layout the base line(s) and provide the Contractor with the benchmark. The Contractor shall be responsible for maintaining baseline(s) and benchmark(s). If baseline and benchmark control points are disturbed or destroyed by the Contractor or subcontractors under his control, Contractor shall be responsible for and bear the cost of their reestablishment and of confirmation of correctness by the surveyor.

3.1.2 Use of Control Points

Using these control points (baselines and benchmark), the Contractor shall furnish, set and maintain suitable stakes, grade boards, temporary structures, templates, and other materials for establishing points, marks, and lines necessary in the execution of work.

3.1.3 Verification of Lines, Grades, and Elevations (QA/QC Grid)

The Contractor will establish a 50-foot grid for verification of lines, grades, and elevations within Quarry 3 during backfill based on the Surveyor's control points. The Contractor shall be responsible for maintaining the 50-foot QA/QC grid. If QA/QC grid control points are disturbed or destroyed by the Contractor, he shall be responsible for and bear the cost of their reestablishment and of confirmation of correctness by the surveyor.

3.1.4 Preservation of Control Points

The Contractor is solely responsible for the preservation of the permanent control points as well as such stakes, grade boards, marks, and similar measurement marks as established from the control points.

3.2 FREQUENCY

Use of a full time on-site Surveyor and/or survey crew is not anticipated to be necessary. The Contractor will be responsible for providing a surveyor as necessary to complete the tasks outlined in this specification. The Contractor may also use personnel who are knowledgeable in survey techniques to set construction lines and grades based on the Surveyor's control points.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Surveying and related field engineering work and documentation shall be a lump sum Field Engineering cost.

4.2 PAYMENT

The work covered in this section shall be included in the lump sum cost for Field Engineering.

SECTION 01300
SUBMITTALS
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section includes, but is not limited to, the submittals required during the duration of the project and the procedures that the Contractor shall use in providing the submittals.

1.2 RELATED SECTIONS

All sections of this Specification.

1.3 PROJECT RECORD DOCUMENTS

The Contractor shall keep on Site at all times for review by the Group and the Group's QA Official one copy of all documents, materials, photographs, and related project records that have been submitted to the Group or QA Official. The Contractor shall also keep on Site at all times an updated copy of the submittal register for review as well as one copy of all permits related to the work on file at the Site.

The Contractor shall ensure that the submittal register and all contract documents on file at the Site are complete, accurate, legible, and are kept in a separate and marked location accessible to all authorized personnel.

PART 2: PRODUCTS

2.1 SUBMITTAL REGISTER

Upon award of the project and review of all Contract Documents including, but not limited to, the Drawings and Specifications, the Contractor shall prepare a Submittal Register for review and approval by the Group and the Group's QA Official. The Submittal Register shall be submitted no later than 14 days after award of the contract. The Submittal Register shall include all submittal items listed in the Specifications and shall also provide the following information, at a minimum:

1. Project name and contract number.
2. Contractor's project or reference number.
3. Submittal title and description of item.
4. Submittal reference number sequentially numbered.
5. Date item was submitted.
6. Number of copies submitted.
7. Parties who received the submittal.
8. Whether response is required by the parties who received the submittal.
9. Whether submittal is part of the original submittal register or an addition.
10. Approval status.

The Submittal Register shall include blank entries for future addition of submittals that were not anticipated.

2.2 SUBMITTAL REFERENCES

The following is a partial list of submittals related to the project. As part of the Submittal Register, the Contractor shall provide a complete list of submittals as specified in the Specifications.

2.2.1 Bid Submittals

With his bid the Contractor shall include project information related to the performance of work including a description of work, general approach and methods to be used. In addition the Contractor shall include the qualifications and names of any subcontractors (such as surveyor or water treatment), vendors, etc that may be used to perform Quarry 3 RA work. The description of work should include material handling, conditioning, and dust control measures as well as anticipated excavation and backfilling practices. The proposed work sequence, haul roads, support zone, and staging areas should also be identified. Any contingency disposal facility and transporter compliance information will also be provided at this time.

2.2.2 Construction Submittals

The Contractor shall submit the following prior to start of Work and indicate them as such on the Submittal Register:

1. Submittal Register (Example of format prior to construction);
2. Remedial Action Work Plan;
3. Health and Safety Plan and all related submittals;
4. Construction Quality Control Plan;
5. Shop drawings and material properties for surface water treatment system
6. Solidification reagents and final mix design, if used

The Contractor shall submit the following prior to installation and indicate them as such on the Submittal Register:

1. Material properties for silt fence and other Erosion and Sediment Control devices;
2. Material properties for dust control agents;
3.. Material properties for stormwater swale, access road, and construction entrance geotextile;

4. Material properties for access road and construction entrance stone;. ;
5. Material properties for seed;
6. Material properties for topsoil, fertilizer, mulch, binder, and turf reinforcement;
7. Material and chemical properties for off-site borrow soil;
8. Shop drawings and material properties for mechanical dewatering system, if used; and,
9. Material properties for all other materials used during the work.

The Contractor shall submit the following during construction and indicate them as such on the Submittal Register:

1. Meeting Minutes;
2. Daily Reports
3. Payment Requisitions
4. Project Record documents and warranty summary upon project closeout; Progress Drawings;
5. Photographs;
6. Delivery and disposal tickets;
7. Waste manifests/shipping paperwork, certificates of disposal and landfill weight tickets.

PART 3: EXECUTION

3.1 SUBMITTAL PROCEDURES

Submittals shall be made by the Contractor to the Group (4 copies) and the Group's QA Official (one copy). Additional copies shall be submitted to USEPA and PADEP, if requested. A submittal cover sheet or transmittal sheet shall accompany each submittal and shall include all information necessary for review. The cover sheet information shall include, but not be limited to:

1. Project Name and Contract Number;

2. Contractor's project or reference number;
3. Submittal title and description of item;
4. Unique Submittal number corresponding to submittal register;
5. Specification Section to which the submittal applies;
6. Date of submission;
7. Parties who received the submittal;
8. Whether response is required by parties who received the submittal, and from which parties a response is required;
9. Deviations from the Specifications and an explanation for such;
10. Contractor's Quality Control Manager's signature;
11. Space for Owner's signature;
12. Space for QA Official's signature with line item responses as follows:

    - Approved
    - Approved with comment
    - Denied
    - Denied with comment
    - Approved pending concurrence by regulatory agencies

13. Space for Comments.

Materials brought on-site or used without approval via the submittal process will be at the Contractors risk. Substitution of materials or equipment shall be in accordance with the General Conditions.

3.2 DOCUMENT STORAGE

The Contractor shall maintain an on-site repository containing submittals, daily reports, and other pertinent QA/QC documents.

PART 4: MEASUREMENT AND PAYMENT

Submittals shall be considered incidental to other work activities and shall not be paid for as a separate item.

SECTION 01400
QUALITY CONTROL SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section shall include, but not be limited to, the implementation of a Construction Quality Control Program (QC Program) by the Contractor. This section also discusses the interaction between the Contractor's QC and the QA activities.

The Contractor shall provide all supervision, expertise, labor, materials, and equipment necessary to implement the QC Program as detailed in the QC Plan and as stated in these Specifications. All testing costs associated with the QC Program, whether it be field or off-site based, shall be borne by the Contractor.

1.2 RELATED SECTIONS

All sections of these Specifications.

1.3 DEFINITIONS

- Construction Quality Control (QC) - Construction Quality Control is defined as those actions taken by manufacturers, fabricators, installers, and contractors which provide a means to measure performance and demonstrate that the material and the workmanship meet the requirements of the Contract Documents. QC is performed by the Contractor.

- Construction Quality Assurance (QA) - Construction Quality Assurance is defined as a planned and systematic pattern of activities designed to assure and document that Quality Control of items or procedures is being performed in accordance with the

Contract Documents. QA is performed by the Group's appointed QA Official, a party independent from the Contractor.

1.4 SUBMITTALS

The Contractor shall prepare a QC Plan for review and approval by the Group and the Group's QA Official. The QC Plan shall detail the Contractor's procedures to be used in implementing the QC Program such that the quality control as specified in these Specifications is met. Specific elements of the QC Plan are provided in Section 2.1. The QC Plan shall be provided to the Group at the same time as the Remedial Action Work Plan (RAWP), within 14 days of the award of Contract.

1.5 QC MANAGER

The Contractor shall designate a qualified person at the Site as the QC Manager who will be charged with ensuring that the QC Program as stated in the QC Plan and the Contract Documents is being implemented. The Contractor shall provide documentation supporting his/her prior experience as a QC Manager, and the QC Manager shall be satisfactory to the Group and the Group's QA Official.

1.6 INSPECTIONS

The Contractor shall implement an inspection system to monitor all of the definable features of work. The inspection system shall consist of a series of inspections performed before a specified work element, periodically while the work element is taking place, and at the completion of the work element. The QA Official shall be advised of each of the inspections at least three (3) days prior to the inspection such that they have the opportunity to attend. The QA Official shall document the minutes of the inspection including attendees, specific issues discussed, and deficiencies noted. Minutes shall be developed, distributed, reviewed and revised similar to Specification 01039, Paragraph 1.5. Inspections during winter demobilization shall be conducted in accordance with Specification 02115. The types of inspections are as follows:

1.6.1 Preparatory Inspection

A preparatory inspection shall be performed prior to beginning work on any definable feature of the project. It shall include:

- A review of the project requirements;
- A check to ensure that all materials and/or equipment have been tested and approved;
- A check to ensure that provisions have been made to provide required Quality Control testing;
- An examination of the work area to ascertain that all preliminary work has been completed; and,
- A physical examination of materials and equipment to ensure that they are on hand and conform to the project requirements.

Subsequent to the preparatory inspection and prior to commencement of work, the QC Manager shall instruct each applicable worker on the level of workmanship required to meet the project's requirements.

The preparatory inspection shall include a meeting to discuss all of the relevant issues aforementioned, and shall be documented and included with that day's QC report. Attendance at this meeting shall be offered to the Group and the Group's QA Official and other interested parties and shall include key Contractor personnel and key subcontractor personnel that will be supervising elements of the work to be performed.

1.6.2 Initial Inspection

An Initial Inspection shall be performed as the work starts to ensure and monitor proper progress of the particular feature of work. All Contractor supervisory personnel to be involved in the particular phase covered by the Initial Inspection shall be present. This inspection will last as long as it takes to get the work underway fully and in proper fashion. It shall include, but not be limited to, an examination of the quality of workmanship and review of Quality Control testing for compliance with project requirements, a review of dimensional requirements, and a discussion of any defined or anticipated problems.

1.6.3 Follow-Up Inspection

Follow-up inspections shall be performed periodically as needed, but at least daily, to ensure continuing compliance with project requirements, including testing and health and safety requirements, until completion of the particular feature of work. Final follow-up inspections shall be conducted and test deficiencies corrected prior to beginning new work. Only the Contractor is required to be present at these inspections, and documentation shall be limited to the fact that the appropriate inspections were performed.

The QA Official will also conduct periodic inspections to verify compliance with the project requirements. The inspections will include, among others aspects, review of records for air quality monitoring and waste disposal.

1.6.4 Completion Inspection

At the completion of all critical work or any increment thereof established by a completion time stated in the project requirements, the QC Manager shall conduct a completion inspection of the work and develop a "punch list" of items which do not conform to the approved plans. The punch list shall include the estimated date by which the deficiencies will be corrected.

The QC Manager or his/her staff shall make a second completion inspection to ascertain that all deficiencies have been corrected and so notify inspection participants for their review and acceptance.

1.7 QUALITY ASSURANCE

The Contractor shall note that a Quality Assurance Program will be implemented at the Site to monitor its quality control procedures and to ensure that the QC Program is being implemented as stated in the QC Plan. A detailed Construction Quality Assurance Plan (CQAP) is provided in the Contract Documents.

1.8 LABORATORY AUDITS

The Group and the Group's QA Official may perform an audit of the analytical laboratory proposed for use by the Contractor in its QC Plan. The Group and the Group's QA Official may reject the proposed laboratory based on this audit and may request that the Contractor propose an alternate laboratory satisfactory to them.

PART 2: PRODUCTS

2.1 QC PLAN

The Contractor shall submit the QC Plan to the Group and the Group's QA Official, USEPA and PADEP within 21 days of contract award.

The following elements, at a minimum, shall be included in the Contractor's QC Plan:

- Chain-of-command of the quality control team including specific duties and qualifications of each of the personnel. This chain-of-command shall also be related to the project organizational structure such that all parties are aware of the lines of communication regarding the QC system;

- Detailed description of the QC Program including objectives, reporting requirements, goals of the program, inspection system, and deficiency tracking system;

- List of the definable features of work and a detailed description of QC procedures to be followed during each of the definable features of work;

- Maximum allowable levels for noise and dust, and procedures to reduce the levels as necessary, to below the allowable limits;

- Procedures to maintain a condition of no visible dust;

- Qualifications of the analytical and physical laboratories proposed to perform the sample analyses; and,

- Field QC procedures including, but not limited to, sampling, containerization, shipping, chain-of-custody, testing, validation, inspection and related activities. All sampling and analysis activities shall be conducted in accordance with the Sampling and Analysis Plan (SAP). This applies to any samples collected by the Contractor including but not limited to: personnel air monitoring, fill material sampling, or any disposal sampling required should the Contractor utilize an alternate disposal facility of its own choosing.

Analytical and physical laboratories shall meet the requirements of the SAP, including reporting limits.

2.2 QUALITY CONTROL REPORTS

The Contractor shall prepare a daily Quality Control (QC) Report detailing any and all work and health and safety activities that were performed. The QC Report shall be prepared by the end of the following work day and two copies each shall be submitted to the Group and the Group's QA Official within this time period.

At a minimum, the Daily QC Report shall include the following:

- Project name and date;
- Description of Site activities performed during the day;
- Description of QC activities performed during the day;
- Description of any tests performed and inclusion of any test results and analytical data received from previous testing. Testing may include, but is not limited to, compaction tests, borrow material samples, perimeter, real-time and personal air monitoring, and samples to obtain disposal approval for soil;
- Listing of any other samples collected (i.e., post excavation confirmation, water treatment compliance, perimeter air monitoring, personnel air monitoring, etc) by the Group's QA Official;
- Details of any discrepancies or field conflicts which occurred during the day;
- Production rates of all field activities;
- Descriptions and quantities of any materials, labor, or equipment mobilized to or demobilized from the Site, including delivery and disposal tickets;
- Daily Health and Safety Reports signed by the Site Health and Safety Officer including data for work area and personnel air monitoring;
- Descriptions of any inspections performed during the day including attendees;
- Submittals made during the day or decisions made on previous submittals;

- List of Site visitors and organizations being represented;
- Site Security activities;
- Any other significant Site activities; and,
- Signature of the QC Manager.

A weekly summary progress report shall be submitted by the Contractor prior to the Progress Meeting, as indicated in the CQAP. At a minimum, this report will include the following information:

- A unique identifying sheet number for cross referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities during the progress reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period;
- A summary of test results, failures, and re-tests;
- Work activities proposed for the next reporting period;
- Project schedule; and,
- The signature of the Contractor.

The Contractor shall submit the Progress Report to the Owner and the QA Official. The Contractor shall also submit electronic files (i.e., Excel or similar) for summary tables of all data, quantities and other information on a regular basis as work progresses and at the request of the QA Official.

2.3 CONSTRUCTION PHOTOGRAPHS

The Contractor shall periodically photodocument the activities being performed and the progress made at the Site using a date-printing digital camera. At a minimum, this photodocumentation shall be performed every week and shall be performed on all of the definable features of work.

The Contractor shall submit one set each of all photographs to the Owner and the QA Official in digital format. Along with each of the photograph submittals shall be a photograph log describing the file name, each of the views shown in the photograph, the time and date the photograph was taken, the direction from which the photograph was taken, and the photographer. All photographs shall be color photographs in digital format taken with a minimum 6 mega-pixel digital camera. Each photograph shall be date and time stamped as it is being taken.

PART 3: EXECUTION

3.1 PERFORMANCE

QC personnel shall inspect, sample, test, and report in accordance with this and all other sections of the Specifications and the Contract Documents. All sampling and analysis shall be conducted in accordance with the SAP. Deviations from the SAP will not be permitted without written approval of the Group, USEPA and PADEP. The Contractor shall cooperate with its Quality Control personnel, furnish samples of materials, equipment, tools, storage, and provide access and assistance as this is an integral and essential element of the work. The time needed for the quality control personnel to take samples and perform tests shall be included in the project schedule and incorporated into the Contractor's price. The Contractor shall notify the QA Official 48 hours prior to the time that field operations will require confirmatory quality assurance testing and engineering inspection in accordance with the Specifications.

For certain materials and products, certificates of compliance are required in lieu of specified sampling and testing procedures. Any certificates required for demonstrating proof of compliance of materials with specification requirements shall be submitted with each lot of material delivered to the Site. The lot so certified shall be clearly identified. Certificates shall be signed by an authorized representative of the producer or manufacturer and shall state that the material complies in all respects with the Contract Documents. In the case of multiple shipments, each shipment shall be accompanied by a certificate of compliance.

The certificate of compliance shall be accompanied by a certified copy of test results or shall state that such test results are on file with the producer or manufacturer and shall be furnished to the Group or the Group's QA Official on request. The Group and the Group's QA Official reserve the right to refuse certain materials on the basis of a certificate of compliance.

A copy of all material delivery tickets shall be submitted to the QA Official. When multiple deliveries of the same material occur during the work, the QC Manager shall keep a log showing the date and quantity of each delivery and the total delivered to date. The QC Manager shall share this log with the QA Official when requested. A copy of all off-site disposal tickets with Certificates of Disposal and weight tickets shall be submitted to the QA Official.

All QC results and reports shall be signed by the QC Manager.

3.2 MANUFACTURER'S SPECIFICATIONS

During installation of products and equipment, the Contractor shall comply with manufacturers' instructions, including each step in sequence. Should the manufacturers' instructions conflict with these Specifications, the Contractor shall request clarification from the QA Official and the Group before proceeding. The Contractor shall comply with specified standards as minimum quality for the work conducted except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

3.3 QUALITY ASSURANCE

The Contractor shall note that a Quality Assurance Program will be implemented at the Site and the time needed for Quality Assurance testing shall be included in the project schedule and incorporated into the Contractor's price. Destructive testing of materials is not anticipated, however any costs associated with repair of tests collected by the QA Official shall be borne by the Contractor. When samples are collected by the Contractor and QA Official, both QA and QC results shall meet the performance standards prior to approval by the QA Official.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

The development and implementation of the Quality Control Program shall not be measured.

4.2 PAYMENT

All costs associated with development and implementation of the Quality Control Program, including but not limited to testing, documentation, and reporting, shall be included in the Contractor's bid and shall not be paid for on a per unit basis.

SECTION 01545
HEALTH AND SAFETY
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section shall include, but not be limited to, the development and implementation of a Health and Safety Program. The Contractor will be responsible for all Health and Safety on the Site for employees, subcontractors, suppliers and visitors. The Contractor shall provide all expertise, supervision, labor, materials, and equipment necessary to develop, prepare, and implement the Health and Safety Program as detailed in this Section.

The Contractor shall develop and implement all necessary precautions for the safety of, and provide the necessary protection to prevent damage, injury or loss to:

- All employees and subcontractors participating in performance of the Work;
- All components of the work, any materials to be used or incorporated in the work, and any equipment to be employed in the execution of the work, whether on- or off-site; and,
- Other property on or adjacent to the project Site including wetlands, surface waters, groundwater, soil, air, trees, shrubs, lawns, sidewalks, pavements, roadways, structures and utilities not designated for removal, relocation, or replacement in the course of construction;

1.2 RELATED SECTIONS

All sections of the Specifications.

1.3 REFERENCES

- OSHA 29 CFR 1910 and 1926.

1.4 DEFINITIONS

OSHA - Occupational Safety and Health Administration

1.5 SUBMITTALS

The Contractor shall prepare and submit a Health and Safety Plan (HASP) for comment by the Group and the Group's QA Official. The HASP shall be submitted along with the Contractor's Remedial Action Work Plan (RAWP), within 14 days of the award of the contract. As part of the Health and Safety Program to be implemented by the Contractor and as specified herein, submittals are also required for the documentation of normal Health and Safety procedures during the duration of the project.

PART 2: PRODUCTS

2.1 HEALTH AND SAFETY PLAN

The Contractor shall prepare a written Health and Safety Plan which is applicable to all components of the work. The plan shall be based upon the requirements and guidelines described herein and shall be signed by a Certified Industrial Hygienist (CIH). The Contractor's Health and Safety Plan will apply to all personnel on-site including the Group, the Group's QA Official, the Contractor, subcontracted personnel, visitors, and regulatory officials. The Contractor may include additional information as appropriate and may utilize any format provided it is neat, clean and complete. The

Health and Safety Program shall meet, at a minimum, the requirements of OSHA Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926). In addition, the plan must include at a minimum, the following information:

- Responsibilities of the Contractor and its Health and Safety Coordinator. The name of the Health and Safety Coordinator and assistant health and safety personnel to be utilized on Site shall also be included;

- A description of the work to be performed at the Site and how health and safety activities are related to the work;

- A hazard evaluation, including discussions of potential hazards involved with each work activity including physical hazards such as, but not limited to, personal injury, noise and natural disasters, as well as chemical hazards associated with the on-site materials known or suspected in conjunction with the work;

- Safe work practices and preventive measures to be taken or implemented for each of the potential hazards identified;

- A discussion of proposed environmental and personnel monitoring including specific types of equipment to be used, action levels to be instituted and the procedures for establishing action levels for real-time dust measurements, VOCs, and SVOCs;

- Zone delineation and decontamination procedures;

- Personnel protection requirements and specific work areas or specific activities or tasks. These procedures should specify protocol for upgrading the level of personnel protection and environmental or industrial hygiene monitoring to assure personnel safety. The Contractor shall supply all personal protective equipment, air monitoring instruments, analyses, and other safety-related equipment or instruments necessary to

perform the work and to continue work in the event of upgraded levels of personal protection;

- Personnel and equipment decontamination procedures;

- Training requirements for personnel utilizing personal protective equipment. The Contractor shall provide 40 hours of classroom training and 8-hour annual refreshers supplemented with site-specific training as required by OSHA in 29 CFR 1910.120 for all personnel including sub-contractors who will be working on-site prior to their initiating on-site work. Additionally, the Contractor's supervisory personnel shall receive an additional 8 hours of supervisory training. The Contractor's site-specific training curriculum should include, at a minimum, the following topics:

  - Chemical Hazards;
  - Physical Hazards;
  - Potential for Exposure on Site;
  - Levels of Protection;
  - Decontamination Procedures;
  - Emergency Procedures and Telephone Numbers;
  - Hospital/Infirmary Directions;
  - Health and Safety Chain-of-Command;
  - Respiratory Checkout; and
  - Fit Tests;

- Requirements for periodic medical monitoring of Site personnel. The Contractor shall use the services of an occupational physician to perform the medical monitoring and surveillance protocol specified by OSHA in 29 CFR 1910.120. The Contractor shall include in the Health and Safety Plan a statement from the occupational physician performing the medical monitoring certifying that the subject employees have the physical ability to perform their assignments while using respiratory protection, if necessary;

- Responsibility and procedures for notifying/contacting emergency personnel;

- Acceptable contaminant concentrations within the work zone and for ambient air around the work zone;

- Dust control measures, including notification of personnel that decontamination water may be used for dust control in contaminated areas;

- Procedures for emergency situation assessment, control procedures, emergency equipment, and personnel evacuation. A complete list of emergency phone numbers including, but not limited to, emergency medical services, fire company, police, hospital, poison control board, and supervising physician should be included;

- Procedures for post-emergency measures including storage, treatment and disposal of hazardous substances, and emergency equipment maintenance, and documentation of emergency events; and,

- Daily and weekly safety logs and a closeout safety report to be prepared by the Contractor.

The Contractor shall provide the Group with four (4) copies of the draft and final version of the Health and Safety Plan accompanied by a transmittal letter signed and dated by the Contractor and the Health and Safety Coordinator within 14 days of contract award. In addition, one copy of the draft and final Health and Safety Plan shall be provided to the QA Official and Design Engineer for review and comment. All on-site personnel and visitors shall be required to read and sign the approved Health and Safety Plan.

2.2 MONITORING EQUIPMENT

The Contractor shall provide all medical and environmental monitoring equipment to be used by the Contractor at the Site. This equipment shall meet the approval of USEPA, PADEP, the Group and the Group's QA Official and be fully functional when use of the equipment is necessary.

2.3 PERSONAL PROTECTIVE EQUIPMENT

The Contractor shall supply all personal protective equipment (PPE) necessary to be in compliance with the Health and Safety Plan for all Site personnel including the Contractor, the Group, the Group's QA Official and regulatory officials. PPE shall include, but not be limited to, cotton coveralls, Tyvek coveralls, gloves, booties, hard hats, hearing and eye protection. Respirators, supplied air systems and sealing tape shall be included if required by project conditions. At a minimum, PPE shall be Level D (cotton coveralls, booties, hard hat, safety glasses and steel toe boots) for all personnel, including visitors, within the exclusion zone.

PART 3: EXECUTION

3.1 SUBMISSION OF PLAN

The Contractor shall submit his health and safety plan as part of the Remedial Action Work Plan. The Plan shall be signed and dated by the Contractor and by the Contractor's Health and Safety Coordinator.

The Group and the Group's QA Official will review the Health and Safety Plan and will transmit comments to the Contractor. It will be the responsibility of the Contractor to incorporate comments into the Health and Safety Plan. The Contractor will not be permitted to initiate Site work until the comments have been addressed and the Final Plan has been submitted. The comments on the Health and Safety Plan shall be relative to the Plan's compliance with the requirements of this Specification and does not imply that all procedures are suitable for the required work. Suitability of the Plan for the work is the responsibility of the Contractor.

3.2 IMPLEMENTATION OF PLAN

Once the Health and Safety Plan has been finalized, requirements of the Health and Safety Plan shall be enforced.

The Contractor must provide an on-site Health and Safety Coordinator during all activities, appropriately trained and certified for supervisory responsibility in health and safety protection. An alternate Health and Safety Coordinator, with equal training, must be designated to serve when the Health and Safety Coordinator is not on-site. The Health and Safety Coordinator or alternate shall be on-site at all times when work is in progress, including during work by sub-contractors. The Health and Safety Coordinator shall serve no other major work activities nor hold any other major job title (i.e., the Health and Safety Coordinator shall not also be the QC Manager, Site Superintendent, Foreman, or Operator, for example).

It shall be the responsibility of the Contractor's Health and Safety Coordinator to ensure that all health and safety requirements are implemented per the Final Health and Safety Plan. The Coordinator will have control over the safe execution of the Contract while in progress. Should for any reason it be determined that the working conditions are unsafe, the Coordinator, at his/her discretion, can suspend or terminate the work. The Coordinator is in charge of personnel decontamination and emergency response measures.

The Health and Safety Coordinator will have the authority to act on all health and safety issues and matters, and to establish new controls, procedures or facilities as needed. If the Group determines that the Contractor's Health and Safety Coordinator is not providing adequate health and safety controls, the Contractor shall provide alternate personnel subject to the approval of the Group to serve as Health and Safety Coordinator.

3.3 AIR MONITORING

Procedures for ambient air monitoring shall be as indicated in the Sampling and Analysis Plan (SAP) and Specification 02117. Deviations from these documents will not be allowed, unless written approval is provided by the Group, USEPA and PADEP.

3.4 HEALTH AND SAFETY TRAINING

All personnel within the exclusion zone shall have 40-hour OSHA training compliant with 29 CFR 1910.120 and with current 8-hour refresher. This requirement applies to personnel conducting below- and above-ground surface activities including surveyors, mowers, installers and maintenance personnel.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

The development and implementation of the Health and Safety Program shall not be measured.

4.2 PAYMENT

All costs associated with development and implementation of the Health and Safety Program, including but not limited to plan preparation, full-time Health and Safety Officer, testing, analysis and PPE, shall be included in the Contractor's bid and shall not be paid for on a per unit basis.

SECTION 01550
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section includes, but is not limited to, the delivery, installation, hook-up, and maintenance of the temporary construction facilities and establishment of the support zone outside of the exclusion zone and work areas. The temporary construction facilities and controls covered by this section include field offices, support trailers (e.g., break trailer and decontamination trailer), utilities, dust and pollution control, protection of personnel and work areas, and creation and maintenance of access roads and parking areas.

1.2 FIELD OFFICE

The Contractor shall provide and maintain at the Site at locations approved by the Group, adequate field offices for its own use, for use by the Group's QA Official, and for weekly progress meetings for up to 6 people. These offices shall be capable of supporting normal office operations.

All offices shall be provided with working locks and shall be weather-proof. The trailers shall have adequate heating, air conditioning, filing cabinets and electric lighting to provide a comfortable environment for the full duration of the project. The electrical service shall not be subject to voltage fluctuations capable of damaging electrical equipment, and the Contractor shall maintain all offices in a clean condition. Electrical service for all offices shall be provided by the Contractor, and the Contractor shall cover the cost of all monthly utility service and related bills.

Each trailer shall be equipped with telephone service. Telephones and facsimile machines shall be provided in offices by the Contractor. The Contractor shall cover the cost of all monthly telephone

service and related bills for all offices. The Contractor shall provide high speed (DSL or equivalent) internet service to all offices and shall cover the cost of all monthly internet service and related bills.

The Contractor is not required to maintain water and sewer service to the office trailer.

1.5 TEMPORARY WATER SERVICE

The Contractor shall provide, maintain, and pay for potable water (e.g., bottled water) for the office and for all work personnel.

1.6 TEMPORARY SANITARY FACILITIES

The Contractor shall provide, maintain, and pay for all sanitary accommodations for all personnel on the project, including the Group, the Group's QA Official, USEPA, PADEP and visitors. Facilities shall be located in areas convenient to personnel and approved by the Owner and shall be maintained in a sanitary condition. At least one unit shall be provided for every 15 persons with separate male and female facilities.

1.7 TEMPORARY ELECTRICITY FOR CONSTRUCTION

The Contractor shall provide all temporary electricity necessary to complete the work as detailed in the Specifications and on the Drawings. The Contractor may connect to local electrical sources or may provide on-site generators; however, the temporary electrical supply method must be approved by the Group and must also meet federal, state, and local regulations.

1.8 TEMPORARY LIGHTING FOR CONSTRUCTION

The Contractor shall provide temporary lighting for the support (i.e., trailers), access, and active work areas. Lighting for the support areas shall be operational from one hour before sunset to one hour after sunrise and should provide adequate lighting in accordance with OSHA guidelines. Lighting for access and active work areas shall be as approved by the Group. The provision of

lighting in the active work areas does not permit the Contractor to work after sunset nor prior to sunrise without the prior approval of the QA Official and the Group. Work hours shall be in compliance with local codes.

1.9 WORK AREA PROTECTION

The Contractor shall protect all areas on and off of the Site that may be damaged by its activities. This shall include, but not be limited to, streets, roads, drainage features, sidewalks, utilities, trees, fences, lawns, railroads, or other maintained areas. Areas that are subject to damage from required activities shall be identified and brought to the attention of the Group's QA Official prior to the start of work, or as soon as they are identified. Any areas or items that are damaged due to negligence or carelessness by the Contractor, or unauthorized activities shall be removed and replaced with new work at the Contractor's expense.

The Contractor shall provide, maintain, and pay for all barricades, temporary fencing, railings, warning lighting, signage and other similar items necessary to comply with OSHA guidelines for safe working environments for both Site personnel and onlookers and to prevent unauthorized entry onto the Site. The Contractor shall provide a professionally prepared sign at the entrance of the Site as approved by the Group to identify the name of the Site, the type of work being performed at the Site, and the specific guidelines for proper access to the Site. The sign shall have a minimum size of 30 inches high by 42 inches wide and shall be removed at the completion of work.

1.10 ACCESS ROUTES AND PARKING

Routes of ingress and egress to the Site shall be clearly marked by the Contractor and shall be as designated on the Design Drawings. Alternate means of access shall be approved by the Group The Contractor shall maintain the access roads and parking areas in adequate condition such that vehicular traffic and pedestrian traffic can safely and easily negotiate the access ways. Conditions which should be corrected by the Contractor shall include, but not be limited to, excessive ponding water, potholes, or excessive mud, dust, snow, or debris.

Parking areas shall be maintained by the Contractor at the support zone. Alternate parking areas shall be approved by the Group and shall be sized adequately to handle the quantity of vehicles generated by the Site personnel including regulatory officials, the Group and the Group's QA Official.

1.11 SECURITY

The Group is not responsible for loss of or damage to the Contractor's work or equipment. The Contractor shall be responsible for protecting and restricting access to all areas of the Site including support, active and inactive work areas by unauthorized persons or vehicles and to document all visitors and deliveries. The Contractor's Site security program shall be as approved by the Group.

The existing gate at Renaissance Blvd. shall be closed and secured during non-working hours to maintain security of the support zone. All other gates shall be closed and secured at all times, except when in use and monitored by an attendant.

1.12 PROGRESS CLEANING

The Contractor shall incorporate a cleaning program for support and work areas of the Site on a periodic basis. The cleaning methods and frequency shall be approved by the Group and shall be adequate to maintain all areas of the Site, including interior of existing and proposed trailers, in a safe, clean, organized, and workable manner.

1.13 POLLUTION CONTROL

The Contractor shall supply all expertise, labor, equipment, and materials necessary to control the spread of contamination and to control the generation of excessive noise, vapors, odor, or dust emissions.

The Contractor shall use and maintain the personnel and equipment decontamination station for proper decontamination of all equipment, personnel and materials leaving the exclusion zone. When work sequencing requires alternate personnel and equipment decontamination stations, the locations shall be approved by the QA Official.

The Contractor shall provide controls and fencing as necessary to keep traffic in designated areas and prevent traffic from bypassing a decontamination station.

The Contractor shall provide all necessary expertise, supervision, labor, materials, and equipment and shall perform all work activities in such a manner as to minimize the amount of noise, vapors, odor, or dust generated from the Site. The Contractor shall also ensure that the levels of noise and dust and methods of mitigating them are in accordance with federal, state and local regulations. Dust shall be controlled to maintain a condition of no visible dust.

1.14 FIRE PREVENTION CONTROL

The Contractor shall take all precautions necessary to prevent fires and explosions in all areas of the Site. All open flame, welding, and heating operations shall be performed in accordance with OSHA standards. The Contractor shall provide and maintain dry chemical type fire extinguisher in the immediate vicinity of any flame or spark producing operations and also in each of the site trailers.

PART 2: PRODUCTS

Not Used

PART 3: EXECUTION

Not Used

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Construction facilities and temporary controls shall not be measured.

4.2 PAYMENT

Mobilization shall include all expertise, supervision, labor, materials, and equipment necessary to be in accordance with this section of the Specifications. Mobilization for Phases 1 and 2 shall be separate lump sum payments. Progress payments will be made on a percent complete basis as determined by the Group. Mobilization for each phase shall be complete when Site preparation and excavation activities are being conducted at the rate shown in the Contractor's schedule.

PAY ITEM	PAY UNIT
Mobilization – Phase 1	Lump Sum
Mobilization – Phase 2	Lump Sum

SECTION 01600
MATERIALS AND EQUIPMENT
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section includes, but is not limited to, the ordering, delivery, handling, storage, quality, acceptability, and substitution of materials and equipment. The Contractor shall be responsible for providing all expertise, supervision, labor, materials, and equipment necessary to complete the tasks specified herein.

1.2 RELATED SECTIONS

All sections of this Specification.

1.3 DEFINITIONS

A. Products – Items purchased for incorporations into the Work, whether purchased for the Project or taken from previously purchased stock. The term 'product' includes the terms 'material', 'equipment', 'system' and terms of similar intent.

B. Named Products – Items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature that is current as of the date of the Contract Documents.

C. Materials – Products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

D. Equipment – Product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.4 SUBMITTALS

Prior to the use of any materials on-site and in accordance with the applicable sections of these Specifications, the Contractor shall submit specifics of the materials to be used onsite to the Group and the Group's QA Official for review and approval. Material for which submittals are required should be indicated by the Contractor on its Submittal Register as detailed in Section 01300 of the Specifications.

1.5 QUALITY ASSURANCE

The Contractor shall ensure that all materials and equipment used at the Site are in strict compliance with the Specifications, the Drawings, and the Construction Quality Assurance Plan. Fill materials shall meet the requirements of the Contract Documents.

1.6 SUBSTITUTIONS

Substitutions may be considered when a product becomes unavailable through no fault of the Contractor or a product of equal or better quality, as determined by the QA Official, becomes available at an equal or lesser price. The Contractor shall document each request for substitution with complete data substantiating compliance of the proposed substitution with the Contract Documents.

The substitution submittal procedures shall be as follows:

1. Submit two (2) copies of each request for substitution for consideration to the Group and the Group's QA Official.

2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence with the request.

The Group will notify the Contractor in writing of the decision to accept or reject the request.

PART 2: PRODUCTS

2.1 MATERIALS

The Contractor shall ensure that, unless otherwise specified, all materials are new and of such quality to meet the requirements of the Contract Documents. The Contractor shall furnish satisfactory evidence as to the kind and quality of all materials if required by the Specifications or upon request by the Group or the Group's QA Official.

2.2 EQUIPMENT

The Contractor shall arrange with the Group for Site access for all construction equipment. The Contractor shall provide only quality equipment that is intended for the specific task. All equipment shall be safe, well maintained, and in good operating condition. The Contractor is advised that all equipment is subject to approval by the Group.

PART 3: EXECUTION

3.1 DELIVERY AND STORAGE

The Contractor shall coordinate all orders and deliveries with the progress of the work so as to cause no undue delays in any part of the work. All materials stored at the Site shall be stored in accordance with the applicable sections of these Specifications and the manufacturer's specification, protected from weather and vandalism, adequately ventilated, and so arranged as to prevent damage, distortion, deterioration, or other harm which would detract from their function. Geosynthetic materials shall not be stored on-site for longer than six (6) months.

All materials delivered to the Site shall clearly indicate the manufacturer's name and the type of product in a conspicuous place.

Equipment stored at the Site shall be stored at the Contractor's risk. The Group shall accept responsibility for materials only after they have been installed, verified by the QA Official and the task is complete. The location of equipment and/or material storage shall be approved by the Group.

Copies of all material delivery and disposal tickets shall be provided to the QA Official.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Measurement for materials and equipment shall be performed in accordance with the specific sections of this Specification.

4.2 PAYMENT

Payment for materials and equipment shall be in accordance with the specific sections of this Specification.

SECTION 01700
DEMOBILIZATION/PROJECT CLOSEOUT
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this section of the Specifications shall include, but not be limited to, the removal of all Contractor's equipment, materials, temporary facilities and personnel from the Site, the restoration of all disturbed areas of the Site, and the finalization of the Contract.

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work
B. Section 01300 – Submittals
C. Section 01550 - Construction Facilities and Temporary Controls
D. Section 02936 - Turf Establishment

1.3 SUBMITTALS

The Contractor shall submit all project record documents as outlined in these Specifications and the final record drawings (i.e., "as-builts") to the Group prior to demobilization. Included in this package shall be a copy of the completed submittal register and the Contractor's written certification that the Contract Documents have been reviewed by the Contractor, the work has been inspected, and that the work is complete in accordance with the Contract Documents and is ready for final inspection by the Group and/or the Group's QA Official.

The Contractor shall also submit final application for payment identifying total adjusted contract sum (if applicable), previous payments, and sum remaining due. The final application for payment shall also include a notarized "statement" indicating that the property is free of liens and all subcontractors have been paid. The language required in the "statement" is provided in the Contract Documents.

1.4 FINAL CLEANING

The Contractor shall perform a final cleaning of the entire Site prior to final inspection by the Group and/or, the Groups QA Official, USEPA and PADEP.

1.5 PROJECT RECORD DOCUMENTS

The Contractor shall maintain on-site and shall submit to the Group upon completion of the project one set of the following Project Record Documents:

1. Progress Drawings;
2. Specifications;
3. CQA Plan;
4. Addenda to the Contract Documents;
5. Change Orders, Field Orders, and other modifications to the Contract;
6. Submittal Register and a copy of all submittals;
7. "As-built" documentation and record drawings (hard copy and electronic CADD files);
8. Field test records;
9. Photographs;
10. Reports on all emergency actions;
11. Records of all site work;
12. Chain-of-custody documents;
13. Laboratory test records;
14. Meteorological records;
15. Daily inspection records;

16. Reports on all safety and accident incidents;
17. Reports on all spill incidents;
18. Air monitoring reports and data;
19. Manifest documents, truck load tickets, bills of lading and shipping papers;
20. Security records;
21. Log of survey and control work; and,
22. Other pertinent documents as directed by the Group or the Groups' QA Official.

The Contractor shall prepare intermediate versions of the record documents upon request of the Group when conditions warrant (i.e., change in conditions, change orders, emergency action, etc.).

1.6 WARRANTIES

Upon completion of the Project, the Contractor shall execute and assemble transferable warranty documents from its subcontractors, suppliers, and manufacturers. Additionally, the Contractor shall provide a written statement detailing the warranties and guarantees for each of its items of work including durations, limitations, and deductibles.

PART 2: PRODUCTS

2.1 RECORD DRAWING

- The Contractor shall maintain a clean, undamaged set of blue or black line prints of Contractor Drawings and Shop Drawings. Where the work varies substantially from the Work as originally shown, the record set shall be marked to show the actual work performed. Whichever drawing(s) is most capable of showing conditions fully and accurately should be marked upon. Where Shop Drawings are used, a cross-reference shall be recorded at the corresponding location on the Contract Drawings. Extra attention shall be given to concealed elements that would be difficult to measure and record at a later date.

- Record sets shall be marked with red erasable pencil; other colors may be used to distinguish between variations in separate categories of the Work.

- New information that is important to the Group/Owner, but was not shown on Contract Drawings or Shop Drawings shall be noted on the as-builts.

- New information or changes effected by the requests for information, field order, or change order shall be noted on the as-builts. Note related change order numbers where applicable.

- Record drawing sheets shall be organized into manageable sets, bound with durable paper cover sheets, and printed with suitable titles, dates and other identification on the cover of each set.

PART 3: EXECUTION

3.1 PREPARATION

The Contractor shall repair any erosion or runoff-related damage to the disturbed areas of the Site and re-seed and re-stabilize as directed by the QA Official, until the work has been accepted as complete.

The Contractor shall remove and dispose of any collected sediment from all sumps, stormwater inlets, storm pipes, erosion control devices and structures. The Contractor shall disconnect and remove all utilities including those associated with the office and decontamination trailers, and shall remove all temporary facilities and structures. The Contractor shall replace or repair permanent access roads, Site security fences and gates and erosion and drainage control devices, if temporarily removed or damaged during work activities.

3.2 CLOSEOUT PROCEDURES

A preliminary inspection will be conducted at the completion of work to determine whether all work required by the Final (100%) Design has been successfully completed. The work will be inspected for conformance to plans and specifications, and for quality, workmanship and completeness. The preliminary inspection shall be conducted by the Contractor, QA Official and Group at least 14 days prior to the pre-final inspection. The Contractor shall notify the Group and the Group's QA Official that the Contract is substantially complete and is ready for inspection a minimum of ten (10) working days prior to the desired date of the preliminary inspection. An itemized list of work requiring completion will be prepared by the QA Official.

A pre-final inspection will be conducted when deficiencies noted in the preliminary inspection have been corrected. The inspection will be conducted by the Contractor, the QA Official, Group, USEPA and PADEP to inspect the work for conformance with the plans and specifications, and for quality workmanship and completeness. An itemized list of work requiring completion will be prepared by the QA Official.

The Contractor shall remedy these deficiencies and send a notice of final completion, as detailed in Subsection 3.3 of this section. Failure to note a defect on a previous inspection list does not relieve the Contractor of its obligation to correct the work.

3.3 FINAL COMPLETION

When the Contractor considers work to be complete, the Contractor shall submit written certification to the Group that:

A. The Contract Documents have been reviewed;

B. The work has been inspected by the QA Official for compliance with Contract Documents;

C. Deficiencies identified during the preliminary and pre-final inspections have been corrected; and,

D. The work is complete and is ready for final walk-through.

After a final inspection by the Group, the Group's QA Official, Contractor, USEPA and PADEP, the Group will notify the Contractor in writing of any incomplete or defective work. The Contractor shall remedy deficiencies and send a second notice of completion, and the work shall be re-examined. This procedure shall continue until the Group and QA Official approval is obtained.

3.4 APPLICATION FOR FINAL PAYMENTS

The Contractor shall submit his invoice for final payment in accordance with contract procedures.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

The Group, in consultation with the QA Official, shall deem demobilization complete when all deficiencies have been corrected to the satisfaction of the Group and all project record documents have been submitted.

4.2 PAYMENT

Demobilization will be paid for according to the unit price schedule of this section.

PAY ITEM	PAY UNIT
Demobilization/ Project Closeout	Lump Sum

SECTION 02110
SITE PREPARATION AND CLEARING
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The Contractor shall furnish all expertise, supervision, labor, materials, and equipment necessary to complete the work specified herein. The work covered by this section shall include, but not be limited to, utility location, monitoring well protection; fence removal and reinstallation; and clearing of the removal areas and adjacent areas necessary to complete the work. This includes the removal of trees, brush, and incidental debris.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering
B. Section 01300 - Submittals
C. Section 02115 - Erosion and Sediment Control Measures
D. Section 02117 – Dust Control and Air Monitoring
D. Section 02210 - Earthwork
E. Section 02500 - Roadways and Paths

1.3 SUBMITTALS

1.3.1 Off-Site Disposal Facilities

Off-site disposal facilities shall be approved by the Group, USEPA and PADEP. Requirements for waste disposal and recycling facilities are provided in Specification 02209.

1.4 QUALITY ASSURANCE

Quality Assurance shall be conducted as indicated in the Construction Quality Assurance Plan (CQAP). The Group's QA Official shall ensure that work is completed as required by the Contract Documents.

PART 2: PRODUCTS

2.1 TRAFFIC CONTROL

Traffic control items such as signage and equipment worn by the flagger shall comply with PENNDOT Work Zone Traffic Control Guidelines and the Traffic Control Plan provided with the Remedial Design Report.

PART 3: EXECUTION

3.1 PROTECTION OF EXISTING FEATURES

The Contractor shall protect benchmarks, monuments, line and grade stakes, other reference points, structures, monitoring wells, overhead and below grade utility lines or poles, and existing pavement that are not indicated for removal against damage from equipment, vehicular and pedestrian traffic, or clearing activities.

The Contractor is responsible for any replacement, decontamination, management, and disposal of structures removed. Decontamination liquids shall be managed by the Contractor in accordance with Specification 01010.

3.2 CLEARING

Material to be cleared shall include trees, shrubs, grass, any other standing vegetation, and any surface debris or foreign matter that may impede the safe, effective, and efficient implementation of excavation and filling activities.

Clearing shall consist of the removal and disposal of standing trees and snags, stumps, boulders, brush, downed timber, debris, logs and other growth, and objects on and above the ground surface. Boulders may remain in-place only if approved by the QA Official. Root mass below the ground surface in excavation areas shall be handled as material requiring offsite disposal in accordance with Specification 02209. Cleared materials shall be promptly moved to a staging area, chipped or shredded (<3 inches in the smallest dimension) and stockpiled for later use during restoration.

Cleared materials may be salvaged for off-site use only as approved in writing by the Group and the Group's QA Official. Vegetation not affected by the Remedy shall remain in-place.

3.3 UTILITY LOCATION

No active utilities are anticipated to fall within the Quarry 3 work area, however, support and lay down areas outside the Quarry my have active utilities nearby. All active and inactive utilities, including those within the Renaissance Blvd. right-of-way, shall be located and marked prior to the start of work. Existing utilities may include electric, water, sanitary, storm, telephone and gas.

3.4 MONITORING WELL PROTECTION

Existing monitoring wells to be protected are shown on Drawings E201 and E203 and include MW-11S, MW-11D, MW-12, MW-13S, MW-13D. Wells shall be protected during construction by installing the protection measures shown on the Drawings including protective pipe bollards or Jersey barriers. At the completion of the project the Contractor shall remove bollards and/or Jersey barriers, as directed by the Group's QA Official. Use of the proposed protection measures does not relieve the Contractor of its responsibility to protect monitoring wells at all times. The Contractor

shall implement alternate or additional measures, with QA Official approval, to maintain protection of monitoring wells.

3.5 FENCE RELOCATION

The existing temporary fence indicated on the Drawings may be moved, or temporarily removed, to allow for construction and grading activities. The fence shall be re-installed during construction activities to the existing alignment.

3.6 TRAFFIC CONTROL

During loading and disposal activities and during soil delivery activities, the Contractor shall provide flag people at the intersections of the access road and Renaissance Blvd. to control traffic. The Contractor shall establish signage to restrict parking as shown on the Drawings.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Work included in this section shall be performed on a lump sum basis and shall, therefore, not be measured. Protection of existing features are considered incidental to the work and shall not be measured.

4.2 PAYMENT

Payment for all site preparation items required by this Specification shall be based on the lump sum price or unit rate as indicated on the bid form. The lump sum price shall include, but not be limited to, all labor, equipment, materials, expertise, testing and analysis required to complete the work required by the Specifications.

SECTION 02115
EROSION AND SEDIMENT CONTROL MEASURES
SPECIFICATION

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this Section shall include, but not be limited to furnishing, installing, and maintaining temporary and permanent erosion and sediment control features. This Section also includes installation of the proposed basin, basin outlet structure, pipe, end-wall, and rip rap aprons. The Contractor shall be responsible for all erosion and sediment control features necessary to direct surface drainage, maintain stable surface conditions and to prevent the release of sediment from the active work areas. The quantity and type of erosion control measures shown on the Drawings may be increased or decreased at the directive of the Group's QA Official based upon actual conditions which occur during the construction of the project.

The installation and maintenance of all erosion and sediment control features shall be in accordance with local, state, and federal regulations and shall conform to the Specifications and be satisfactory to the Group's QA Official.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering
B. Section 01300 - Submittals
C. Section 02110 - Site Preparation and Clearing
D. Section 02117 – Dust Control and Air Monitoring
E. Section 02209 - Soil and Waste Removal/Handling Placement
F. Section 02210 - Earthwork
G. Section 02715 - Water Management (During Construction)
H. Section 02936 - Turf Establishment

1.3 REFERENCES

ASTM D 4354 - Practice for Sampling of Geotextiles for Testing

ASTM D 4355 - Test Method of Deterioration of Geotextiles and Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)

ASTM D 4491 - Test Methods for Water Permeability of Geotextiles by Permittivity

ASTM D 4632 - Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)

ASTM D 4751 - Test Method for Determining Apparent Opening Size for Geotextile

ASTM D 4759 - Practice for Determining Specification Conformance of Geosynthetics

PADEP Stormwater Best Practices Manual dated December 2006
PADEP Erosion and Sediment Pollution Control Manual dated April 15, 2000.
Montgomery County Conservation District (MCCD) requirements.

1.4 SUBMITTALS

Prior to the installation of erosion and sedimentation control measures, the Contractor shall submit specifications of the geotextile materials for silt fence, roadways, entrances and swales and physical property information proposed for the work to the Group and the Group's QA Official for approval.

Material submittals shall also be submitted for stone and rip rap utilized within roadways, entrances, aprons, decontamination pads, and swales. Submittals shall include the source name, and location (address, street, town, lot and block, county and state), material gradation (ASTM D422), the prior use of the source, and a statement from the supplier that the material is not contaminated. Bills of

lading for each load of imported material shall be submitted to the Group's QA Official to document the borrow source.

The material properties of geomembrane material to be installed beneath the lined decontamination pad(s) shall be submitted to the Group and the Group's QA Official for approval prior to installation.

1.5 QUALITY ASSURANCE

Quality assurance of erosion and sedimentation measures shall be performed in accordance with the Construction Quality Assurance Plan (CQAP), the Erosion and Sediment (E&S) Control Plan and any other erosion and sediment control permits obtained by the Group or Contractor. As described in the CQAP for erosion and sedimentation control, the work will be monitored by the QA Official. The Contractor is responsible for ensuring that all materials meet this specification. Any material not in conformance with these Specifications will be rejected and removed from the Site at the Contractor's expense.

PART 2: PRODUCTS

2.1 SILT FENCE GEOTEXTILE

Silt fence geotextile shall be composed of strong, rot-proof synthetic fibers formed into a fabric of either the woven or non-woven type. The fabric shall have a minimum height of 18-inches as shown on Drawings E402; plus 18-inch burial depth and contain stabilizer and/or inhibitors to make the filaments resistant to deterioration resulting from exposure to sunlight or heat. The geotextile shall conform to the requirements shown in Table 1.

TABLE 1

Physical Requirements

For Temporary Silt Fence Geotextiles

Property	Test Method	Self Supported Requirements
Grab Tensile Strength Lbs.	ASTM D4632	90 minimum[1]
Elongation at 50% minimum grab tensile strength (45 lbs.)	ASTM D4632	50 maximum
Permittivity[2] (sec^{1})	ASTM D4491	.01 minimum
Apparent Opening[2] Size (mm)	ASTM D4751	0.425 maximum
Ultraviolet[3] Degradation	ASTM D4355	Minimum 90% strength retained
Mullen Burst Strength (psi)	ASTM D3786	190 minimum
Puncture Strength (lbs)	ASTM D 751	40 minimum

NOTES:

1. Minimum - Use value in weaker principal direction. All numerical values represent minimum average roll value (i.e., test results from any sampled roll in a lot shall meet or exceed the minimum values in the table). Lot sampled according to ASTM D4354.
2. Permittivity & AOS indirectly relate to filtration performance of silt fence fabrics. Values presented reflect minimum criteria of products currently used.
3. Strength retained after 500 hours of ultraviolet exposure when tested according to ASTM D4355. This method specifies tensile testing by 2-inch strip (or raveled strip) for both control and exposed samples.

2.2 SILT FENCE POSTS

Standard silt fence posts shall be wood, steel or synthetic material having a minimum length of 18 inches plus burial depth of 18 inches. Posts for reinforced silt fence shall be wood, steel or synthetic material having a minimum length of 30 inches plus burial depth of 18 inches. Super silt fence posts shall be 4 inch diameter aluminum or galvanized steel posts having a minimum length of 33 inches plus 36 inches of burial depth. Posts shall be of sufficient strength to resist damage during installation, and to support applied loads.

2.3 SILT FENCE REINFORCEMENT

Reinforced silt fence shall be reinforced with industrial polypropylene or steel mesh (14 gauge minimum) with 6 inch maximum opening. Support wires shall be minimum 10 gauge wire.

Super silt fence shall be reinforced with chain link fence fabric with 2 inch woven mesh. Chain link shall be fastened to posts using No. 6 gauge aluminum wire or No. 9 gauge galvanized steel preformed clips. No. 7 gauge tension wire shall be used at the top and bottom of chain link fence.

2.4 HAY BALES

Hay bales shall be standard size and composed of securely tied clean grass hay and cereal straw. Bales shall be stored in a dry environment to prevent mold.

2.5 AGGREGATE

2.5.1 Construction Entrance(s) And Decontamination Pad Coarse Aggregate

Coarse aggregate used for the construction entrance(s) and decontamination pad shall be clean hard durable stone of 1.5 to 4 inch size meeting AASHTO #1 gradation as follows:

Sieve Size	% Passing
4"	100
3 ½"	90 - 100
2 ½"	25 – 60
1 1/2"	0 - 15
3/4"	0-5

The stone shall be of such quality that it will not disintegrate on exposure to traffic, water, or weathering. The construction entrance(s) thickness shall not be less than 8 inches. The decontamination pad(s) thickness shall not be less than 12 inches.

2.5.2 Access Road, Support Zone, Water Treatment Area Course Aggregate

A. Provide aggregate meeting the gradation requirements of AASHTO 3 as listed below:

Sieve Size	% Passing
2 1/2"	100
2"	90 – 100
1 ½"	35 – 70
1"	0 - 15
1/2"	0-5

B. Aggregate will be crushed rock having a minimum unit weight of 160 pounds per cubic foot.

2.6 GEOTEXTILE FILTER FABRIC

Construction entrances, decontamination pads, access roads, aprons, and other support areas (including the water treatment area pad) shall be underlain by a non-woven geotextile filter fabric material possessing a minimum grab tensile strength of 200 lbs/in (ASTM D4632), minimum mass per unit area of 8 oz per square yard (ASTM D3776), minimum puncture strength of 120 lbs (ASTM D4833), minimum elongation at failure of 50% (ASTM D4632), minimum Mullen Burst strength of 400 lbs (ASTM D3786), and maximum apparent opening size of 0.210 mm (70 U.S. sieve size, ASTM D4751).

2.7 FILTER BAGS

Filter bags may be used to trap sediment in water pumped from excavations or low points that has been approved for discharge. Unfiltered dewatering is not permitted. The bags shall be fabricated using non-woven geotextile fabric with an Apparent Opening Size (AOS) of 70 or smaller. Length and diameter shall be selected based on the anticipated flow.

2.8 RIP RAP

Stone for the riprap aprons shall consist of field stone or rough unhewn quarry stone of approximately rectangular shape. The stone shall be hard and angular and of such quality that it will not disintegrate on exposure to water or weathering. The specific gravity of the individual stones shall be at least 2.5.

2.9 EROSION CONTROL MAT

Erosion control mat shall be as specified in Specification 02936.

2.10 SKIMMER AND BERM

The principal spillway for the temporary sediment basin shall be a skimmer manufactured by Faircloth. The orifice of the skimmer shall be 3 inches with a 4 inch head. A watertight plate with 4-inch stub shall be used to attach the skimmer. The stone skimmer berm shall be constructed with AASHTO #57 stone.

2.11 OUTLET STRUCTURE

The outlet structure shall be a pre-cast concrete inlet box conforming to PADOT Standard Inlet structures meeting PADOT Specifications, Publication 408, Section 714. The inlet box shall consist of a minimum Class AA pre-cast concrete. The inlet box shall have a cover adjustment slab with a 24" by 45.25" opening to accommodate a Type M grate. The inlet box shall have a minimum Class AA pre-cast Type M concrete top unit conforming to PADOT Specifications, Publication 408 Section 605, 606, and 714. The inlet box shall be placed on 4 inches of AASHTO #57 stone.

The Contractor shall provide two 3/8-inch stainless steel orifice plates as shown on Drawings E401 and E402 for the temporary and permanent basin outlet structure. An orifice shall be provided in the plates for 3 inches and 5.25 inches, respectively.

2.12 ENDWALL

The endwall shall be reinforced pre-cast concrete conforming to PADOT Type D-W structures suitable for use with 18-inch diameter corrugated polyethylene pipe, PADOT Specifications, Publication 408, Section 605.

2.13 PIPE

The outlet structure pipe shall be 18-inch diameter corrugated high-density polyethylene (CPE) smooth interior pipe (e.g., Advanced Drainage Systems N-12, or approved equivalent). The pipe shall have soil-tight bell and spigot joints.

The pipe shall also be capable of supporting a maximum cover depth of up to 20 feet using soil compacted to 95% of standard proctor, such as ADS N-12 or approved equivalent.

2.14 BEDDING

AASHTO #57 crushed stone shall be used for base support for the inlet box and endwall.

2.15 DECONTAMINATION PAD LINER

Smooth 30-mil HDPE geomembrane shall be used beneath decontamination pads.

PART 3: EXECUTION

3.1 FAMILIARIZATION

Prior to implementing any erosion and sediment control measures, the Contractor shall become thoroughly familiar with the Site, the Site conditions, and all portions of the work pertaining to and/or related to this Section. The Contractor shall carefully inspect the completed work of other

Sections and verify that all work is complete to the point where the work covered by this Section may commence. Any conflicts or concerns with work which may impact the erosion, and sediment control work shall be brought to the attention of the Group's QA Official in writing.

3.2 GENERAL

E&S measures shall be installed prior to any major soil disturbance and be maintained until permanent protection is established. The Site shall be graded so all stormwater is diverted to soil erosion and sediment control features. All necessary precautions will be taken to minimize sediment transfer and to prevent erosion of the downstream area. Soil washed, dropped, spilled or tracked outside the limit of disturbance or into the public right-of-way shall be removed immediately. The existing paved roadways shall be maintained in a clean condition.

3.3 SILT FENCE INSTALLATION

A trench 6 inches in depth (except for super silt fence which requires 8 inch depth) shall be excavated with equipment such as a trenching machine or motor grader; or, if equipment cannot be operated at that location, by hand.

Post installation shall start at the center or the low point (if applicable) with the remaining posts spaced a maximum of 8 feet apart. Posts shall be installed with at least 18 inches in the ground, except for super silt fence which requires 36 inch burial depth. Where the required burial depth is not able to be achieved, the posts should be adequately secured to prevent overturning of the fence due to sediment loading. This may require a decrease in post spacing.

Geotextile shall be securely attached to the post in accordance with Drawing E402 by wire, cord, staples, or other acceptable means. The geotextile shall be installed in such a manner that 6 inches of fabric is left at the bottom to be buried in the trench (8 inches for super silt fence) and a minimum overlap of 18 inches is provided at all splice joints. The geotextile shall be installed in the trench such that 6 inches (8 inches for super silt fence) is against the side of the trench and 6 inches (8 inches for super silt fence) is across the bottom of the trench in the upstream direction. The trench

shall be backfilled so that no flow can pass under the barrier. Backfill soil shall be properly compacted, as directed by the Group's QA Official.

At the time of installation, geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, storage, or installation.

3.4 HAY BALE INSTALLATION

Hay bales shall be installed end to end in areas where silt fence installation is not feasible. A trench four inches in depth shall be excavated with equipment such as a trenching machine or motor grader; or, if equipment cannot be operated at that location, by hand. All bales shall be securely tied and staked. Bales shall be placed in a row with ends tightly abutting the adjacent bales. Bales shall be embedded a minimum of 4 inches. Bales shall be securely anchored in place by two stakes or re-bars driven through each bale. The first stake in each bale shall be driven toward the previously installed bale to force bales together.

3.5 CONSTRUCTION ENTRANCE(S)

The construction entrance(s) shall be installed at the location(s) shown on the Drawings. The subgrade shall be prepared by grading as directed by the Group's QA Official. The geotextile filter fabric shall be placed immediately after subgrade preparation with each section of fabric having a minimum overlap of 1 ft. Placement of the stone shall immediately follow installation of the geotextile in a method to prevent damage to fabric. A minimum of 8 inches of construction entrance coarse aggregate shall be placed over the geotextile prior to running over with mechanical equipment.

3.6 DECONTAMINATION PAD

The decontamination pad shall be installed using methods similar to installation of the construction entrance(s). At a minimum, decontamination pads and/or stations shall be installed for equipment and/or personnel decontamination at the entry/exit to work or excavation areas as needed. The

geomembrane shall be installed prior to installation of filter fabric and shall slope towards the contaminated zone or collection sump. Water that collects within the sump of the decon pad shall drain via a pipe to Pond 2. The decontamination pad shall be constructed as shown on the drawings.

3.7 STOCKPILES

Excavated soil stockpiles, if used, shall be located in areas requiring remediation as approved by the Group's QA Official. Stockpiles of clean material removed during earthwork or imported from off-site shall be stockpiled in areas not proposed for excavation or construction as approved by the Group's QA Official. The maximum stockpile sideslope shall be 2H:1V unless steeper slopes are approved by the Group's QA Official. Stockpiles shall be covered daily with secured 9-mil plastic sheeting.

3.8 STORMWATER MANAGEMENT BASIN

3.8.1 Temporary Sediment Basins

Pond 2 will be used as a sediment basin throughout Phase 1 and during the excavation activities of Phase 2. All surface water that collects in Pond 2 will be treated in the on-site treatment system and pumped to Matsunk Creek. Once all impacted soil has been removed from the Quarry, a temporary sediment basin will be constructed at the east end of the Quarry and Pond 2 will be backfilled. The basin shall be constructed during Phase 2 in accordance with the PADEP Stormwater Best Practices Manual, PADEP Erosion and Sediment Pollution Control Manual, Montgomery County Conservation District requirements, USDA Pond Code No. 378 and applicable permits. Earthwork shall be conducted in accordance with Specification 02210 to the lines and grades shown on the Drawings. Intermediate grading for the completion of Phase 1 is shown on Drawing E201. Final restoration grading for the completion of Phase 2 is shown on Drawing E341.

The principal spillway (i.e., the outlet structure, pipe and anti-seep collars) shall be installed at the locations shown on Drawings E341 and E401 through the embankment. Pipe installation shall be in accordance with manufacturer's recommendations. Pipe alignment and grade shall be controlled

with suitable string lines, an electronic laser beam system or by other acceptable methods. Anti-seep collars and their connections to the pipe shall be water tight.

Backfill of the pipe trench (i.e., structural soil fill) shall be placed following approval by the Group's QA Official of outlet pipe and anti-seep collar installation. Backfill requirements are provided in Specification 02210.

Anti-seep collars shall be installed at the locations shown on the Drawings. The projections shall be 6 feet from the 18" corrugated polyethylene pipe as shown on the Drawings. The permanent outlet structure shall be installed as shown on the Drawings; however, the temporary orifice plate shall be used during construction.

The baffle shall be constructed and installed in accordance with the PADEP Erosion and Sediment Control Manual to the dimensions and locations shown on the Drawings. The skimmer shall be attached to the temporary orifice plate at the permanent outlet structure in accordance with Manufacturer's recommendations. The skimmer berm shall be constructed as shown on Drawings E402 to prevent the skimmer from settling onto sediment. Guide stakes shall be installed to prevent the skimmer from moving from side to side.

After completion of basin construction and approval by the Group's QA Official, stormwater flow shall be diverted to the basin and Pond 2 shall be removed from service as discussed in Specification 02110.

3.8.2 Permanent Stormwater Basin

Following establishment of vegetation throughout the Site and approval by the Group's QA Official, the Contractor shall convert the temporary sediment basin to a permanent stormwater management basin by removing the baffle and backfilling the basin to the final grades shown on Drawings E341 and E401. The backfill shall be seeded in accordance with Specification 02936. Following establishment of vegetation on the basin bottom, the skimmer shall be removed and the permanent orifice plate shall be installed at the outlet

structure.

3.9 RIPRAP LINED CHANNELS AND APRONS

Swales shall be rip rap lined or vegetated as shown on the Drawings. Vegetation and erosion control mat requirements are provided in Specification 02936. The subgrade for the proposed riprap lined channels and aprons shall be prepared to the required lines and grades, and shall be adequately stable as determined by the Group's QA Official. Alignment and grade control for channels shall be conducted with suitable string lines, an electronic laser beam system or by other acceptable methods. Laser shall be used for slopes two percent and less. Any fill required in the subgrade as determined by the Group's QA Official shall be compacted to a density approximating that of the surrounding material. Brush, trees, stumps and other objectionable material shall be removed.

The geotextile fabric shall be placed immediately after subgrade preparation. The geotextile fabric shall be installed according to the manufacturer's requirements. If the fabric is placed in multiple sheets, the sheets shall have a minimum overlap of 1.0 foot and the edge of fabric at the overlap shall be shingled to allow flow across the overlap. The upstream and downstream ends shall be embedded a minimum of 12 inches deep. Care shall be taken not to damage the fabric when placing the riprap. If damage occurs, that sheet shall be removed and replaced at the Contractor's expense.

Placement of the riprap shall follow immediately after placement of the fabric. The riprap shall be placed so that it produces a dense well-graded mass of stone with a minimum of voids. The riprap shall be placed to its full thickness in one operation. The riprap shall not be placed by dumping into chutes or similar methods which are likely to cause segregation of the various stone sizes. Riprap shall be placed from a height no greater than one foot. Riprap placement shall occur from downslope to upslope. The basin outfall apron shall be grouted in-place to completely fill rip rap voids and shall be approved by the Group's QA Official.

3.10 TEMPORARY SEEDING

Disturbed areas that are not subject to construction traffic and have been approved by the Group's QA Official to be left exposed more than 14 days shall immediately be seeded with a temporary seed mix and fertilizer. Seed mix and application methods are specified in Section 02936. If the season prevents establishment of the temporary seed, mulch the exposed area with straw or equivalent at rate of 2 tons per acre. Mulch shall meet the requirements of Section 02936.

Immediately following the initial disturbance of rough grading, all critical areas subject to erosion (i.e., steep slopes and berms) shall receive a temporary seeding in combination with straw mulch or equivalent at a rate of 2 tons per acre using the seed mix and mulch specified in Section 02936. Slopes steeper than 3H:1V shall be graded and stabilized daily as installation occurs.

All areas left disturbed after the initial construction season shall be temporarily seeded and mulched prior to demobilization.

3.11 MAINTENANCE AND REMOVAL OF TEMPORARY MEASURES

The Contractor shall maintain the integrity of the basin, silt fence, hay bales, decontamination stations and construction entrance(s) as long as they are necessary to contain sediment associated with project activities. The Contractor and Group's QA Official shall inspect all temporary silt fences, hay bales, filter bags and the construction entrance(s) at least daily and after storm events. Any deficiencies shall be immediately corrected by the Contractor at the Contractor's expense.

In addition, the Contractor shall make a daily review of the location of silt fences in areas where construction activities have changed the natural contour and drainage runoff to ensure that the silt fences are properly located for effectiveness. Where deficiencies exist, additional silt fences shall be installed as directed by the Group's QA Official. Should the silt fence become damaged or otherwise ineffective while the barrier is still necessary, it shall be repaired promptly. Sediment deposits shall either be removed when the deposit reaches approximately one-half of the height of the silt fence, hay bale or check dam, or a second silt fence shall be installed as directed by the Group's QA

Official. Sediment within the temporary sediment basin shall be removed when sediment has accumulated to the elevation shown on the Drawings.

The temporary erosion control measures shall remain in place until the Group's QA Official directs that they be removed. Upon removal, the Contractor shall remove and dispose of any stone and excess silt accumulations, dress the area to give a positive aesthetic appearance, and vegetate all bare areas in accordance with the contract requirements. The silt fence or hay bale materials shall remain the property of the Contractor. Materials, including silt, removed from erosion control features shall be placed on-site and seeded at a location approved by the Group's QA Official.

Dewatering operations outside the Quarry shall discharge directly into a sediment filtration device. The sediment filter shall be placed so as not to cause erosion of the downstream area. Field placement and use of the structure must be approved by the Group's QA official prior to commencement of dewatering activities.

3.12 MAINTENANCE OF PERMANENT EROSION AND SEDIMENT MEASURES

The Contractor shall be responsible for protecting permanent erosion and sediment control measures from erosion, siltation or damage from the time of installation until a stable Site condition has been reached. If, at the opinion of the Group's QA Official, the permanent measures exhibit an unacceptable amount of siltation, disturbance or damage they shall be repaired or replaced by the Contractor at no additional cost to the Group.

Upon permanent Site stabilization and completion of construction, the Contractor shall apply to the Group's QA official for a final compliance inspection to check that all provisions of the plan have been achieved.

3.13 EROSION PROTECTION DURING DEMOBILIZATION

Prior to the winter demobilization, the Group's QA Official and Contractor shall thoroughly evaluate the Site and identify areas requiring additional protection against erosion, washouts, and cross-

contamination during the winter demobilization. Areas identified with inadequate protection shall be corrected by the Contractor prior to demobilization. This shall include, but not be limited to, the installation of additional silt fence, diversion berms, diversion swales, temporary cover, and temporary seed.

The Contractor shall be responsible for inspections, maintenance and repairs during the winter demobilization, at no additional cost to the Group. Inspections shall be conducted weekly, and after rain events. The Contractor shall coordinate inspections with the Group's QA Official such that both parties are present during the inspection.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Decontamination pads shall be constructed on a lump sum basis and shall, therefore, not be measured. Sediment removal (including from the basin), maintenance of erosion control features and use of filter bags is considered incidental to the work and shall not be measured. Construction entrances shall be measured as units installed. Stormwater channels, silt fence, and hay bales shall be measured in lineal feet installed.

Earthwork shall be measured in accordance with Specification 02210. Installation of seed and erosion control mat shall be in accordance with Specification 02936. The outlet structure, including pipe, endwall, baffle, skimmer and discharge apron shall be installed on a lump sump basis and shall not be measured. Maintenance of temporary measures such as the baffle and skimmer shall be considered incidental to the work and shall not be measured.

4.2 PAYMENT

Silt fence and hay bales shall be paid based on the unit price indicated on the bid form. This payment shall be full compensation for furnishing all materials, and erecting, maintaining, removing and disposing silt fence and hay bales.

Payment for decontamination pads shall be lump sum and payment for construction shall be per unit. Payment for decontamination pads and construction entrances shall include all stone, geotextile, geomembrane, and other materials, labor, and equipment required for installation and maintenance. Payment for decontamination pads and construction entrances shall be made in two payments, one half after installation and the second half after removal of the feature and restoration of the area.

Stormwater channels shall be paid for per lineal foot installed, which shall include full compensation for all materials, labor and equipment to install swales in accordance with these Specifications.

Use of filter bags, and maintenance of erosion control measures, including removal of sediment, shall not be paid for separately.

Payment for the basin outlet structure, including pipe, endwall, baffle and skimmer and discharge apron, shall be lump sum.

The completed work shall be paid in accordance with the following unit price schedule:

PAY ITEM	PAY UNIT
Regular Silt Fence	Lineal foot
Reinforced Silt Fence	Lineal foot
Super Silt Fence	Lineal foot
Hay Bales	Lineal foot
Construction Entrance	Each
Decontamination Pad	Lump Sum
Outlet Structure	Lump Sum

SECTION 02117
DUST AND ODOR CONTROL AND AIR MONITORING SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this Section shall include, but not be limited to furnishing, installing, and maintaining dust controls and air monitoring. The Contractor shall be responsible personnel air monitoring within the work zone in accordance with the Contractor's Health and Safety Plan (HASP) and for all controls necessary to prevent generation of dust and odors. The Group's QA Official will be responsible for performance of perimeter and near-field air monitoring as described in the Sampling and Analysis Plan (SAP). The quantity and type of dust and odor control measures may be increased or decreased at the directive of the Group's QA Official based upon actual conditions which occur during the construction of the project. Such variations in quantity shall not be considered as alterations in the details of construction or a change in the character of the work.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering
B. Section 01300 - Submittals
C. Section 02110 - Site Preparation and Clearing
D. Section 02115 – Erosion and Sediment Control Measures
E. Section 02209 - Soil and Waste Removal/Handling Placement
F. Section 02210 - Earthwork
G. Section 02715 - Water Management (During Construction)
H. Section 02936 - Turf Establishment

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

Material properties for dust and odor emission control agents (if any other than water are used) shall be submitted to the Group and the Group's QA Official for approval. Information shall include the source, MSDS sheets and the proposed methods of application.

The Contractor shall submit the analytical laboratory's qualifications for approval by the Group, USEPA and PADEP prior to use. The Contractor shall submit the real-time air monitoring trigger level calculations for PPE to the Group's QA Official prior to use.

1.5 QUALITY ASSURANCE

Quality assurance of dust and odor control measures and air monitoring shall be performed in accordance with Contract Documents, including the Construction Quality Assurance Plan (CQAP) and the Sampling and Analysis Plan (SAP). Work will be monitored by the Group's QA Official. The Contractor is responsible for ensuring that all materials meet this specification. Any material not in conformance with these Specifications will be rejected and removed from the Site at the Contractor's expense.

PART 2: PRODUCTS

2.1 DUST AND ODOR CONTROL AGENTS

Dust control agents shall include potable water, stockpile covers, mulch, or spray adhesives. Decontamination water may be used for dust control only in contaminated areas. Mulch shall meet the requirements of Section 02936. Odor control agents shall include potable water and foam suppressants.

2.1.1 Dust Control Agents

The use of spray adhesives must specifically be approved by the Group through the submittal process prior to on-site use.

A. Short-term gelatin/cellulose based coatings shall be used, when necessary, for dust control during active excavation and overnight. Short-term coatings shall be able to remain effective from a few hours to a few days.

B. Product shall consist of fibrous cellulose or gelatinous membrane materials combined with a binder and water.

C. Coatings shall be bio-degradable and non-toxic.

2.1.2 Odor Control Agents

A. Short-term foam suppressants shall be used as necessary for odor control during active excavation and overnight.

B. Short-term foam suppressants are thick viscous foams that trap emissions and dust within its bubbles.

C. Short-term foam suppressants shall be biodegradable, non-toxic, non-flammable and odorless.

D. Odor masking agents may also be used with approval of the Group's QA Official.

2.2 AIR MONITORING

Materials, equipment and laboratory used for air monitoring shall be in accordance with the SAP. In general, the Contractor will supply air monitoring materials, equipment, and laboratory for work zone and personnel monitoring.

PART 3: EXECUTION

3.1 FAMILIARIZATION

Prior to implementing any dust and/or odor control measures, the Contractor shall become thoroughly familiar with the Site, the Site conditions, and all portions of the work pertaining to and/or related to this section. The Contractor shall carefully inspect the completed work of other Sections and verify that all work is complete to the point where the work covered by this Section may commence. Any conflicts or concerns with work which may impact the work shall be brought to the attention of the Group's QA Official in writing.

3.2 DUST CONTROL

Dust control shall be conducted throughout the Quarry 3 work areas, the access road and on Renaissance Blvd. during all phases of work to minimize the presence of visible dust. The Group's QA Official has the authority to stop work at any time if visible dust is present at the perimeter of the Quarry 3 Site. Work may not proceed until dust control measures are implemented to the satisfaction of the Group's QA Official at no additional cost to the Group for either the additional dust control or the stoppage of work. Dust control measures shall be applied periodically throughout each work day throughout the Site as necessary. Dust control measures shall be applied to disturbed contaminated areas, including excavations and soil stockpiles, at the end of each work day as necessary. Dust control may be conducted by sprinkling with potable water in non-contaminated areas, or with decontamination water in contaminated areas, until the surface is wet; or mulching at 2 to 2.5 tons per acre with anchoring. Spray-on adhesive may also be used in areas of no vehicular traffic. Dust control shall be conducted by the Contractor to the satisfaction of the Group's QA

Official. Except for water, all materials used for dust control shall be approved by the Group through the submittal process.

3.3 ODOR CONTROL

Odor control shall be conducted throughout the Quarry 3 work areas during all phases of work to prevent the release of nuisance odors to the surrounding properties. The Group's QA Official has the authority to stop work at any time if significant odors become present. Work may not proceed until odor control measures are implemented to the satisfaction of the Group's QA Official at no additional cost to the Group for the stoppage of work. Odor control measures shall be applied as necessary throughout each work day. Odor control measures shall be applied to excavations at the end of each work day, as directed by the Group's QA Official. Odor control may be conducted by sprinkling with decontamination water in excavation areas, until the surface is wet; or by using foam suppressants. Except for water, all materials used for odor control shall be approved by the Group through the submittal process.

3.4 AIR MONITORING

3.4.1 General

Perimeter air monitoring and near field monitoring outside the work zone will be conducted by the Group's QA Official. Real-time and personnel air monitoring in the work zone shall be conducted by the Contractor in accordance with the HASP including, but not limited to, maintenance, calibrations, weather data collection, documentation, sampling, shipping, analysis and submission of quality control reports. Personnel monitoring shall be addressed in the Contractor's HASP.

The Contractor personnel who perform the air monitoring functions shall be experienced in the field of air monitoring at various sites. Any discrepancies in air monitoring procedures shall be resolved as directed by the Group's QA Official.

Air monitoring results from the Contractor and QA Official will be included in the Daily QC reports generated by the Contractor.

3.4.2 Performance Standards

The performance standard for real time perimeter air monitoring for particulates is 1,500 ug/m^3. In addition a 'no visible dust' standard shall be enforced at the perimeter of the Quarry 3 Site. The site performance standard for Total VOC's will be 1 ppmV. When perimeter air monitoring results averaged over a 15-minute period exceed the performance standard, the Group's QA Official shall immediately notify the Contractor. The Contractor shall immediately stop work and implement additional dust and/or odor control measures as described in this Specification. Work may not commence until real-time readings are less than the trigger level and/or the Group's QA Official has approved resuming work.

Performance standards based on real time measurements are subject to change during the project once a correlation is developed with laboratory analytical data.

3.4.3 Completion

The Contractor shall not terminate monitoring of air until approved by the QA Official.

Contractor shall submit a final Air Monitoring Report at the conclusion of the project which shall include the results of all air sampling and analyses, meteorological measurements, real-time monitoring, equipment calibration and maintenance records and copies of the field logbook.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

The use of water for dust and odor controls is considered incidental to the work and will not be measured. The use of foams or posi-shells, as directed by the QA Official, shall be paid for on a

time and materials basis. The Contractor shall provide equipment, material, and labor rates for application of foams or posi-shells for dust and odor controls in his bid. The amount of time and materials used during application of dust and odor controls shall be subject to approval of the Group's QA Official. Work zone personnel monitoring shall be measured as a lump sum item.

4.2 PAYMENT

Water for dust and odor controls is considered incidental to the work and will not be paid for separately. Application of foams or posi-shells, as directed by the QA Official for dust and odor controls shall be paid based on the time and materials used as determined by the Group's QA Official. Payment shall include, but not be limited to, all labor, materials, equipment, expertise, re-application, monitoring and change of methods and/or materials required to maintain compliance with the Specification for dust and odor controls.

Air monitoring, including real-time and personnel monitoring within the work zone, shall be paid based on the lump sum price, with payment given in accordance with the percentage of completion of work as determined by the Group's QA Official. Payment shall include, but not be limited to, all labor, materials, equipment, maintenance, calibration, data collection, recording, documentation, expertise, and quality control/quality assurance required to conduct air monitoring in accordance with the Contract Documents.

The completed work shall be paid in accordance with the following unit price schedule:

PAY ITEM	PAY UNIT
Odor/Dust Control	Time and Materials
Labor	Hr.
Equipment	Hr.
Foams/Shells	Gallon
Air Monitoring	Lump Sum

SECTION 02209

SOIL AND MATERIAL REMOVAL/HANDLING/DISPOSAL SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The information presented in this Section is intended to include all activities necessary for the excavation, removal, stockpiling, movement, and disposal of contaminated soils, sediments, and organic material. Sediment material removed from the Ponds may require an intermediate step such as dewatering and/or conditioning prior to shipment offsite. Soils and organic material removed from the Plateau Area will be blended, as necessary, to form a stable material during excavation prior to shipment offsite.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering

B. Section 01300 - Submittals

C. Section 01545 - Health and Safety

D. Section 02115 - Erosion and Sediment Control Measures

E. Section 02210 - Earthwork

1.3 REFERENCES

Not Used.

1.4 SUBMITTALS

1.4.1 Materials Handling Measures

The Contractor shall provide as part of the bid package a detailed description of the materials handling measures (especially related to the removal of contaminated soils, sediments, and organic materials), both procedural and physical, that will be implemented during the project. The description shall provide a complete narrative and figures showing sequencing, filling methods, dewatering methods, soil and materials handling, including how releases will be monitored and controlled, and how excavation stability will be maintained. Contractor's procedures shall meet the general provisions presented in this specification. This description will represent a significant factor in evaluating the Contractor's understanding of the project.

1.4.2 Conditioning Mix Design and Reagents

If the Contractor determines that conditioning will be necessary the Contractor shall submit, as part of the bid package, the proposed mix design for conditioning of the Pond sediments, including application rates, bulking factor, curing time, and test results indicating that the conditioning performance standards have been met. The Contractor shall also submit the proposed reagent, source, MSDS sheet, a certification that the reagent is non-hazardous, and supporting analytical data for any reagents. The mix-design and reagent shall be approved by the Group's QA Official prior to use. The Contractor shall provide a detailed description of how and where the conditioning process will be performed as part of the Contractor's Construction Work Plan.

1.4.3 Conditioning Area

The Contractor shall provide the proposed layout for the conditioning equipment in the Contractor's Construction Work Plan to be approved by the Group and the Group's QA Official.

1.4.4 Off-Site Disposal Facility

The materials and soils to be removed from the Site will be prepared for transport, conditioning if necessary and disposed of at a non-hazardous waste landfill as directed by the Group. The Group has already obtained approval for disposal at the Waste Management G.R.O.W.S. Landfill

The Contractor may propose an alternate disposal facility to the Group for approval. If approved by the Group, the contractor shall be responsible for all costs associated with the waste profiling and approval process at an alternate facility. Any alternate disposal facilities shall be permitted by the state in which they are located. The Group reserves the right to reject any proposed disposal facility or require use of a specific facility.

All completed manifests and bills of lading and certificates of disposal shall be submitted to the Group Official. The Contractor shall provide any and all information requested by the Group, including, but not limited to, a compliance and safety audit, certificates of insurance, indemnifications, permit information, regulatory compliance history, and transportation safety plan.

1.5 QUALITY ASSURANCE

Quality Assurance of removal/excavation shall be performed in accordance with the Construction Quality Assurance Plan (CQAP). The Group's QA Official shall ensure that work is completed as required by the Contract Documents. The Contractor shall accommodate any testing or sampling being conducted by the Group's QA Official.

PART 2: PRODUCTS

2.1 CONDITIONING REAGENT

The conditioning reagent shall be any material that can achieve the performance goals for the conditioned material as approved by the Group's QA Official. Conditioning reagents shall not be waste materials or industrial by-products.

PART 3: EXECUTION

3.1 CLEANUP STANDARDS

Soil contaminants encountered during excavation will consist primarily of Arsenic, Semi-Volatile Organic Compounds (SVOCs) such as Naphthalene, and polynuclear aromatic hydrocarbons (PAHs). Additional information regarding concentrations of Arsenic, SVOCs, and PAHs and associated analytical results are available in the Design Report and the Drawings.

Once an excavation area is complete the Group's QA Official will collect confirmatory samples. Compliance with the soil cleanup standards will be statistically evaluated such that all soils remaining in the Quarry meet all of the following criterion as demonstrated by confirmation sampling

The Group's QA Official will notify the Contractor if the soils clean up standards have been met, if additional excavation and sampling is necessary, etc.

3.2 SOIL, SEDIMENT, AND ORGANIC MATERIAL EXCAVATION

The areas requiring removal include the Pond 1, Pond 2, Pond 3, The Plateau Area, and several peripheral soil locations within the Quarry. Contractor's surveyor will be responsible for physically marking the removal limits and locations shown on the Drawings (E201 and E203) and as directed by the Group's QA Official to allow easy tracking in the field.

All soils and organic materials requiring remediation shall be removed to the horizontal and vertical limits of excavation indicated on the Drawings or as designated by the Group's QA Official, by means and methods proposed by the Contractor and approved by the Group's QA Official. Excavation depth within the Ponds will be dictated by refusal of an excavator bucket at rock. In the plateau area excavation is limits are also expected to be defined by bedrock bottom and sidewalls, however a non-impacted layer of soil may be present between the bottom of Plateau material and

bedrock in which case confirmatory sampling will determine if excavation of such material is required. Soil excavation depths shown on Drawing E203 are from existing ground surface.

In general, acceptable removal methods are expected to include the use of hydraulic excavators, front end loaders and similar equipment. Hydraulic or mechanical dredging equipment may be employed to perform sediment removal within the Ponds. The use of equipment or procedures that could produce excessive dust, odor, or cross-contamination will not be allowed.

Following completion of initial excavations to the extents shown on the Drawings, subsequent excavations shall be conducted as determined by confirmatory sampling in accordance with the Sampling Analysis Plan (SAP). Subsequent excavations shall also be approved by the Group's QA Official. Excavations shall be deemed complete when confirmatory sampling meets the cleanup standards. If initial sampling exceeds the cleanup standards, additional excavation will be conducted as follows:

- vertically in 6-inch increments and shall extend half way between the failed sample and the nearest surrounding passing bottom samples.
- horizontally outward in 5-foot increments and shall extend half way between the failed sample and the nearest passing sample on the left and right,
- or as directed by the Group's QA Official.

Additional confirmatory samples shall be collected until the samples meet the cleanup standard. Confirmatory sample collection and analysis will be performed by the Group's QA Official. When excavation limits are defined by refusal of the excavator bucket by rock on the bottom or a sidewall, bottom and/or sidewall confirmatory sampling at such locations will not be performed.

The Contractor shall be aware that excavations are required at significant depths and on steep slopes. The Contractor will use benching and/or sloping to create safe and stable work areas. The Contractor shall account for these activities when selecting means and methods of excavation. Backfilling to create ramps and safe slopes will be performed in accordance with Specification 02210.

Large rocks, boulders, and cobbles (> ½ CY) present in excavation areas will be set aside within the excavation and remain onsite. Root mass generated in excavation areas shall be treated as material requiring remediation and be disposed of offsite with soils.

3.3 REMOVAL METHODS AND SEQUENCING

It is anticipated that excavation and material disposal sequencing shall follow the proposed sequencing in the Design Drawings and Design Report. The Design anticipates that excavation work will begin with the Phase 1 removal of materials from Pond 3, followed by Pond 2, and then Pond 1. Work would progress from east to west and Ponds 1 and 3 will be backfilled to create addition support zone area. Backfilling to interim grades shall be performed in accordance with Specification 02210. Excavation of the Plateau Area will then be performed in Phase 2, working from east to west. Once the Plateau Area excavation is completed the peripheral soil locations within the Quarry may be excavated moving from west to east. The Contractor's proposed alternate sequencing and/or approach, if any, shall be identified in the Bid and shall be approved by the Group, USEPA and PADEP prior to implementation.

Whether the Contractor elects to utilize the excavation sequencing identified in the Design, or implements an approved alternative, the Contractor shall assume full responsibility for implementation of the work in accordance with the Contract Documents.

3.4 CONFIRMATORY SAMPLING

Confirmatory soil samples shall be collected by the Group's QA Official, or his designee, at the bottom of excavation. Sampling procedures, frequency, and analysis method shall be as identified in the SAP. The Contractor shall allow for delay caused by confirmatory sampling in the schedule. Confirmatory samples will be collected at a frequency of one per 2500 SF for bottom of excavation locations and at a frequency of one per 50 ft of length for sidewall locations. When the bottom of an excavation area is defined by rock or a sidewall of an excavation is defined by rock no confirmatory sample will be collected from those locations.

If necessary, the Contractor shall provide assistance to the Group's QA Official collecting confirmatory samples.

3.5 PREPARATION OF SOIL AND MATERIALS FOR DISPOSAL

It is anticipated that the materials and sediments removed from within the Ponds will be very wet and require some means of dewatering and/or conditioning prior to transport. The performance criteria for dewatering are that the material must pass the paint filter test (USEPA METHOD 9095B) and must remain stable in the transport truck during the entire trip to the disposal facility. Acceptable means of dewatering and conditioning include allowing water to naturally drain from the soils, mechanical methods (filter press), addition of conditioning agents (lime kiln dust, Portland cement), etc. The Contractor shall submit the proposed means of dewatering and/or conditioning to the Group as part of the bid and approved by the Group prior to use.

It is anticipated that some of the materials to be excavated from within the Plateau Area will be very moist and unsuitable for transport offsite. The moist materials within the Plateau Area are inter-bedded with drier layers of soil. During excavation the dryer soil layers should be blended with the moist layers to create a uniform blend suitable for transport. If necessary, plateau materials will be conditioned to make them suitable for transport offsite.

3.5.1 Conditioning/Dewatering

Conditioning/Dewatering activities must be performed within Quarry 3 to minimize odor migration. Excavation activities shall be coordinated with conditioning activities. The Contractor shall ensure that appropriate dewatering equipment or an adequate volume of material proposed for conditioning is available.

If filter presses or other dewatering equipment is used, water draining from the equipment shall be directed to Pond 2 for treatment in the on-site treatment system.

If conditioning agents are used, the Contractor shall deliver conditioning additives directly to the

conditioning area immediately prior to or during mixing operations. The Contractor shall take measures to control dust during delivery, mixing, and subsequent handling operations. The Contractor shall control proportioning of soils, sediments, organic materials and conditioning reagents. The Contractor shall completely mix additives with the soils, sediments, and organic materials to ensure a homogeneous mixture. The Contractor's QC procedures shall ensure adequate mixing.

The conditioning recipe shall be submitted as part of the bid. The Contractor shall follow all recipe procedures detailed in the bid. The contractor shall bear the cost of purchase and disposal for conditioning agents in excess of 10% over the recipe amount. Full-scale conditioning operations shall not begin until any changes to the proposed methods have been approved by the Group in writing, the unexcavated quarry surface has been surveyed, and grades are approved by the Group's QA Official.

3.6 MATERIAL TRANSPORT

Materials will be prepared and dewatered/conditioned as necessary to create a stable material that meets the requirements of the selected disposal facility, as well as the 'Paint Filter Test' (USEPA Method 9095) prior to shipment offsite. All shipments shall be appropriately manifested, labeled, and placarded in accordance with local, state and federal regulations and shall meet applicable maximum weights. Each vehicle shall be inspected by the Group's QA Official prior to shipment. Each vehicle shall be lined and covered with a tarp secured on all sides and the tailgate secured. The wheels, sides and underbody shall be decontaminated as necessary prior to departure from the Site. All vehicles shall display the appropriate PADEP and DOT placards.

The Contractor will be responsible for scheduling the Material Transportation.

3.7 OFF-SITE DISPOSAL

The following materials shall sent offsite for disposal:

- Non-hazardous soils and waste materials
- Non-hazardous debris;
- Spent PPE; and,
- Office trash.

All excavated materials shall be loaded for off-site disposal. The Group has characterized the materials and obtained PADEP Form U approval for material to be sent to the Waste Management GROWS/TRRF facility in Tullytown, Pennsylvania. The Group shall be responsible for all waste characterization sampling required to maintain disposal facility approval for acceptance.

All Other materials (debris, spent PPE, Office/General trash) requiring disposal will be handled by the Contractor subject to approval by the Group and the Group's QA Official.

3.8 CROSS-CONTAMINATION

For the purpose of this project, cross-contamination is defined as the movement of contaminated soils, waste or water onto areas which are currently below or have already been remediated below the corresponding clean-up standard. Work must be performed in a manner to minimize cross-contamination of "clean" areas by the "contaminated" materials.

At times during the project the limited working space and access into the Quarry may necessitate work practices that lead to cross-contamination. These conditions shall be identified by the Contractor in his bid along with the planned procedures to minimize the extent of these conditions.

If an area is identified as being cross-contaminated based on visual observations, the Contractor shall address the suspected materials in accordance with the planned procedures or as directed by the Group's QA Official. Additional confirmatory sampling as a result of cross-contamination, if required, shall be conducted by the Group's QA Official in accordance with the SAP.

When cross-contamination occurs that is caused by carelessness or negligence of the Contractor; the Contractor shall be responsible for all costs of cleaning up those cross-contaminated areas, disposing

of the soil and performing confirmatory sampling at no cost to the Group, including any cross-contamination that occurs during the demobilization

3.9 PRE- AND POST-EXCAVATION SURVEY

Before and after all excavation activities, the Contractor's surveyor shall perform a survey of the soil removal area for the purpose of establishing the volume of material removed and documenting the work conducted. Confirmatory soil sample locations shall also be documented by the Surveyor, including sample identification and depth. The Contractor shall coordinate surveying with sampling activities conducted. Surveying techniques shall be in accordance with Specification 01050, shall be based on generally accepted engineering and surveying practices and shall accurately depict topographic conditions.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Removal, dewatering, conditioning, handling, and loading of materials from within the Ponds shall be measured based on the weight of materials as received at the disposal facility.

Excavation, preparation, handling, and loading of materials excavated from the Plateau Area will be measured per ton as measured at the disposal facility.

Excavation, preparation, handling, and loading of materials excavated from the peripheral soil locations within the Quarry will be measured per ton as measured at the disposal facility.

Excavation beyond the horizontal and vertical limits shown on the Drawings without approval by the Group's QA Official shall not be measured.

Off-site disposal of soils, debris, spent PPE, Office/General trash shall be measured per ton disposed off-site based on weight tickets when received at the disposal facility.

4.2 PAYMENT

Off-site disposal soils, sediments and organic materials shall be paid per ton based on disposal facility weight tickets and certificates of disposal. Payment will not be made until all paperwork is received. Payment shall be considered full compensation for all work required by the Specifications, including, but not limited to dewatering, conditioning, handling, transport, off-site disposal, sampling, analysis, permits, fees and coordination with the disposal facility. The disposal purchase and disposal cost of conditioning agents used in excess of 10% over the contractor's recipe amount in their bid will be deducted from the contractor's payment.

Contaminated soil and materials excavation from Plateau Area and peripheral soil location areas shall be paid per ton as measured at the disposal facility. Payment shall be considered full compensation for all work required by the Specifications, including, but not limited to excavation, handling, preparation for transport, and loading.

Payment shall not be made for excavation, and placement or disposal of materials cross-contaminated by the Contractor. The completed work shall be paid in accordance with the following unit price schedule:

Disposal of other non-hazardous materials and wastes generated during the work (recyclable metals, and office garbage, etc) shall be paid per ton that is disposed of offsite.

If necessary, the construction of the Conditioning Area shall be a lump sum and shall be paid in two parts. One-half of the lump sum shall be paid when the Conditioning Area is established and in use. The second half of the lump sum shall be paid when the Conditioning Area has been removed and the area restored.

The Contractor shall be responsible for surcharges for overweight loads or loads rejected due to unsuitable physical characteristics.

Surveying shall be incidental to the work.

PAY ITEM	PAY UNIT
Pond Sediment Removal, Conditioning and loading for Off-site Disposal	Ton
Plateau Area Excavation, Conditioning and loading for Off-site Disposal	Ton
Non-Plateau Area Excavation, Conditioning and loading for Off-site Disposal	Ton
Off-Site Disposal – Miscellaneous/Trash	Ton
Conditioning Area	Lump Sum

SECTION 02210
EARTHWORK
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by this Section shall include, but not be limited to, the excavating, hauling, handling, placement, and compaction of fill soil for rough grading and backfilling of Ponds, soil removal areas, and general fill in Quarry 3.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering
B. Section 01300 - Submittals
C. Section 02115 - Erosion and Sediment Control Measures
D. Section 02209 - Soil and Waste Removal/Handling/Placement

1.3 REFERENCES

ASTM D 421 - Test Method for Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Contents

ASTM D 422 - Test Method for Particles-Size Analysis of Soils

ASTM D 1557 - Test Method for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.5-kg) Hammer and 18-inch (475-mm) Drop

ASTM - D 2216 - Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock

ASTM - D 2487 - Classification of Soils for Engineering Purposes

ASTM D 2922 - Test Method for Density of Soil and Rock In-Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 - Test Method for Moisture Content of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.4 SUBMITTALS

The Contractor shall propose soil fill from off-site sources. The Contractor shall submit to the Group and the Group's QA Official for review and approval, a copy of geotechnical and analytical laboratory test data from an independent laboratory detailing gradation (ASTM D422), Atterberg Limits (ASTM D4318), modified proctor results (ASTM D1557), moisture content (ASTM D421), and analytical testing conducted in accordance with the Sampling and Analysis Plan (SAP). The submittal for each off-site borrow source shall also include the borrow source name, location (address, street, town, lot and block, county and state), the prior use of the source and a statement from the supplier that the material is non-impacted and meets the analytical requirements indicated in the SAP. Analytical testing shall be conducted by the Contractor once initially for each borrow source, and thereafter at the frequency described in the SAP. Bills of lading for each load of imported material shall be submitted to the Group's QA Official to document the borrow source.

Off-site borrow soils shall be retested by the Contractor for analytical and geotechnical parameters as discussed in Section 3.7. The Group may also test off-site borrow soils at a frequency of its own discretion.

1.5 QUALITY ASSURANCE

Quality assurance of earthwork operations shall be performed in accordance with the Construction Quality Assurance Plan (CQAP). As described in the CQAP, earthwork will be monitored and tested by the Contractor's Quality Control representative, and observed and documented by the Group's QA Official. The Contractor is responsible for ensuring that all earthwork materials and placement activities meet this Specification. Any material not in conformance will be rejected and removed from the Site at Contractor's expense.

1.6 DEFINITIONS

General Soil Fill – Fill soil that is used to fill the Ponds backfill excavation areas, eliminate low spots and to obtain the design grades necessary to enhance surface drainage.

Structural Soil Fill - Material used to backfill over pipe installations.

Topsoil - Topsoil placed over general soil fill throughout the quarry and other disturbed areas as discussed in Section 02936.

PART 2: PRODUCTS

2.1 STRUCTURAL SOIL FILL

Structural soil fill shall be used to backfill over pipe installations. The material shall be capable of supporting construction loads to assure stability. Structural fill shall contain a maximum 35% fine-grained material (passing a #200 U.S. Std. Sieve) as measured by ASTM D422. Unless stated otherwise in this section, the structural fill soil shall have a maximum liquid limit (LL) of 40 and a maximum plasticity index (PI) of 15 as determined by ASTM D4318. The structural soil fill shall also be free of organic matter, debris, or other deleterious material. Maximum particle size for structural soil fill shall be 4 inches. Fill material shall meet the Quarry 3 clean up standards and the

Pennsylvania Clean fill criteria as defined in the Remedial Design Report and the Sampling and Analysis Plan.

2.2 GENERAL SOIL FILL

General soil fill shall fall within the USCS soil classifications of GW, GP, GM, GC, SW, SP, SM, SC and CL. Maximum particle size for general soil fill shall be 12 inches. Fill material shall meet the Quarry 3 clean up standards and the Pennsylvania Clean fill criteria as defined in the Remedial Design Report and the Sampling and Analysis Plan.

PART 3: EXECUTION

3.1 GENERAL

All fill shall be placed to the lines and grades as shown on the Drawings. Interim grades to be established at the completion of Phase 1 are shown on Drawing E201. The final restoration grading to be performed for the completion of Phase 2 are shown on Drawing E341. Survey controls required for earthwork placement shall be established by a Pennsylvania licensed professional surveyor retained by the Contractor. Controls shall be established as indicated in Specification 01050, unless otherwise specified.

3.2 FAMILIARIZATION

Prior to the start of earthwork activities, the Contractor shall become thoroughly familiar with the Site, the Site conditions, and all portions of the work falling within this Section. The Contractor shall carefully inspect the completed work of other sections and verify that all work is complete to the point where the work covered by this section may commence. Any conflicts or concerns with work completed, which may impact earthwork, shall be brought to the Group and the Group's QA Officials attention in writing.

3.3 SITE PREPARATION

The Contractor shall install erosion and sediment controls as shown on Drawing E401 and as described in Section 02115. Temporary erosion and sediment control measures shall be placed down-slope of areas to be disturbed, including soil stockpiles, prior to the beginning of work in that area and consistent with the Drawings. The Contractor shall maintain the erosion and sediment controls for the duration of the construction and until the areas are successfully revegetated. Accumulated sediment shall be managed as indicated in Specification 02115.

3.4 FILL AREA PREPARATION

Material shall not be placed in any fill zone until the subgrade of that zone has been suitably prepared, surveyed (if required), and has been approved by the Group's QA Official. The foundation for the fill shall be prepared by leveling and rolling, where applicable, so that the surface materials of the foundation will be compact and well-bonded with the first layer of fill as herein specified for the subsequent layers of fill. Any areas which are noted to pump, deflect, or be unsuitably soft, as determined by the Group's QA Official, shall be excavated and replaced with suitable material or stabilized by other means, at the discretion of the Group's QA Official. Under no circumstance shall backfill be placed on topsoil or any other organic strata. Backfill shall not be placed on a frozen subgrade. Areas where fill is to be placed shall be clean, and free of standing water, ice, frozen ground, vegetation or soft zones.

3.5 PLACEMENT

Brush, roots, sod, organic matter and other unsuitable materials shall not be placed within any fill area. The Contractor shall remove and dispose of all unsuitable items within the fill encountered during dumping or spreading. Large rocks, boulders, and cobbles greater than 12 inches in diameter that are observed in the general fill material shall be removed and set aside. General soil fill shall be placed in maximum18-inch thick loose lift layers and compacted in accordance with Paragraph 3.6. Structural soil fill shall be placed in maximum 12-inch thick loose lift layers and compacted in accordance with Paragraph 3.6

Backfill adjacent to pipes shall be placed in horizontal layers not to exceed four inches in thickness and compacted by hand tampers or other manually directed compaction equipment. Backfill shall completely fill all spaces under and adjacent to the pipe and structures. Equipment shall not be allowed to operate closer than 4 feet to any part of the structure. Equipment shall not be driven over any part of a pipe or concrete structure, unless there is a compacted fill of 24 inches or greater over the structure or pipe.

Successive layers shall not be placed until the layer under construction has been properly compacted to the density and moisture requirement of paragraph 3.6. If the compacted surface of a fine grained material is determined to be too smooth to bond properly with the succeeding layers, it shall be loosened by harrowing or by any other methods as approved by the Group's QA Official before the succeeding layer is placed.

The Contractor shall maintain and protect all fill areas in a satisfactory condition at all times until final completion and acceptance of the work. The Contractor shall excavate and remove from the fill any material which the Group's QA Official considers unsuitable, and shall also dispose of such material and refill the excavated areas as directed.

The Contractor may be required to remove any fill material placed outside of the lines and grades shown in the Drawings at no expense to the Group.

When constructing fill against an existing slope that is steeper than 20 percent, the slope shall be properly benched according to standard construction practice. The Group's QA Official shall monitor benching to assure that the bench extends at least 2 feet, and not greater than 4 feet, into the existing slope for every 2 feet thickness of material placed.

During earthwork operations, all fill materials shall be monitored by the Contractor and the Group's QA Official to determine conformance to the project Specifications. Material conformance testing shall be performed by the Contractor whenever a significant material variation is observed or as

required by the CQAP. The Group's QA Official shall monitor frequency of testing and review results for compliance with Specifications.

3.6 COMPACTION

The Contractor shall compact all soil fill. All compaction equipment shall be suitable to the slope and area conditions of the Site, and shall be subject to approval by the Group's QA Official. If necessary, hand-operated compaction equipment such as mechanical tampers shall be used for working in confined areas.

Each lift of general soil fill shall be compacted to a density of 90% of the maximum dry density as determined by the Modified Proctor Test (ASTM D1557). General soil fill shall have a moisture content within +5% to -3% of the optimum moisture content prior to compaction. Structural soil fill shall be compacted to a density of 95% of the maximum dry density as determined by the Modified Proctor Test (ASTM D1557).

At the end of each day's construction activities, completed lifts or sections shall be sealed by rolling with a rubber tired or smooth-drummed roller.

Areas which do not meet density requirements or are unstable under the loading of compaction equipment shall be corrected by appropriate moisture control, recompaction, or removal and replacement with additional fill, as determined by the Group's QA Official. When a lift fails compaction requirements, additional compaction tests shall be performed at 20' offsets in four directions around the failed test until failure limits are defined.

3.7 TESTING

The field density and moisture content of the structural soil fill and general soil fill shall be determined by the Contractor at least once for every 10,000 square feet placed per lift using nuclear density methods (ASTM D2922 and D3017). Fill material shall be tested for geotechnical properties every 5000 CY or when a change in material is observed. Fill material shall be tested for Quarry 3

clean up standards and the Pennsylvania Clean fill criteria once per 10,000 CY for each borrow source. More frequent testing may be performed, as determined by the Group's QA Official. Tests shall be observed by the Group's QA Official and results shall be submitted to the Group's Official.

3.8 CONSTRUCTION QUALITY ASSURANCE

The Group's QA Official shall monitor sample collection and subsequent compaction operations to evaluate material stability in accordance with the CQAP.

3.9 SURFACE WATER AND GROUNDWATER WATER MANAGEMENT

The Contractor shall be responsible for managing all precipitation and surface water entering the work areas. Contractor shall provide, maintain, and operate pumps and other equipment as necessary pursuant to Section 02715. Surface water collected within remediated areas shall be managed in accordance with Section 02715.

3.10 PROTECTION OF FINISHED WORK

The Contractor shall implement appropriate measures to protect completed work areas and construction materials from damage by site activities, vandalism, flooding or other forces whether natural or man made. If damage occurs, the Contractor shall make all repairs and replacements necessary, as determined by the Group's QA Official, at no additional cost to the Group.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Structural soil fill shall be considered incidental to pipe installation and will not be measured. Any fill placed for the convenience of the Contractor shall not be measured. General fill soil shall be measured in tons based on delivery tickets.

4.2 PAYMENT

Payment of structural soil fill shall be considered incidental to pipe installation and will not be paid separately. General fill soil shall be paid on the basis of tons placed within the Quarry 3 work area. Payment for each item shall be full compensation for completing the work in accordance with the Drawings and Specifications, or as directed by the Group's QA Official, including, but not limited to, transportation to the Site, materials, labor, expertise, equipment, preparation of fill materials, off-site borrow area selection, sampling, pre-construction and ongoing testing, subgrade preparation, placement, compaction, trimming, field quality control, surveys, and maintenance and protection of final grades.

All work associated with furnishing and hauling material will not be paid separately but shall be included in the unit price. No additional payment will be made for removing approved fill material which is rendered unsuitable after placement or replacement; nor for removal, hauling, disposal and replacement of objectionable fill material, or for any fill material placed outside of the lines and grades as shown on the Drawings or approved by the Group's QA Official.

Completed work shall be paid in accordance with the unit price schedule.

PAY ITEM	PAY UNIT
Structural Soil Fill	None
General Fill Soil	Ton

SECTION 02500
ROADWAYS SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

This work shall include furnishing all materials, labor and equipment necessary to replace, modify and/or install temporary access roads as shown on the Drawings.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering
B. Section 01300 - Submittals
C. Section 02115 - Erosion and Sediment Control Measures
D. Section 02210 - Earthwork

1.3 REFERENCES

ASTM D 4355 - Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus

ASTM D 4491 - Test Method for Water Permeability of Geotextiles by Permittivity

ASTM D 4533 - Test Method for Trapezoidal Tearing Strength of Geotextiles

ASTM D 4632 - Test Method for Breaking Load and Elongation of Geotextiles (Grab Method)

ASTM D 4751 - Test Method for Determining Apparent Opening Size of a Geotextile.

ASTM D 4833 - Test Method for Index Puncture of Geotextiles, Geomembranes, and Related Products

ASTM D 4884 - Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.

1.4 SUBMITTALS

A. Samples: Submit geotechnical analysis for proposed stone material to the Group's QA Official for review and approval.

B. The submittal for each off-site source of aggregate shall also include the source name, location (address, street, town, lot and block, county and state), the prior use of the source and a statement from the supplier that the material meets the analytical requirements indicated in the Sampling and Analysis Plan (SAP).

C. Bills of lading for each load of imported material shall be submitted to the Group's QA Official to document the borrow source.

D. Submit manufacturers' certification reports with the requirements of standards and testing methods specified herein for geotextile proposed for this project prior to material delivery. The material manufacturer and Contractor must satisfy the QA Official that the materials they offer to furnish and install shall meet the requirements set forth in these specifications. The Contractor shall transmit to the QA Official all information given to them by the manufacturer or supplier prior to approval for furnishing and installing any such material.

1.5 QUALITY ASSURANCE

Quality Assurance shall be performed in accordance with the Construction Quality Assurance Plan (CQAP). The QA Official shall ensure that work is completed as required by the Contract Documents.

PART 2: PRODUCTS

2.1 GEOTEXTILES

A. Non-woven geotextile shall be used as a separation layer between the roadway aggregate and the subgrade.

B. Geotextile Physical Properties: Access roads, aprons, parking areas and other support area shall be underlain by a non-woven geotextile filter fabric material possessing a minimum grab tensile strength of 200 lbs/in (ASTM D4632), minimum mass per unit area of 8 oz per square yard (ASTM D3776), minimum puncture strength of 120 lbs (ASTM D4833), minimum elongation at failure of 50% (ASTM D4632), minimum Mullen Burst strength of 400 lbs (ASTM D3786), and maximum apparent opening size of 0.210 mm (70 U.S. sieve size, ASTM D4751).

C. Thread: Sewn seams, if used, shall be constructed with high-strength polyester, nylon, or other approved thread type. Thread shall have equivalent chemical compatibility and ultraviolet light stability as the geotextile and the color shall contrast with the geotextile for easy inspection. The minimum break strength of the thread shall be 50 pounds.

2.2 ACCESS ROAD COURSE AGGREGATE

A. Provide aggregate meeting the gradation requirements of AASHTO 3 as listed below:

Sieve Size	% Passing
2 1/2"	100
2"	90 – 100
1 ½"	35 – 70
1"	0 - 15
1/2"	0-5

B. Aggregate will be crushed rock having a minimum unit weight of 160 pounds per cubic foot.

PART 3: EXECUTION

3.1 MODIFICATION OF EXISTING ROADWAYS

Existing Site haul roads shall be modified and utilized to the extent possible to minimize the quantity of new access road construction. The access road from Renaissance Blvd. to Quarry 3 shall be constructed as shown on Drawing E201 with a minimum width of 24 feet and a maximum grade of 8%. Temporary access roads in Quarry 3 or along the rim of Quarry 3 shall be constructed as needed to complete the work and shall be removed at the completion of work, unless otherwise directed by the Group. Additional construction shall be conducted with the approval of the Group's QA Official.

3.2 MATERIAL HANDLING

Transportation, handling, off-loading, and storage of the geosynthetic material shall be the responsibility of the Installer. The Installer shall provide all necessary equipment and assure that personnel are properly trained for handling of the geosynthetic material. The Installer shall be responsible for replacing any damaged or unacceptable material and removing defective material from the Site at no cost to the Group. No off-loading shall be done unless the QA Official is present. Any damage occurring during the off-loading shall be documented by the Installer and the Group's QA Official. The Group's QA Official shall be the final authority on determination of damage. Dragging panels on ground surfaces and folded materials shall not be permitted

Geosynthetic rolls shall be stored in their original, unopened wrapping in a dry area which provides protection from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or any other damage. Rolls shall be stored not more than 3 high and on a prepared surface. The materials shall be stored above the ground surface and beneath a roof or other protective covering. Seriously damaged rolls, as determined by the Group's QA Official, shall be rejected. Geosynthetic material rolls may be stored on-site for a maximum of 6 months prior to use. Rolls delivered to the Site greater than 6 months before use will be rejected, nor will rolls that have been onsite for 6 months be acceptable for use.

3.3 PLACEMENT AND SURFACING

A. Perform grading operations so that the surface will be well drained at all times. Finish all grading on neat, regular lines conforming to the sections, lines, grades, and contours shown on the Drawings. If contours are not shown, perform grading in accordance with the criteria set forth herein. Perform grading work in proper sequence with all other associated operations.

B. Prepare roadway subgrade in accordance with Drawing E402. All subgrades should be proof rolled with a large (10-ton) smooth drum roller. Any soft or wet spots shall be removed and replaced with suitable fill material. Bring the entire subgrade to the elevation prior to installation of any permanent roadways. Provide necessary temporary surface drainage and keep the same operating to the satisfaction of the Group's QA Official until finish grading has been completed.

C. After subgrade elevations are achieved, place geotextile and sew or heat bond seams; or use 1-foot min overlap before back-dumping aggregate. Grade the aggregate with a light-weight, low-ground-pressure tracked bulldozer by spreading a minimum of 6 inches of the material in advance of the equipment. The bulldozer shall blade into the load of material to be spread with a slightly upward motion. Compact aggregate with a minimum of four passes of a minimum 10-ton smooth drum roller operated in

the vibratory mode. Final access road aggregate thickness shall be a minimum of 12-inches.

3.4 PROTECTION OF EXISTING FEATURES

Existing stormwater inlets, monitoring wells, and other features located near roadways on-site will be identified and made visible with flagging or cones. Paint may be used to mark features to be protected with the approval of the Group's QA Official.

Monitoring wells will be protected from vehicle or equipment traffic with concrete filled bollards. Stormwater inlets shall be protected by covering with steel plates or placing Jersey Barriers to route traffic around them.

Other features on-site requiring protection may be identified by the Group and the Group's QA Official. The Contractor shall be responsible for damage caused to existing Site features not identified for removal.

3.5 ROADWAY REMOVAL

Temporary access roads shall be removed at the completion of work and disturbed areas shall be addressed and seeded in accordance with Specification 02936 unless otherwise directed by the Group.

Road materials removed at the end or work (or removed as part of road maintenance) shall be handled and disposed of offsite in accordance with Specification 02209.

3.6 PARKING AREA

The contractor shall construct a parking area suitable for his employees and equipment in the support area designated on the Drawings.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Temporary access roads shall be measured on a lineal foot basis along the road centerline. Maintenance of the access road and construction and maintenance of the Contractor's parking area shall be incidental to the work and shall not be measured.

4.2 PAYMENT

Temporary access roads shall be paid based on a lineal foot basis at the unit price indicated on the bid form. This payment shall be compensation for completing the work in accordance with the Specifications and Drawings including, but not limited to, materials, labor, expertise, equipment, subgrade preparation, installation, grading, trimming, maintenance, quality control and testing.

PAY ITEM	PAY UNIT
Temporary Access Road	Lineal Foot

SECTION 02715
WATER MANAGEMENT SPECIFICATIONS
(DURING CONSTRUCTION)

PART 1: GENERAL

1.1 DESCRIPTION

The work covered by these Specifications shall include, but not be limited to, the management, diversion, and handling of any surface water, which exists in, flows into, precipitates onto, or infiltrates into active work areas in and around Quarry 3 including the collection and treatment/disposition of decontamination water. The work includes the installation of surface water flow diversion structures and the preparation of collection areas within the Quarry 3 work zone.

The Contractor shall be responsible for handling all water as required to complete the work in a neat and dry condition, to the point practicable, and as detailed in these Specifications.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals
B. Section 02115 - Erosion and Sediment Control Measures
C. Section 02209 - Soil and Waste Removal/Handling/Disposal
D. Section 02210 – Earthwork

1.3 REFERENCES

PADEP Erosion and Sediment Pollution Control Program Manual dated April 15, 2000
PADEP Stormwater Best Practices Manual dated December 2006
Montgomery County Conservation District requirements

1.4 SUBMITTALS

Not Used.

1.5 QUALITY ASSURANCE

Quality Assurance shall be performed in accordance with the Construction Quality Assurance Plan (CQAP). The Group's QA Official shall ensure that work is completed as required by the Contract Documents.

PART 2: PRODUCTS

2.1 GENERAL

Any products used by the Contractor to divert, manage, or handle stormwater shall be approved by the Group's QA Official and shall meet the requirements of the Specifications.

PART 3: EXECUTION

3.1 GENERAL

The Contractor shall be responsible for keeping areas where construction activities are being performed dry, to the extent practicable, and for diverting stormwater from the active work areas in and around Quarry 3 including the collection and treatment/disposition of decontamination water. During excavation of impacted soil/sediment, surface water which enters the Quarry by direct rainfall or run-on shall be either left within the excavation work area and allowed to percolate or be diverted to Pond 2. Water that accumulates within Pond 2 will be treated in the on-site treatment system and disposed to Matsunk Creek under the PADEP permit.

3.2 PREPARATION

The Contractor shall construct berms, channels and terraces as necessary to control, contain, and divert un-infiltrated water from the on-going work areas in Quarry 3 to Pond 2.

When all excavation work is complete, Pond 2 will be backfilled and a temporary stormwater inlet (skimmer) will be installed to create a temporary sediment basin at the east end of the Quarry. Surface water shall be directed to the temporary sediment basin at Pond 2 by temporary diversion berms and channels. Diversion berms shall be constructed as necessary to maintain control of stormwater, and as directed by the Group's QA Official. Water collected in the temporary sediment basin at Pond 2 will be allowed to infiltrate or will be pumped to the water treatment system as needed to prevent overflow.

3.3 MONITORING

The Group's QA Official shall periodically monitor the water management systems to ensure that they are adequately maintained.

3.4 DECONTAMINATION WATER

Decontamination water shall be collected in Pond 2 and treated in the on-site treatment system.

3.5 PHASE 1 DEMOBILIZATION (if necessary)

At completion of Phase 1 activities if the Contractor demobilizes, the drainage conditions at the Site shall be reviewed by the Group's QA Official and Contractor to ensure that appropriate measures are in-place to minimize cross-contamination during the demobilization. The Contractor shall implement, to the satisfaction of the Group's QA Official, additional measures including but not limited to grading the ground surface, diversion berms, diversion channels, silt fence and temporary seeding. The Contractor shall be responsible for all stormwater management, including maintenance

and repair of stormwater management features, and removal of cross-contamination while operating and during any shutdown periods.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Handling and measurement of surface water, stormwater, decontamination water and groundwater in and around the work areas is incidental and shall not be measured as a separate item.

Treatment of surface water, when necessary, shall be measured in accordance with Specification 15010.

4.2 PAYMENT

Handling of surface water, stormwater, groundwater and decontamination water in and around work areas is considered incidental and shall not be paid for as a separate item

Treatment of surface water, when necessary, shall be paid for in accordance with Specification 15010.

SECTION 02936
TURF ESTABLISHMENT
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work to be performed under this section shall include all labor, materials and equipment to prepare sub grade to receive topsoil, spread topsoil, fertilize, mulch, seed, install erosion control mat, water, and maintain seed until acceptance in accordance with the Contract Documents and as directed by the Group's QA Official.

1.2 RELATED SECTIONS

A. Section 01050 - Field Engineering
B. Section 01300 - Submittals
C. Section 01700 - Demobilization/Project Closeout
D. Section 02110 - Site Preparation and Clearing
E. Section 02115 - Erosion and Sediment Control Measures
F. Section 02117 – Dust and Odor Control and Air Monitoring
G. Section 02210 - Earthwork

1.3 REFERENCES

- PADEP Erosion and Sediment Pollution Control Program Manual dated April 15, 2000

- Penn State College of Agricultural Sciences Erosion Control and Conservation Plantings on Noncropland

- PADEP Stormwater Best Practices Manual dated December 2006
- Montgomery County Conservation District requirements

1.4 SUBMITTALS

Contractor shall submit the topsoil source name, location and previous use, results of topsoil geotechnical and analytical analysis, a certification that the topsoil is clean and recommendations for fertilizer and lime. Analytical testing shall be conducted in accordance with the Sampling & Analysis Plan (SAP). Contractor shall submit material source and property information for temporary and permanent seed, mulch, binder, fertilizer, and erosion control mat.

1.5 QUALITY ASSURANCE

Quality Assurance shall be performed in accordance with the Construction Quality Control Plan (CQAP). The Group's QA Official shall ensure that work is completed in accordance with the Contract Documents.

PART 2: PRODUCTS

2.1 TOPSOIL

Topsoil shall consist of natural, fertile agricultural soil and have the USDA classification of sandy loam, loam, sandy clay loam, silty clay loam, loamy sand, or silt loam. Topsoil shall not be in a frozen or muddy condition. Topsoil shall be free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, noxious weeds, and foreign matter.

Soil analyses shall be conducted at least once for every 5,000 cubic yards of topsoil placed. Soil analyses shall consist of tests for total organic content, nutrients, and pH. The Contractor shall incorporate fertilization and liming recommendations developed from the soils analyses for the topsoil. Recommendations shall include at a minimum: application rates, fertilizer type and quality, and lime type and quality. Topsoil shall have a minimum organic content of 5% as determined by

ASTM D-2974. The submittal for each soil borrow source shall include the source name, location (address, street, town, lot and block, county and state), the prior use of the source, and testing information from the supplier illustrating that the material meets the Quarry 3 Clean Up and PADEP Clean Fill requirements (Appendix G – Sampling and Analysis Plan Section 3.2.3). Analytical testing shall be conducted once for each borrow source, unless additional testing is requested by the Group's QA Official. Bills of lading for each load of imported material shall be submitted to the Group's QA Official to document the soil borrow source.

2.2 FERTILIZER AND LIMESTONE

The Contractor shall submit a sample of the approved topsoil to the Penn State University Agricultural Analytical Service Laboratory to determine fertilizer and limestone application rates.

Fertilizer for seed shall be commercial grade, free flowing, uniform in composition and shall conform to applicable State and Federal regulations. Fertilizer for seed shall meet the recommendations developed by topsoil analysis.

Limestone shall be pulverized dolomitic limestone or approved equal.

For temporary seed applications, limestone shall be applied at 1 ton per acre and fertilizer shall be applied at a rate of 150 lb per acre unless directed otherwise by the Group's QA Official.

2.3 SEED

Seed shall meet the requirements for purity and germination, as specified in the Proceedings of the Association of Official Seed Analysis, Rules for Testing Seeds.

Seeds shall be furnished in original containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging, and location of packaging. Damaged packages shall not be accepted. Seed germination shall have been tested within 12 months of the

planting date. No seed shall be accepted with a germination test date more then 12 months old unless retested.

2.3.1 Temporary Seed

The temporary seed mix for spring seeding (up to June 15) shall meet the following requirements:

Seed Type	Application Rate PLS	Minimum Purity (%)	Germination (%)
Annual Ryegrass	40 lb/acre	98	85
or Spring Oats	96 lb/acre	98	85
or Spring Oats plus Ryegrass	64 lbs/acre oats; 20 lb annual or Perennial Ryegrass	98	85
or Winter Wheat	180 lbs/acre	98	85
or Winter Rye	168 lbs/acre	98	85

PLS means Pure Live Seed. PLS is the product of the percentage of pure seed times percentage of germination divided by 100. To secure the actual planting rate for a species, divide the seeding rate PLS by the PLS percentage shown on the seed tag.

The temporary seed mix for late spring and summer seeding (June 16 to August 15) shall meet the following requirements:

Seed Type	Application Rate PLS	Minimum Purity (%)	Germination (%)
Annual Ryegrass	40 lb/acre	98	85
or Japanese or Foxtail Millet	35 lb/acre	98	
or Sudangrass	40 lbs/acre	98	85
or Spring Oats	96 lbs/acre	98	85
or Winter Wheat	180 lbs/acre	98	85
or Winter Rye	168 lbs/acre	98	85

The temporary seed mix for late summer and fall seeding (August 16 and later) shall meet the following requirements:

Seed Type	Application Rate PLS	Minimum Purity (%)	Germination (%)
Annual Ryegrass	40 lb/acre	98	85
or Winter Rye	168 lbs/acre	98	85
or Winter Wheat	180 lbs/acre	98	85

2.3.2 Permanent Seed

The permanent seed mix shall meet the following requirements:

Seed Type	Application Rate PLS	Minimum Purity (%)	Germination (%)
Birdsfoot Trefoil	6 lb/acre	98	80
plus Crownvetch	10 lb/acre	98	65
plus Tall Fescue	20 lb/acre	98	80
plus Spring Oats (spring)	64 lb/acre	98	85
or Annual Ryegrass (spring or fall)	10 lb/acre	98	85
or Winter Wheat (fall)	90 lb/acre	98	85
or Winter Rye (fall)	56 lb/acre	98	85

2.4 MULCH

Mulch shall consist of clean grass hay and cereal straw so that undesirable weeds are not produced. Hay or straw mulch shall not be chopped or finely broken (except for hydroseeding). Mulch may also consist of excelsior blanket or jute netting or other as approved by the Group's QA Official. Mulch shall be applied at a minimum of 3 tons per acre (140 pounds per 1,000 square foot).

Chipped cleared materials and chipped grubbed materials from non-excavation areas may also be used as mulch with Group's QA Official approval. Wood chips shall be applied at 4 to 6 tons per acre (185 – 275 pounds per 1,000 square foot).

A mulch-anchor shall be applied immediately after mulching. Mulch anchoring shall be conducted using peg and twine, mulch nettings, crimping, or liquid mulch-binders as approved by the Group's QA Official.

Mulch shall be applied to areas of temporary and permanent seed.

2.5 EROSION CONTROL MAT

Erosion control mat in swales and on slopes 4H:1V and steeper shall be Curlex I (American Excelsior Company), or approved equivalent. Erosion control mat shall be suitable for 2:1 slopes and up to 5 fps velocity.

PART 3: EXECUTION

3.1 GENERAL

Topsoil, permanent seed and mulch shall be applied in all backfilled and disturbed areas.

3.2 DELIVERY, STORAGE AND HANDLING

3.2.1 Seed

Seed shall be delivered and stored in sealed standard containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, date of packaging and location of packaging. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. Damaged packages are not acceptable.

3.2.2 Fertilizer

Fertilizer shall be delivered and stored in waterproof bags showing weight, chemical analysis, and name of manufacturer.

3.3 TOPSOIL PLACEMENT

The areas which will be covered by topsoil shall be properly graded. Underlying soil shall be loosened to a depth of 2 inches before placing the topsoil. Stones and other foreign material 2 inches or larger in any dimension shall be removed. Unsuitable or surplus material shall be removed and satisfactorily disposed of by the Contractor.

Topsoil shall be placed on prepared areas and, unless otherwise indicated, spread and compacted. Topsoil thickness shall be 4-inch uniform depth +/- 1.0 inches.

Compaction shall be with a roller weighing not over 120 pounds per foot width of roller. Topsoil shall not be placed in a wet or frozen condition or on wet or frozen subgrade.

3.4 SEED BED PREPARATION

Previously placed materials shall be protected by the Contractor during seeding. Foreign materials, plants, roots, stones, and debris shall be removed from the area being seeded. Erosion mat shall be installed in accordance with manufacturer's instructions.

The Contractor shall cultivate the ground surface to a depth of 3 inches until the soil is uniform in texture and suitable for seeding. Disking, raking, blading, or other approved methods shall be used to prepare the soil for seeding. Areas inaccessible to mechanized equipment shall be cultivated by hand. The surface of the seedbed shall conform to the established finished grades.

3.5 FERTILIZER

Fertilizer for seed shall be applied at the rate recommended by the results of the topsoil analyses. Application shall be performed as nearly as practicable to depth of 3 inches with a drill or broadcast spreader or hydraulically as a seed/ fertilizer slurry.

3.6 TEMPORARY SEED APPLICATION

Temporary seed shall be applied immediately at the rate identified in Section 2.3.1 if the area will be exposed without construction traffic for 14 days or more. After seedbed preparation, the Contractor shall apply the specified seed mixture and fertilizer. Seed shall be sown uniformly by means of a rotary seeder, hydraulic equipment, or other approved technique.

3.7 PERMANENT SEED APPLICATION

After seedbed preparation, the Contractor shall apply the specified permanent seed mixture within 7 days of grading completion. The allowable time periods for seed installation are provided in Section 2.3.2. Seed shall be sown uniformly by means of a rotary seeder, hydraulic equipment, or other approved technique. If hydroseeding is used, the seed application rate shall be increased by 25%. All areas disturbed by the remedial activities shall be permanently seeded using the seed types and application rates listed in Section 2.3.2. Seeding shall be performed in accordance with the Manufacturer's recommendations.

3.8 MULCHING

Mulch material shall be applied by the Contractor following seeding. Mulch may also be applied during hydroseeding. Mulch shall be spread uniformly over the temporary or permanent seeded areas at the rates specified in Section 2.4.

3.9 WATERING

The Contractor shall water the seed as required during dry periods. Sufficient water shall be applied in the form of a fine spray to moisten the soil to a depth of three (3) inches. Watering shall be performed so as not to disturb seed or anchor mulch. Watering may not be required, depending on the weather conditions.

3.10 EROSION CONTROL MAT

Erosion control mat shall be installed on disturbed slopes equal to or steeper than 4 horizontal to 1 vertical in accordance with the Drawings and the manufacturer's recommended installation procedures. Erosion control matting shall be installed with seed at the stormwater basin and swales.

3.11 PROTECTION AND INSPECTION

The Contractor shall protect seeded and planted areas against traffic and damage by erecting barricades and warning signs. Upon permanent Site stabilization and completion of construction, Contractor shall notify the Group's QA Official for a final compliance inspection to check that all provisions of the certified plan have been achieved.

3.12 REPAIR AND MAINTENANCE

The seeded and planted areas shall be subject to scheduled inspections by the Group's representative and Contractor 30 days, 90 days, 180 days and one year after from the date of substantial completion as determined by the Group and Group's QA Official. The Group may also perform more frequent inspections as deemed necessary based on factors such as weather and success of vegetation. If, during the course of these inspections, any portion(s) of the seeded or planted areas are found to be unsatisfactory (areas of erosion, thin vegetative coverage, no coverage or damaged plants) to the Group, the areas shall be repaired and re-seeded by the Contractor as originally specified, at no additional expense to the Group.

The Contractor guarantees at least 90 percent surface area coverage of live, growing species from the seed mix applied for a period of one (1) year following the date of substantial completion, with the largest individual surface area not meeting the 90 percent coverage requirement not to exceed 100 square feet. Areas not fulfilling this requirement shall be prepared and re-seeded at the expense of the Contractor. Areas disturbed by re-seeding shall also be re-seeded at the Contractor's expense using the seed mix specified in this Specification.

The following maintenance shall be completed to establish and maintain the permanent vegetative cover:

1. Apply sufficient water to ensure uniform seed germination and plant growth. The water shall be applied slowly to avoid puddling and crusting of the topsoil.

2. Add topsoil where necessary, including areas affected by erosion, to maintain a uniform surface at the design grade.

3. Reseed damaged areas showing root growth failure, deterioration, bare or thin spots, and eroded areas and apply sufficient water to ensure uniform germination and growth.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Topsoil, of the specified depth, shall be measured in area by square yards. Topsoil spread to a greater depth than specified or directed shall not be paid for but shall be considered as having been included as part of the contract unit price bid for topsoil. Erosion control mat shall be measured by actual installed area in square yards.

Nutrients and lime will not be measured and shall be included in the unit price for seeding. Permanent and temporary seed, mulch and fertilizer shall be measured in-place by area in square yards. Only temporary seed applied to the areas approved by the Group's QA Official shall be measured. Watering, maintenance, repairs, re-seeding, and replacing erosion control mat shall not be measured and shall be included in the unit price for seeding. The 1-year warranty shall be a lump sum item and shall not be prorated.

4.2 PAYMENT

Turf establishment items shall be paid for by the Group at the contract prices. Payment shall be full compensation for turf establishment in accordance with the Drawings and Specifications. Payment for erosion control mat shall include all overlaps and fasteners. The 1-year warranty shall be paid on a lump sum basis at the completion of the 1-year warranty period. Payment shall be conducted in accordance with the following contract items:

PAY ITEM	PAY UNIT
Topsoil (4 inch)	Square Yard
Permanent Seed, Mulch, Fertilizer	Square Yard
Temporary Seed, Mulch, Fertilizer	Square Yard
Erosion Control Mat	Square Yard
1-Year Warranty	Lump Sum

SECTION 15010
SURFACE WATER TREATMENT AND DISCHARGE SYSTEM
SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

The work to be completed under this section includes the removal and treatment of surface waters within the three Ponds in Quarry 3 and the subsequent discharge to Matsunk Creek. This section contains general information required to install and operate the water treatment equipment as shown on the Drawings and described in this specification.

The Contractor will be responsible for providing a complete and functional water treatment system to remove contaminants from surface water and meet the discharge requirements defined in this specification. In addition the Contractor will be responsible for installation of the HDPE discharge piping and for providing the necessary pump and pipe systems to transfer water from the ponds to the Water Treatment and Discharge System (System) and from the System to the discharge point at Matsunk Creek. The work also involves the operation of the water treatment system and replacement of activated carbon, as necessary, throughout the project.

Included in the rental of the System shall be all supervision, labor, materials, tools, equipment, and services as required for installation and test operation of equipment, including the services of vendor's service engineers as well as receiving, unloading, storage, protection, installation, and complete erection of all mechanical equipment required to provide turn-key operation of the System.

Installation shall include, but not be limited to, site preparation, placing, shimming, anchoring, grouting, cleaning, painting, lubricating, assembling, testing, and adjusting of all mechanical equipment. Installation shall also include providing all required miscellaneous parts.
The Contractor shall identify utility supply requirements and coordinate this work with the utility companies to provide a complete and operational installation.

1.2 RELATED SECTIONS

A Section 01300 – Submittals

B. Section 02110 – Site Preparation and Clearing

C. Section 02210 – Earthwork

1.3 RESPONSIBILITY FOR EQUIPMENT

The Contractor shall be responsible for determining weights of all equipment to be handled, and to provide adequate handling equipment and experienced riggers. Any weights shown on the Drawings are approximate and are to be used at the Contractor's discretion.

1.4 QUALITY OF EQUIPMENT AND WORKMANSHIP

Equipment and appurtenances shall be designed in conformity with the specified standards as listed herein. Equipment shall be constructed of materials for the conditions of exposure and of such strength to withstand all stresses which may occur during shipment, testing, installation, and all conditions of normal operation.

All equipment shall be installed true and level and to location as indicated on the Shop Drawings provided by the Contractor's treatment system vendor. All work shall be performed to the satisfaction of the Crater Resources PRP Group (Group). Precision gauges and levels shall be used in setting all equipment.

The Contractor shall be responsible for the installation of the equipment in a manner consistent with the requirements of performance warranties and equipment workmanship of the manufacturer.

Machinery parts shall conform exactly to the dimensions shown on the Shop Drawings. The corresponding parts of identical machines shall be made interchangeable. Clearance shall be provided for repairs, inspection, and adjustment.

Exposed surfaces shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chambered for personnel protection.

All Machinery and equipment shall comply in all respects with the provisions of the Occupational Safety and Health Act of 1970, and other applicable Federal, State and Local Laws and regulations.

1.5 CONFORMANCE TO DESIGN CRITERIA AND PERFORMANCE GUARANTEE

In the Bid Proposals, the Contractor shall formally acknowledge receipt of and understanding of the design criteria presented in the Specifications.

The Group understands that the Contractor is not engaged in the business of designing and providing water treatment systems similar to the System and that Contractor will obtain the System from a water treatment system supplier/subcontractor suggested by the Group (Supplier) pursuant to a subcontract between the Contractor and the Supplier (Subcontract). The Subcontract shall incorporate this specification and shall include specific provisions that (1) make the Group a third party beneficiary of the obligations of the Supplier pursuant to the Subcontract and (2) assign to the Group the benefits of all performance related obligations contained in the Subcontract.

Notwithstanding anything contained in the Contract Documents to the contrary, Contractor shall not be liable to the Group for any damages (whether in contract, in tort or otherwise) arising from or related to the performance of the System, including without limitation any liquidated damages imposed by the Contract Documents. The Group understands that the Contractor is not providing any express warranties or guarantees with respect to the performance of the System and that THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE ARE WAIVED AS RESPECTS THE CONTRACTOR.

In the event modifications to the System are required in order for the System to achieve the requirements of this specification, the implementation of such modifications shall be deemed a Change Order pursuant to the Contract Documents entitling Contractor to both a time extension associated with the implementation of such modifications and additional compensation therefore.

1.6 CODES, PERMITS, AND INSPECTION

Installation of equipment shall comply with all applicable Federal, State, and Local Laws. Contractor shall provide a certificate of final inspection and approval from the inspection authority having jurisdiction for any equipment where such is required. All licenses and permits shall be obtained by the Group.

1.7 SUBMITTALS

Contractor shall submit the following to the Group for approval:

- System Design including materials lists, quantities, and shop drawings;
- An Operation and Maintenance Plan for the treatment system;
- Pump information;
- HDPE fusion welded pressure piping materials; and,
- Flow meter/totalizer information.

1.8 DEFINITIONS

Breakthrough – during operation of the water treatment system the term 'breakthrough' shall be defined for the LPGAC system as when VOC and SVOC concentrations in the water after the lead LPGAC vessel exceed the PADEP Letter of Authorization permitted limits for VOC/SVOC shown on Table 2-1 of the Design Report; for the ion exchange system, if necessary, it will be defined as when the metals concentrations in water after the ion exchange unit exceed the PADEP Letter of Authorization permitted limits for metals shown on Table 2-1.

PART 2: PRODUCTS

2.1 TREATMENT SYSTEM PERFORMANCE REQUIREMENTS

The System performance requirements are as follows:

A. Ambient Air Temperature

Maximum: 120 degrees F
Minimum: 20 degrees F

B. Water Temperature

Maximum: 75 degrees F
Minimum: 32 degrees F

C. Flow Rate

Maximum: 250 GPM
Minimum: 20 GPM
Average: 250 GPM

D. Influent Water Characteristics

The contaminant concentrations in the influent water are provided in Table 2-2 the Design Report.

E. Effluent Water Discharge Requirements

The PADEP discharge criteria for 250 GPM discharge to Matsunk Creek is provided in Table 2-1 of the design Report.

2.2 PUMP AND PIPE SYSTEM

The Contractor shall provide a pump and piping system capable of transferring water from the Quarry 3 Ponds to the System. Pond water shall be removed from the surface down.

Based on available information, the deepest Pond water elevation will be in Pond 1 (approx El. 110 ft). The elevation of the Quarry 3 Pond Surface (except for Pond 2) is approximately El. 145 ft. The locations, elevations, and distances are shown on Drawing E201.

Using a suction pump or suction and booster pump combination, the Contractor shall convey the water from the ponds through the System and then through approximately 2000 feet of 5" (Nominal) HDPE pipe to Matsunk Creek. The inlet end of the suction hose shall be equipped with a 1/8-inch screen to prevent debris from entering the hose. The approximate elevation of the discharge location is El. 105 ft. The alignment of the HDPE force main is shown on Drawing E202.

Pumps used to operate the System shall be equipped with hour meters reading to within 1 hour for use in determining hours of pump operation.

2.3 WATER TREATMENT SYSTEM

The Contractor shall provide a complete turnkey System capable of meeting the requirement of the PADEP letter of authorization to discharge to Matsunk Creek. The Contractor shall provide head loss calculations for the proposed water treatment system for use in correctly sizing the pumping system.

The Contractor will provide a stable, level, graded stone surface for the water treatment system at the location shown on Drawing E201. Disturbed soil or fill placed to provide a level surface shall be considered structural fill and compacted as defined in Specification 02210. The stone pad shall be 12" thick and consist of PADOT 2A modified stone or AASHTO #3 stone compacted with 2 passes of a smooth drum roller.

The Contractor may also request use of alternate locations and should inform the Owner of such request during the bidding process.

2.3.1 Particulate/Solids Removal

The Contractor shall provide an easily maintained pre-filter (basket strainer, bag filter system, portable sand filter), settling tank, or other means to remove solids from the influent surface water. The pre-filter shall be equipped with a means of determining when changing or cleaning is necessary (i.e., differential pressure gauge, or visual observation). The filter media shall also have a redundant back up, or be capable of being quickly changed out/cleaned such that no significant down time is experienced during regular cleaning or replacement of the pre-filter media.

2.3.2 SVOC Removal

The System shall consist of two steel vessels containing liquid phase granular activated carbon (LPGAC) for SVOC removal. The two vessels shall be interconnected with piping and valves to create a manifold such that the system can be operated in series with either vessel in the lead or lag position, with both vessels in parallel, or with each vessel in isolation.

Virgin activated carbon will be used for the initial filling. Reactivated carbon may be used for future change outs with Owner approval.

2.3.3 Metals Removal

The System shall also include ion-exchange system components for metals removal, if necessary, to meet the discharge limits.

2.3.4 Sample Ports

The System shall include sample ports between the lead and lag vessels; as well as after the lag vessel and/or ion exchange vessel (discharge).

2.4 FLOW METER

The Contractor shall provide a flow meter downstream of the System capable of providing an instantaneous measurement of system flow rate as well as totalizing flows. The flow rate output/display shall read in gallons per minute and display out to three significant digits left of the decimal point. The flow totalizer shall read in gallons and display out to at least 7 digits left of the decimal point. Accuracy shall be within +/-2%.

2.5 HDPE FORCE MAIN

The Contractor shall supply fusion welded pressure piping for the 5" (Nominal) diameter HDPE discharge line. The HDPE force main shall be able to withstand an operating pressure of at least 110 psi and have in inner diameter of at least 4.7". The HDPE force main shall be installed in accordance with Specification 15500.

The HDPE force main shall run from the treatment area on the east end of Quarry 3 (approx El. 160 ft) to the discharge location at Matsunk Creek (approx El. 105 ft).

2.6 WATER DISCHARGE ENERGY DISSIPATER

The Contractor shall place rip-rap at the outlet of the HDPE where it discharges to Matsunk Creek as shown on Drawings E202 and E403.

2.7 ALTERNATIVE TREATMENT OPTIONS

The Contractor may also elect to provide alternative means of water treatment. These alternatives shall be outlined in the bid submittal. The Contractor shall also perform isotherm calculations to produce estimates for carbon and ion exchange media life for various size units and provide costs for different treatment scenarios (i.e. larger carbon vessels, less frequent change out; smaller carbon vessels, more frequent change out) to minimize the cost to the Group.

PART 3: EXECUTION

3.1 MOBILIZATION/DEMOBILIZATION

The Contractor shall coordinate delivery and set-up of the System with the Vendor such that the System does not sit idle prior to use. The System will be demobilized following completion of Pond backfill activities.

During the winter months the water treatment system may be demobilized or winterized and put off line, based upon the Contractor's work schedule. Winterization will be performed by the Contractor and will consist of standard procedures for exposed outdoor piping and water vessels to protect against damage from water expansion and ice (i.e., drain water from system, blow out lines).

3.2 INSPECTION

Inspection by the Group's QA Official will not relieve the Contractor of his responsibility for workmanship, materials, and specification requirements. Each piece of equipment shall be provided with a nameplate, securely fastened in a conspicuous place and clearly inscribed with the equipment manufacturer's name, year of manufacture, serial number, principal rating data, and equipment item number.

The equipment covered in these specifications shall be fabricated in the minimum number of sub-assemblies necessary for transportation. Small components or assemblies shall be adequately boxed or crated to prevent damage during shipment. Each assembly or package shall be identified with a durable shipping tag securely attached and plainly marked with the Contractor's order number, manufacturer's purchase order number, and equipment item number. All openings shall be covered with plywood, plastic, or wood plugs or shields to prevent debris from entering the assemblies. Each assembly or sub-assembly shall have lifting lugs to facilitate erection.

3.3 OPERATION AND MAINTENANCE INSTRUCTION:

The Contractor shall demonstrate to the Group's QA Official its ability to operate the water treatment system. If necessary the Contractor will obtain additional safety and operational training from equipment vendors and manufacturer's used in the system.

An Operation and Maintenance Plan shall be developed for the water treatment system and provided to the Group's QA Official.

3.4 FIELD SERVICE:

The Contractor shall provide the services of a qualified System field representative and supporting personnel for the equipment furnished and installed under this Contract to perform the following:

1. Assistance during equipment installation by the Contractor to align the equipment or check the alignment of pre-aligned equipment prior to and after making connections to or anchoring of the equipment.

2. Inspection during equipment installation work by the Contractor to determine compliance with equipment erection methods and procedures recommended by the manufacturer.

3. Advise the Contractor during equipment check out, start-up, and mechanical "run-in period" of the equipment and systems supplied by the equipment manufacturer.

4. Submit written approval of the equipment installation to the Group's QA Official after satisfactory completion of mechanical start-up and "run-in period" of the equipment by the Contractor.

5. Conduct the start-up including and providing personnel necessary to operate, adjust, calibrate, and tune the equipment and systems into operating service in accordance with the design criteria.

6. The Contractor shall be responsible for providing a change out of LPGAC and/or regeneration of ion exchange media within 48 hours of notification of breakthrough by the Group's QA Official.

3.5 OPERATION OF WATER REMOVAL, TREATMENT AND DISCHARGE SYSTEM

The Contractor shall be responsible for operation of the Water Treatment System, in accordance with the requirements and practices provided by the System equipment manufacturer/supplier. The Contractor will not exceed limits for operating pressure, flow rate, solids, etc provided by the treatment system Vendor.

The Contractor shall ensure that the inlet of the suction hose is kept above the sediment surface within the ponds (or sump) such that muck, debris, and excessive solids are not drawn into the treatment system. Removal of Pond water shall be from the surface down.

The LPGAC vessels shall be operated by the Contractor at all times in a series configuration. Any changes to that mode of operation (operation in parallel, or isolation of a single vessel) must be submitted to and approved by the Group's QA Official prior to implementation.

The System may be operated 24-hours per day or as much as is required by the Contractor to complete Pond water removal in a timely and efficient manner. The Contractor shall coordinate operation and pumping activities with the Group's QA Official each day.

3.6 COMPLIANCE SAMPLING

Compliance sampling will be performed weekly during operation. Compliance samples shall be collected by the Group's QA Official. Samples will be sent to the selected laboratory for analysis and results shall be requested on a 48 hour turn around time.

Compliance samples shall be collected at the effluent of the ion-exchange unit (if used), the midpoint between the lead and lag vessels, and at the discharge location.

3.7 BREAKTHROUGH

Breakthrough is defined as an exceedance of the PADEP Effluent Limits for Temporary Discharge to Matsunk Creek (listed on Table 2-1 of RDR as well as Appendix J) at a specified location.

3.7.1 LPGAC Vessels

The LPGAC vessels shall be operated in series configuration such that if breakthrough is observed at the lead vessel the System may be shut down and evaluated with confidence that breakthrough of the lag vessel has not yet occurred. In such an instance, the Group's QA Official will evaluate the data and distribute data to the Contractor. The Contractor will be responsible for arranging and/or performing the carbon change out of the lead vessel. Interim operation of the water treatment system prior to the Carbon change out may be performed with the approval of the Group's QA Official. The Group's QA Official will also direct the Contractor whether to maintain or change the configuration of the lead and lag vessels.

Spent carbon may be taken for re-activation.

3.7.2 Ion Exchange

If breakthrough is detected at the ion exchange unit the Group's QA Official will evaluate the data and distribute results to the Contractor. The Contractor will be responsible for arranging for backwash of the ion exchange media. If necessary the Contractor shall shut down water treatment operations until the media backwash is completed.

3.8 PROTECTION FROM DAMAGE

The Contractor shall protect the water treatment system and it's components from damage. Particular care should be made to ensure that damage does not occur to the HDPE force main. The HDPE force main should be secured in place as necessary.

3.8.1 Winterization

If the system is operated during periods of below freezing temperatures, or is shut down over such a period the Contractor shall take steps to protect and winterize the system. For a shut down, draining and blowing out all vessels and piping would be appropriate. For winter operations heat tracing, insulation, or other means of freeze prevention would be necessary.

PART 4 : MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Mobilization, erection, construction, and placement of the System by the Contractor shall be performed as a lump sum and will not be measured.

Time onsite for LPGAC and Ion Exchange units shall be measured based upon time on-site starting from the time of the Contractors on-site training. Measurement shall be in Months or fractions thereof.

In the event that LPGAC or Ion Exchange media requires replacement the activity shall be measured as one event for each System.

Demobilization of the System by the Contractor shall be performed as a lump sum and not measured.

Construction of a stone pad for the water treatment system shall be performed as a lump sum and not measured.

Operation of the System shall be measured in gallons of treated water as recorded by a flow meter downstream of the treatment unit.

Installation of the 5" HDPE Force Main shall be measured per lineal foot installed.

Construction of a rip-rap energy dissipater at the outlet of the HDPE Force Main shall be performed as a lump sum and not measured.

4.2 PAYMENT

Mobilization, erection, construction, and placement of the Water Treatment System by the Contractor shall be paid for as a lump sum. The lump sum price shall include, but not be limited to, all labor, equipment, materials, expertise, testing and analysis required to complete the work required by the Specifications.

Time onsite for LPGAC and Ion Exchange units shall be paid for per month. During winter months when the units are not in use they will be paid for at a reduced rate.

LPGAC and Ion Exchange media change out shall be paid for each occurrence. This will include all costs incidental to the work such as travel time to and from the site, personnel and equipment costs, replacement media, and loading and hauling away spent media.

Demobilization of the System shall be paid for as a lump sum.

Construction of the stone pad shall be paid for as a lump sum. The cost will include clearing, grading, stone placement, and compaction to create a stable, level surface for placement of the System.

Operation of the System shall be paid for on an hourly basis. The cost of labor, utilities, pump(s), operation of the pump(s) drawing water out of the Ponds, adjustments to hoses and inlet placement, use of hoses, maintenance and adjustments to the System, repairs to the discharge piping, repairs to pumps, any other work items, materials, or equipment necessary to remove and treat water from Quarry 3 and discharge to Matsunk Creek is considered included in the operation of the system.

The 5" HDPE Force Main shall be paid for on a per lineal foot basis. Payment shall be considered compensation for all materials, equipment, labor, routing, and installation to construct the force main as shown on the Drawings.

Construction of the rip-rap energy dissipater at the outlet of the HDPE force main shall be paid for as a lump sum. Payment shall be considered compensation for all materials, equipment, labor, grading, clearing, etc necessary to place the rip-rap as shown on the Drawings.

PAY ITEM	PAY UNIT
Mobilize, Set Up Water Treatment System	Lump Sum
Carbon Unit Rental (in-use)	Per Month
Ion Exchange Unit Rental (in-use)	Per Month
Carbon Unit Rental (off-line)	Per Month
Ion Exchange Unit Rental (off line)	Per Month
Carbon Unit Change-Out (virgin)	Per Event
Carbon Unit Change-Out (reactivated)	Per Event
Ion Exchange Unit Media Change-Out	Per Event
Demobilize Water Treatment System	Per Event
Construct Stone Pad for Water Treatment System	Lump Sum
Operation of Water Treatment System	Per Hour
Installation of 5" HDPE Force Main	Lineal Foot
Rip-rap Installation	Lump Sum

SECTION 15500
HDPE PIPE AND FITTINGS SPECIFICATIONS

PART 1: GENERAL

1.1 DESCRIPTION

This Specification covers requirements for high density polyethylene pipe and fittings. The Contractor shall ensure that all materials be supplied and work performed in accordance with these Specifications. HDPE pipe will be installed to convey water from the water to Matsunk Creek in accordance with Section 15010 of these Specifications.

1.2 RELATED SECTIONS

A Section 01300 – Submittals

B. Section 15010 – Surface Water Treatment and Discharge System

C. Where all or part of a Federal, ASTM, ANSI, AWWA, etc., standard specification is incorporated by reference in these Specifications, the reference standard shall be the latest edition and revision.

1.3 INSPECTIONS

All work shall be inspected by the Group's QA Official who shall have the authority to halt construction if, in his opinion, these specifications or standard construction practices are not being followed. Whenever any portion of these specifications is violated, the Design Engineer or his Authorized Representative shall, by written notice, order further construction to cease until all deficiencies are corrected.

PART 2: PRODUCTS

2.1 QUALIFICATION OF MANUFACTURERS

The Manufacturer has facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The Group shall approve qualified Manufacturers.

2.2 MATERIALS

Materials used for the manufacture of polyethylene pipe and fittings shall be PE 3408 high density polyethylene meeting cell classification 345464C for black or 345464E for color and stripes per ASTM D 3350; and shall be listed in the name of the pipe and fitting manufacturer in PPI (Plastics Pipe Institute) TR-4 with standard grade HDB rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements. The fitting material may be gray or black.

2.3 INTERCHANGEABILITY OF PIPE AND FITTINGS

Polyethylene pipe and fittings shall be supplied by the same qualified and approved manufacturer. Pipe and fittings from different manufacturers shall not be interchanged.

2.4 POLYETHYLENE PIPE

Polyethylene pipe shall be manufactured in accordance with ASTM F 714 and shall be so marked. Each production lot of material or pipe shall be tested for melt index, density, and for black pipe, % carbon. Each production lot of pipe shall be tested for dimensions and ring tensile strength.

2.5 POLYETHYLENE FITTINGS

Polyethylene fittings shall be molded or fabricated by the approved pipe manufacturer. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe.

2.6 MOLDED FITTINGS

Molded polyethylene fittings shall be manufactured in accordance with ASTM D 3261 and shall be so marked.

2.7 X-RAY INSPECTION

The Manufacturer shall submit samples from each molded fittings production lot to x-ray inspection.

2.8 FABRICATED FITTINGS

Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.

2.9 POLYETHYLENE FLANGE ADAPTERS

Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout.

2.10 BACK-UP RINGS AND FLANGE BOLTS

Flange adapters shall be fitted with convoluted ductile iron back-up rings. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.

2.11 MJ ADAPTERS

MJ Adapters shall have stainless steel stiffener that is mechanically locked into the adapter.

2.12 COMPLIANCE TESTS

In case of conflict between contractor's inspection and testing of the materials and Manufacturer's certifications, the Contractor, Design Engineer, or the Group's QA Official may request retesting by the Manufacturer or have retests performed by an outside testing service. All retesting shall be at the requestor's expense, and shall be performed in accordance with the Specifications. If retesting indicates that a manufacturing flaw exists in the subject item(s), the Contractor or it's Manufacturer will bear the retesting expense and item(s) replacement costs.

PART 3: EXECUTION

3.1 JOINING

3.1.1 Heat Fusion Joining

Joints between plain end pipes and fittings shall be made by butt fusion using procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

3.1.2 Butt Fusion of Unlike Wall Thickness

Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. Standard DR's for polyethylene pipe are 9, 11, 13.5, 17, 21, 26, 32.5, and 41.

3.1.3 Joining by Other Means

Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters, or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

3.1.4 Branch Connections

Branch connections to the main shall be made with saddle fittings or tees.

3.2 INSTALLATION

3.2.1 General

When delivered, a receiving inspection shall be performed and any shipping damage shall be reported to the Manufacturer within 7 days.

In general, the pipe will be installed on the ground surface. In areas of high-traffic, or where it is other-wise desirable to bury the pipe, the Contractor will install the pipe underground as directed by the Design Engineer. Underground installation shall be in accordance with these specifications and ASTM D 2321.

3.2.2 Foundation and Grade

Pipe shall be laid on a stable foundation that provides continuous support without voids below the pipe. Unstable surface or trench bottom soils shall be removed, and a 6" foundation or bedding of compacted general fill material shall be installed to pipe bottom grade. A trench cut in rock or stony soil shall be excavated to 6" below pipe bottom grade, and brought back to grade with compacted general fill bedding. The trench bottom shall be graded to the required slope before placing the pipe in the trench. Where bedding must be removed to provide clearance for devices such as mechanical joints, bolted flanges, or appurtenances, the bedding shall be replaced and compacted beneath the device before backfilling so that the pipeline grade and continuous support without voids are maintained. All necessary precautions shall be taken to ensure a safe working environment in accordance with all applicable safety codes and standards.

3.2.3 Excavation

Trench excavations, where necessary, shall conform to the plans and drawings and with all applicable codes.

3.2.4 Mechanical Joint and Flange Installation

Mechanical joint (MJ) and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ adapters and flanges shall be centered and aligned to each other before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1 hour after initial assembly,

flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.

3.2.5 Pipe Handling

When lifting with slings, only wide fabric choker slings capable of safely carrying the load shall be used to lift, move, or lower pipe and fittings. Wire rope and chain are prohibited. Slings shall be of sufficient capacity for the load, and shall be inspected before use. Worn or damaged equipment shall not be used.

3.2.6 Backfilling

Backfill soil, where needed, shall be native material, provided the soil is free of debris, stones, boulders, clumps, frozen clods, or the like larger than 8" in their largest dimension. Backfill shall be placed and compacted using a mechanical tamper in 6" lifts to at least 6" above the pipe crown. During backfill placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.

3.3 TESTING

3.3.1 Fusion Quality

The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the QA Official, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

3.3.2 Leak Testing

Leak testing shall be conducted in accordance with Performance Pipe Technical Note 802 *Leak Testing*.

PART 4: MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

HDPE pipe installation shall be measured in accordance with Specification 15010.

4.2 PAYMENT

HDPE pipe installation shall be measured in accordance with Specification 15010.

APPENDIX E

Design Drawings

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APPENDIX F

Vehicle and Pedestrian Traffic Control Plan
(Not Included - Provided With 100% Phase 1 RD)

APPENDIX G

Sampling and Analysis Plan

APPENDIX G
SAMPLING AND ANALYSIS PLAN
100% REMEDIAL DESIGN

QUARRY 3

CRATER RESOURCES SUPERFUND SITE
UPPER MERION TOWNSHIP, MONTGOMERY COUNTY, PENNSYLVANIA

Prepared For:

CRATER RESOURCES COORDINATING RESPONDENT GROUP

Prepared By:

ADVANCED GEOSERVICES CORP.
West Chester, Pennsylvania

Project Number 2001-847-15
January 20, 2009
Revised July 8, 2009

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been written for the construction and post-construction portions of the Remedial Action for Quarry 3 of the Crater Resources Superfund Site (Site) located in Upper Merion Township, Pennsylvania. This SAP provides the specific descriptions of soil, treated water, and air sampling procedures to be performed during the Construction and Post-Construction activities. The previously approved Quality Assurance Project Plan (QAPP) provides the quality assurance procedures for the field sampling and laboratory analysis of the samples.

The SAP consists of six sections. Section 1.0 presents a brief discussion of the Site background which includes location and Site history. Section 2.0 discusses the sampling objectives. The sampling location and frequency is provided in Section 3.0. Section 4.0 discusses the sample identification for each sampling area. Section 5.0 details the equipment decontamination procedures to be followed and Section 6.0 covers the sample handling that is required.

1.1 SITE BACKGROUND INFORMATION

Records indicate that from 1918 through 1981, a coke manufacturing facility in Swedeland, Pennsylvania discharged waste water via pipeline into Quarry 3. The facility was located on the west side of the Schuylkill River, approximately one mile to the northeast of the Site.

During the years of operation the coking process generated coal gas, light oils, tars containing phenolic compounds, naphthalene, ammonia, and wastewater. These compounds are grouped together in the ROD and termed waste ammonia liquor (WAL). It is reported that wastewater from the coke manufacturing process underwent varying degrees of treatment over the years but was consistently discharged into the Quarries 1, 2, and 3 during the years of operation.

Over the past 35 years the Site has been thoroughly assessed and investigated by federal, state, and local environmental regulatory agencies. A Remedial Investigation (RI) was performed by the Crater Resources Participating Parties Group and that investigation is summarized in a document titled "Remedial Investigation Report, Crater Resources Superfund Site, dated June 4,

1999. Following approval of the RI Report, the Crater Resources Participating Parties Group prepared a Feasibility Study for the site title "Feasibility Study for the Crater Resources Superfund Site, Upper Merion Township, Pennsylvania, dated February 29, 2000. The United States Environmental Protection Agency (USEPA) modified and then approved the FS on June 16, 2000. The USEPA issued a Record of Decision (ROD) for the Site on September 27, 2000, which set forth the remedial requirements for the Site.

1.1.1 Overall Site Remedy

This remedial action is being conducted in accordance with the remedy specified in the ROD and the Crater Resources Superfund Site Administrative Order (Order) for "Remedial Design and Remedial Action", Docket No. 3-2001-0009, dated April 30, 2001. The USEPA is the lead regulatory agency at the Site, with support being provided by the Pennsylvania Department of Environmental Protection (PADEP) and the Upper Merion Township Board of Supervisors. Completion of the remedial action at the Site is the responsibility of the Crater Resources Cooperating Respondent Group (Group).

Remediation of several areas of the Site is being or has been completed by other parties in cooperation with the Group and those areas are addressed in other remedial design documents. This SAP focuses on the remedial activities to be performed in Quarry 3.

1.1.2 Quarry 3 Remedial Action Descriptions

The Quarry 3 Remedial Action (RA) focuses on the removal of impacted soils, sediment, and surface water in Quarry 3 and filling the Quarry with clean soil to a level that establishes a uniform grade and proper drainage of stormwater as required by the ROD. Due to the size of the project, it is anticipated that the construction activities could be conducted during two construction seasons with a winter shutdown from Late December through early March. It is anticipated that construction would be phased as follows:

- Phase 1: The first Phase, which is planned to be performed between August, 2008 and December, 2008 includes the removal of sediment and surface water from the

three Ponds in Quarry 3 and filling the Ponds with clean soil to the surrounding grade. Construction of the proposed access road, installation of office trailers, clearing and grubbing, and construction material lay-down areas would also be completed during this phase. It is possible that backfill activities could extend into the spring of 2009.

- Phase 2: The second Phase, which is planned to be performed in 2009 will include removal of impacted soils and Plateau Area material in Quarry 3 and filling the remaining quarry floor area with clean soil to a level that establishes a uniform grade, and provides for proper drainage of stormwater.

The RA Contractor may elect to perform the work using an alternate schedule and approach such as performing both phases of work at the same time, working through the winter and not demobilizing between phases. The final construction approach will be provided in the Contractor's Remedial Action Work Plan.

2.0 SAMPLING OBJECTIVES

2.1 QUARRY 3 PERFORMANCE STANDARDS

The performance standards for the Quarry 3 RA are presented in the ROD and include the ARARs presented in Table 14 of the ROD. Some ROD standards have been or are in the process of being modified by USEPA based on the results of the pre-design analyses discussed in the Remedial Design Report. The performance standards include the following:

- Pond Surface Water – Surface water in the Ponds will be treated on-site and discharged to Matsunk Creek. The treatment standards for discharge to Matsunk Creek have been provided by PADEP and are presented in Table 2-1 of the Design Report;

- Pond Sediments – Sediments at the bottom of the Ponds will be excavated to the bedrock surface, dewatered or otherwise conditioned and taken off-site for disposal. The processed sediments must pass the paint filter test and remain stable in the transport truck. Since the Pond bottoms and sidewalls are reported to be rock, no sampling is planned following excavation.

- Plateau Area Material – The Plateau material will be excavated to the bedrock surface or until the remaining soil meets all of the following criteria as demonstrated by confirmation sampling:

  - the 95% upper confidence limit (UCL) on the mean concentration (as calculated using the operative statistical program at the time of preparation)of each residual soil PAH constituent is below the ROD standard;
  - the inorganic constituents are consistent with background concentrations; and,

- Naphthalene concentrations are lower than 48 mg/kg as the 95% upper confidence limit (UCL) on the mean concentration.

- Remaining Impacted Soils in Quarry 3 – The remaining impacted soils in Quarry 3 will be excavated at the locations identified in the Remedial Design Report to the limits necessary to meet the following criteria, as demonstrated by confirmation sampling:

  - the 95% upper confidence limit (UCL) on the mean concentration (as calculated using the operative statistical program at the time of preparation) of each residual soil PAH constituent is below the ROD standard; and,
  - the inorganic constituents are consistent with background concentrations.

- Naphthalene concentrations are lower than 48 mg/kg as the 95% upper confidence limit (UCL) on the mean concentration.

- Sediment, Soil and Plateau Area Material Disposal – All materials to be sent off-site for disposal must be handled in accordance with Pennsylvania Residual Waste Regulations at PA Code 299, PA hazardous waste regulations at 25 PA Code, Chapters 262, 263 and 264, and federal hazardous waste regulations at 40 CFR Part 268. The Pond sediment and Plateau Area material have been tested for waste profiling purposes and have been determined to be non-hazardous wastes. Therefore, it is anticipated that all materials will be disposed in accordance with the residual waste regulations.

- Backfill of Quarry 3– The Quarry will be backfilled with soil that meets the excavation performance criteria. This soil may include Site soil that meets the criteria or soil imported from off-site. The Quarry will be graded to drain out the east end of the quarry into the adjacent drainage ditch. Backfill soils will be compacted to minimize the potential for subsidence.

- Air Emissions – Fugitive dust and other air emissions will be closely monitored and control measures will be implemented as necessary to minimize potential impacts to the surrounding area.

2.2 SAMPLING OBJECTIVES

The sampling objectives for the Quarry 3 RA are to document compliance with the performance standards discussed above. Specific sampling objectives are discussed below:

- Surface Water – Treated Pond surface water will be sampled to demonstrate compliance with the treatment standards for discharge to Matsunk Creek, which have been provided by PADEP.

- Sediments – Dewatered or conditioned Pond sediments will be tested to confirm that there are no free liquids in the sediment (USEPA Paint Filter Liquids Test). It will also be visually inspected to confirm that it is stable in the transport truck prior to the truck leaving the site. No sampling or analyses are planned. Since the Pond bottoms and sidewalls are reported to be rock, no excavation bottom or sidewall sampling is planned following excavation.

- Plateau Area Material – Following excavation of the Plateau Area material, the excavation area will be sampled to demonstrate that the remaining soil meets performance standards presented above.

- Remaining Impacted Soils in Quarry 3 – Following excavation of the remaining impacted peripheral soils, the Quarry, the excavation areas will be sampled to demonstrate that the remaining soil meets performance standards presented above.

- Sediment, Soil and Plateau Area Material Disposal – No additional testing is anticipated during Quarry 3 remedial activities for disposal compliance.

- Backfill of Quarry 3– Backfill soils will be sampled prior to being delivered to demonstrate that it meets the Quarry soil performance criteria.

- Air Emissions – Air monitoring will be performed to demonstrate that public health is being protected.

3.0 SAMPLE LOCATION, FREQUENCY, AND DATA EVALUATION

PHASE 1

3.1 SURFACE WATER TREATMENT COMPLIANCE SAMPLING

Surface water from the three Ponds in Quarry 3, water from decontamination activities, as well as water that accumulates within the Quarry prior to the completion of soil excavation activities, will be pumped out of the Quarry and treated on-site prior to discharge to Matsunk Creek. The QA Official will collect samples of the treatment system effluent for analysis to demonstrate compliance with the PADEP Letter of Authorization to Discharge (Appendix J) as well as to monitor treatment system performance.

3.1.1 Sample Frequency

During the RA, treated water will be sampled in accordance with the following schedule:

- During start up and testing, sampling will be performed after the first 50,000 gallons have been treated to confirm the system is operating as required. Water will be discharged back into Pond 2 during the start up period. If the discharge criteria are not met, the contractor will make adjustments to the system, and discharge treated water to Pond 2, until the sample data indicates the treatment criteria can be met on a consistent basis.
- During the first two days (48 hours) of discharge to the Creek, sample daily.
- Sample weekly thereafter, until discharge ceases.

3.1.2 Sample Collection

The QA Official will collect treated water compliance samples. A grab sample will be collected at the effluent location of the treatment system via a sample collection port or tap. If the treatment system uses a series of vessels to remove contaminants, then once discharge to the

creek has begun, a sample will also be collected prior to the lag treatment vessel to monitor treatment system performance.

3.1.3 Data Evaluation

Treated surface water data will be reviewed and evaluated against the discharge criteria by the QA Official and the Contractor to confirm compliance with the PADEP Letter of Authorization to Discharge and to determine when carbon replacement or other maintenance may be required.

3.2 OFF-SITE BORROW MATERIAL

3.2.1 Structural Soil Fill

The Contractor shall perform geotechnical analysis on imported material to be used as structural soil fill as described in Specification 02210 Paragraph 2.1 at a frequency of once per 5,000 CY.

The Contractor shall perform analytical testing on imported material to be used as soil backfill to demonstrate that the material is below the Quarry 3 ROD standards and meets the Pennsylvania Clean Fill Criteria. Analytical testing shall be performed at a rate of once per 10,000 CY for each borrow source.

More frequent testing may be required, as determined by the QA Official.

3.2.2 General Soil Fill

The Contractor shall perform geotechnical analysis on imported material to be used as general soil fill as described in Specification 02210 Paragraph 2.2 at a frequency of once per 5,000 CY.

The Contractor shall perform analytical testing on imported material to be used as general soil fill to demonstrate that the material is below the Quarry 3 ROD standards and meets the Pennsylvania Clean Fill Criteria. Analytical testing shall be performed at a rate of once per 10,000 CY for each borrow source.

More frequent testing may be required, as determined by the QA Official.

3.2.3 Fill and Topsoil Analytical Criteria

Pennsylvania Clean Fill Criteria requirements for supplier certification, due diligence, and analytical testing are provided in Appendix III of this SAP.

In addition the Quarry 3 remedial standards are listed below.

Inorganics – the UTL background concentrations to be used are:

	Surface	Subsurface
Aluminum	21,825 mg/kg	N/A
Arsenic	13.1 mg/kg	13.1 mg/kg
Iron	67,004 mg/kg	N/A
Manganese	N/A	4,113 mg/kg
Mercury	11.6 mg/kg	13.0 mg/kg

Organics

	Surface	Subsurface
Benzo(a) anthracene	3.59 mg/kg	N/A
Benzo(b)fluoranthene	5.65 mg/kg	N/A
Benzo(a)pyrene	4.13 mg/kg	11.0 mg/kg
Dibenzo(a,h)anthracene	0.895 mg/kg	4.48 mg/kg
Indendo(1,2,3,c,d)pyrene	2.96 mg/kg	N/A
2 Methylnaphthalene	N/A	16 mg/kg
Naphthalene	48.0 mg/kg	48.0 mg/kg

Imported fill soil will meet the lower of the surface or subsurface criteria.

For topsoil Total Organic Content (ASTM D-2974) must also exceed 5%.

PHASE 2

3.3 PLATEAU AREA SAMPLING

3.3.1 Plateau Bottom Soils Investigatory Sampling

A layer of potentially un-impacted native soils, up to several feet thick, may exist between the Plateau Materials and bedrock (see table of excavation depths versus refusal depth on Drawing

E203). If the material appears to be un-impacted it will be sampled in a similar manner to the Pre Design Investigation Sampling. Soils that are below the Quarry 3 Clean Up Standards may remain in place. Investigatory sampling will be performed by the Group's QA Official. Samples will be collected by digging test pits and sampling the materials therein.

3.3.1.1 **Sample Location/Frequency**

Samples will be collected from within the potentially un-impacted soils which sit above the bedrock at the Plateau Area. Samples will be collected from the 0-6" horizon, 1-2' horizon, 2'-4' horizon, 4'-6' horizon, and from 1' above to the bottom of the excavation.

Samples will be collected based on a 50'X50' grid (one sample per 2500 SF). A single test pit will be excavated within the grid with samples collected at the multiple depths describe in the previous paragraph. An example sampling grid is shown on Drawing E404.

The QA Official will locate and document the sample collection points.

3.3.1.2 **Sample Collection**

The Contractor will assist with sample collection by providing equipment and labor to excavate test pit. The investigatory samples will be collected from within the test pit. The QA Official will collect Plateau Area confirmatory samples using a decontaminated shovel, trowel, or hand auger to obtain the sample.

3.3.1.3 **Data Evaluation**

The results of the bottom soils investigatory sampling will be evaluated using the 95% UCL calculation methodology described in Section 2.5 of the Phase 2 RD Report.

3.3.2 Plateau Confirmatory Sampling

The excavation of the Plateau Area will occur within the areas shown on the drawings (E203). If the bottom soil layer is completely excavated the bottom and/or sidewalls of the excavation may be at bedrock, in which case no confirmatory sampling from rock surfaces will be performed. If the investigatory sampling indicates that no remaining bottom soils require investigation then no confirmatory sampling will be required. If the investigatory sampling indicates that some bottom soils require excavation then confirmatory sampling will be performed to determine when excavation is complete. The QA Official will perform the sampling and associated activities and the Contractor will provide assistance as needed to facilitate the sample collection process.

3.3.2.1 **Sample Location/Frequency**

One grab sample will be collected from the bottom of excavation at a frequency of one per 2500 SF. Side wall samples will be collected for every 50 feet of sidewall length.

The QA Official will locate and document the sample collection points.

3.3.2.2 **Sample Collection**

The QA Official will collect Plateau Area confirmatory samples. Samples will be collected by using a decontaminated shovel, trowel, or hand auger to obtain the sample. Sidewall samples will be collected from the mid-height of the sidewall and 0-6" into the sidewall.

3.3.2.3 **Data Evaluation**

For bottom locations that exceed the remedial action goals, additional excavation will be performed within the 2500 SF area represented by the failed sample, as directed by the QA Official. After removal of additional material, the area will be re-sampled.

For sidewall locations that exceed the remedial action goals, additional excavation will be performed along length of the sidewall from the mid-point between samples that meet remedial goals and samples that do not. Following the additional excavation, the sidewall will be re-sampled.

3.4 PERIPHERAL SOIL REMOVAL POST-EXCAVATION CONFIRMATORY SAMPLING

The excavation of impacted peripheral soils from within Quarry 3 will occur within the areas shown on Drawing E203. An initial area-wide excavation to a depth between 6" and 12" will occur. Additional excavation of shallow subsurface soil will also be performed initially in 10'X10' squares around sample locations SB-1, SB-3, SB-7, SB-17, and SB-20. The QA Official will perform the sampling and associated activities and the Contractor will provide assistance as needed to facilitate the sample collection process.

3.4.1 Sample Location

For the area-wide excavation, one grab sample will be collected for every 50 feet of sidewall length within the excavation area. One grab sample will be collected from the bottom of excavation at a frequency of one per 2500 SF.

For each of the individual deeper excavation locations one sample will be collected from each sidewall and one sample from the bottom.

The QA Official will locate and document the sample collection points.

3.4.2 Sample Collection

The QA Official will collect soil excavation confirmatory samples. Samples will be collected by using a decontaminated shovel, trowel, or hand auger to obtain the sample. Sidewall samples will be collected from the mid-height of the sidewall and 0-6" into the sidewall. Bottom samples will be collected from the 0-6" interval below the excavated surface.

3.4.3 Data Evaluation

Soil Removal area confirmation samples will be evaluated using the statistical approach developed for Quarry 3 as described in Appendix M and sample locations exceeding the remedial action goals will be re-excavated.

For sidewall locations, the additional excavation will be performed along the entire depth of the sidewall from the mid-point between samples that meet remedial goals and samples that do not. Following the additional sidewall excavation, the sidewall will be re-sampled.

For bottom locations, the additional excavation will be performed within the 2500 SF area represented by the failed sample, as directed by the QA Official. After removal of the additional material, the area will be re-sampled.

3.5 TOPSOIL

The Contractor shall perform a soil analysis on material to be used as topsoil to determine total organic content, nutrients, and pH such that fertilization and liming recommendations can be developed. Topsoil analysis shall be performed once for every 5,000 CY.

The Contractor shall perform analytical testing (unless recent and representative analytical data are available from the borrow source) on material to be used as topsoil at a frequency of once for each borrow source to demonstrate that the material is below the Quarry 3 ROD standards and meets the Pennsylvania Clean Fill Criteria.

More frequent testing may be required, as determined by the QA Official.

3.6 AIR MONITORING

Air monitoring will be performed during all phases of work during the Quarry 3 RA. Air monitoring will consist of three zones of monitoring: work zone, near field and perimeter. The purpose of work zone air monitoring is to ensure that adequate PPE is being utilized and to

ensure that workers are not being exposed to contaminants. Work zone air monitoring will be performed by the Contractor in accordance with his Health and Safety Plan (HASP). Near field monitoring consists of real time monitoring that is performed by the QA Official. The near field monitoring will allow the Contractor to react to real time particulate, VOC, and odor observations and modify work activities to ensure that excessive levels of dust and odors are not leaving the Quarry. Perimeter monitoring will be performed by the QA Official to monitor air quality for the general public who use the parking lots, office buildings, roads, foot paths, and Golf Course bordering Quarry 3.

3.6.1 Perimeter Air Sampling

3.6.1.1 **Frequency**

Perimeter air sampling will be conducted for Arsenic, Mercury, Total VOC, Naphthalene, Coal Tar Pitch Volatiles and particulates prior to and during construction activities. Samples will be collected simultaneously for a nominal 8-hour period at 4 locations.

Frequency of air monitoring will be as follows:

- Background samples will be collected for at least two 8-hour daytime periods prior to the start of any Quarry 3 construction activities;
- During the first two days of a Quarry 3 remedial activity (i.e., Sediment Removal, Plateau Area Excavation, Soils Excavation, Stockpiling outside of the Quarry, Material Conditioning, etc); and,
- Randomly, one day per week during construction.

Additional air monitoring may also be performed any time the Health and Safety Coordinator (HSC), the Group's QA Official, or the Group determines the need for increased monitoring such as fluctuations in real time data above action levels or significant odor perception onsite or at perimeter;

A summary schedule for air monitoring activities is presented on Table 3-1.

3.6.1.2 **Location**

Four locations around the perimeter of the Work area will be sampled during construction. The sampler locations shown on Figure 3-1 are described below and will be adjusted by the Group's QA Official based on site conditions and the predominant wind direction.

- **PM-1**

  PM-1 will be located near the construction entrance at Renaissance Boulevard. This location will be used to assess monitor the air quality at Renaissance Boulevard.

- **PM-2**

  PM-2 will be located North-east of the entrance of Quarry 3 near the property line with the adjacent parking lot at 2301 Renaissance Boulevard. This location will be used to monitor air quality at the adjacent office building and parking lot.

- **PM-3**

  PM-3 will be located along the South rim of the Quarry near the edge of the Golf Coarse. This location will be used to monitor air quality at the Golf Course.

- **PM-4**

  PM-4 will be located to the North-west of the Quarry near the back corner of the parking lot for the office building located at 2701 Renaissance Boulevard. This location will be used to monitor air quality at the adjacent office building and parking lot.

3.6.1.3 **Procedures**

Sample collection will be performed using personal air samplers (Gilian GIL-AIR, or approved equivalent) equipped with an appropriately sized filter. Multiple air sampler pumps equipped with different cartridges for the various Quarry 3 constituents will be required at each location. Equipment and laboratory methods for the various site COCs are listed on Table 3-1.

3.6.1.4 **Field Sampler Calibration**

Perimeter air monitoring devices shall be calibrated at the manufacturer's recommended frequency.

3.6.1.5 **Climatological Data**

Climatological data will be collected via the Northeast Regional Climate Center (NRCC). Daily wind speed and direction data are obtained from the NRCC for King of Prussia, Pennsylvania. The wind speed is recorded in miles per hour, while the direction is recorded in degrees. A wind sock or other onsite means of determining prevailing wind conditions at the Site will also be used. The direction recorded is the direction from which the wind is blowing.

3.6.1.6 **Data Evaluation**

Samples analyzed by laboratory methods include arsenic, mercury, VOCs, naphthalene, coal tar volatiles, and particulates. The selected laboratory will maintain full accreditation through the American Industrial Hygiene Association (AIHA). Analysis will follow all specified OSHA/NIOSH procedures. Lab samples will be shipped overnight and submitted for a 5 day turn around time (TAT) for the first two days of sampling. Sample TAT will be specified for the remaining samples based on the initial data.

Qualitative real-time data will be compared against quantitative laboratory data to refine action levels and monitor site conditions so that workers and the public are protected. Perimeter action levels are listed on Table 3-2 and the recommended course of action for exceedences of those action levels is described in Specification 02117, as well as summarized on Table 3-2.

3.6.2 Near Field (Real-time) Air Monitoring

Real-time air monitoring will be performed every 2 hours at two locations on the Quarry rim downwind of work activities, downwind of any other work zones related to the Quarry 3 remediation, and at the Work area perimeter. Real-time near field monitoring will be conducted separately of the Contractor's personal air monitoring. Real time measurements will be recorded based on a 15-minute running average.

3.6.2.1 **Total Suspended Particulates**

Real-time air monitoring for total suspended particulates (TSP) will be conducted during construction. Monitoring will be conducted at least every two hours using hand-held units with datalogger capabilities such as Casella Microdust Pro 800nm Aerosol Monitor, or approved equivalent.

Real-time monitoring for particulates will be performed during material excavation, backfill, waste handling, loading or unloading of bulk solids, and during times of transport truck traffic on the haul road.

A real-time airborne particulate concentration of 1.5 mg/m^3 at the Quarry 3 rim will be used as the upper limit to ensure that the OSHA limit for total dust (15 mg/m^3) is not exceeded. Exceedences of this limit at the Quarry rim will trigger a modification of work activities until adequate measures can be taken to reduce TSP to acceptable levels. If necessary, work activities will be stopped until adequate dust controls can be enacted.

3.6.2.2 **Semi- and Volatile Organic Compounds**

Real-time air monitoring of volatile (VOC) and semi-volatile organic compounds (SVOC) will be conducted during construction. Monitoring will be conducted at least every two hours using hand-held units with datalogger capabilities such as Photo Vac 2020 Pro Plus PID, or approved equivalent (10.6 eV ionization potential).

Real-time monitoring for odors and emissions will be performed during excavation, anytime open excavation areas exist, and during waste handling.

A TVOC measurement of 1 ppmV will be used as the upper limit to ensure that volatile and semi-volatile organic compounds are not being emitted during work at unacceptable levels.

3.6.2.3 **Calibration**

Hand held air monitoring instruments will be calibrated on a daily basis in accordance with the procedures recommended by the instrument manufacturer.

3.6.3 Personal Air Monitoring

Personal air monitoring will be conducted during construction as required by the Contractor's Health and Safety Plan to monitor Site Constituents of Concern (COC) in the work areas. Samples will be collected on a time weighted average. The impact of sample results on work practices will be as defined in the Contractor's Health and Safety Plan.

Suggested air COC concentrations are listed on Table 3-2. The calculated factor of safety for those suggested air COC concentrations is listed on Table 3-3.

Table 3-3 calculates what the maximum soil concentration of the individual compounds could be at their individual PEL when the TSP is at 15 mg/m^3 (OSHA PEL for Particulates). That calculation is then compared to the actual highest soil concentration reported in the Statistical Analysis performed for Quarry 3. The ratio difference between the calculated maximum and the actual maximum concentration provides the factor of safety at the dust PEL of 15 mg/m^3.

3.6.4 Recordkeeping

At a minimum all air monitoring results will be recorded in a bound log book. Readings from perimeter, near field, and personnel monitoring will be recorded. Prevailing wind direction and weather conditions at the site will also be recorded. In addition, any exceedences of air monitoring limits shall be noted along with the corrective actions taken to address the exceedance.

3.7 DISPOSAL SAMPLING

Sampling and testing required for disposal of materials will be performed by the Group's QA Official.

3.7.1 Sample Location

It is not anticipated that chemical analysis will be required for excavated and conditioned materials that are being disposed of offsite. However, if necessary the material will be sampled in accordance with the selected disposal facilities requirements, or as directed by the Group.

For conditioned material (Pond sediments and plateau material) that is being loaded into trucks for offsite transport a representative sample will be collected from loaded trucks or material stockpiles to perform field paint filter testing as described in Appendix II of this SAP.

3.7.2 Sample Frequency

Samples of conditioned material collected for chemical analysis will be collected at the frequency required by the disposal facility, or as directed by the Group.

Conditioned material will be tested for free liquids using the 'Paint Filter Test' described in Appendix II of this SAP. The 'paint filter test' will be performed at least once per 250 CY of material to be sent offsite for disposal. Testing frequency may be increased as determined by the Group's QA Official based on material conditions.

3.7.3 Data Evaluation

Results for any material sampled and analyzed for disposal facility criteria will be reviewed and compared against the applicable facility requirements. The QA Official will direct the Contractor how to proceed based on that review and the determinations of the disposal facility.

Material that does not pass the 'paint filter test' will not be permitted to be loaded and/or shipped offsite. Such material would have additional conditioning performed to make it suitable for transport.

3.8 POST RA SUPPORT AREA SAMPLING

Sampling and testing required to confirm that there has been no impact to soils beneath haul roads, transfer areas, decon pads, and other support areas within the exclusion zone will be performed by the Group's QA Official.

3.8.1 Sample Location/Frequency

At the completion of the soil removal the haul road, decon pad, and other stone/geotextile constructed support areas will be removed. The soils beneath will be sampled by the Group's QA Official at locations showing visual signs of being impacted, and in accordance with a sample grid established based on section 3.8.2.

One grab sample will be collected from the soils beneath former support areas within the exclusion zone at a frequency of one per 2500 SF. For the former haul road areas within the exclusion zone, one grab sample will be collected for every 100 feet of length (approximately 1 per 2400 SF). At least one separate bottom sample will be collected from the area of the former decon pad and from the area of the former water treatment area.

Sidewall samples are not anticipated to be necessary.

The QA Official will locate and document the sample collection points.

3.8.2 Sample Collection

The QA Official will collect soil excavation confirmatory samples. Samples will be collected by using a decontaminated shovel, trowel, or hand auger to obtain the sample. Sidewall samples will be collected from the mid-height of the sidewall and 0-6" into the sidewall. Bottom samples will be collected from the 0-6" interval below the excavated surface.

3.8.3 Data Evaluation

Confirmation samples collected from exclusion zone support areas will be evaluated by comparing to the remedial action goals for Quarry 3 SVOCs and sample locations exceeding the remedial action goals will be re-excavated.

For bottom locations, the additional excavation will be performed within the 2500 SF area represented by the failed sample, as directed by the QA Official. After removal of the additional material, the area will be re-sampled.

4.0 SAMPLE DESIGNATION

4.1 TREATED WATER SAMPLE DESIGNATION

During surface water treatment operations samples collected for compliance analysis will be identified by the location within the treatment system (e.g. "LPGAC-Eff" or "LPGAC-Mid" for carbon vessels in series; "IEX-Eff" for ion exchange unit effluent). The date (Month, Day, Year) will also be incorporated. Example: LPGAC-Eff-09202008. If multiple samples are collected on the same day, then a letter will be added to the identification (i.e., LPGAC-Eff-09202008-A)

4.2 SOIL SAMPLE DESIGNATION

4.2.1 Borrow Source Sample Designation

During construction, off-site borrow source material will be imported to use as fill. A short ID to identify the supplier ("Soil Depot"), material (topsoil "TS", general fill "GF", structural fill "SF", stone "ST", etc), sample number, and aliquot number will be used to identify the samples. For example, SoilDepot-TS-1-1 would be the first aliquot from the first sampling event for topsoil. This sample could be a grab sample analyzed for VOCs. For composite samples analyzed for other compounds, a "C" and the individual aliquot identifiers would be used and the sample identification would be SoilDepot-TS-1-C1234, which indicates that this is a composite of the first four aliquots from the first sampling event for topsoil from the supplier "Soil Depot."

4.2.2 Confirmatory Sampling

Samples collected as part of the confirmatory sampling program outlined in this SAP will be identified with the source area within Quarry 3 (Pond1, Pond2, Pond3, Plateau, 6" Soils, SB1, SB3, SB7, SB17, or SB20) and the type of confirmatory sample (Bottom "BT" or Sidewall "SW"). In addition, sidewall samples will also have a directional identifier incorporated into the sample ID (i.e., North "N", South "S", East "E", West "W"). The date (Month, Day, Year) will also be incorporated. Example: Pond1-BT-10182009 or SB17-SW-N-05022009. If multiple

samples are collected at the same location on the same day, then a letter will be added to the identification (i.e Pond1-BT-10182009-A)

4.3 AIR SAMPLE IDENTIFICATION

4.3.1 Perimeter Air Sampling

The perimeter air sample designation will consist of the sample location (PM-1, PM-2, etc.) and sample run date (month, date, year); example PM-4-08122008.

4.3.2 Real-Time Air Sampling

As samples are not generated during real-time air sampling, sample identification is not required. However, the data generated by real-time air sampling will be recorded in field books or printouts from the data logger.

4.3.3 Personal Air Sampling

Personal air samples will be designated with a unique naming system developed by the Contractor. At a minimum, the naming system will include the job classification associated with the sample and sample run date.

5.0 EQUIPMENT DECONTAMINATION

For the sampling events that will occur during the Quarry 3 RA, the following section outlines the procedures for sampling equipment decontamination.

The sampling methods prescribed herein have been developed to minimize the possibility of cross-contamination. Equipment decontamination will be conducted prior to sampling each location. Those sampling implements which cannot be decontaminated effectively will be disposed of between and after sample collection.

5.1 DECONTAMINATION PROCEDURES

5.1.1 Soil

The soil sampling equipment will be stainless steel trowels or hand augers and stainless steel bowls for area-wide and borrow source sampling. Decontamination procedures for all non-disposable sampling equipment to be used will be as follows:

- Remove particulate matter and surface films with tap water;
- Alconox and brush as necessary;
- Tap water rinse;
- 10% Nitric acid rinse (if sampling for metals);
- Rinse with deionized water;
- Pesticide grade Isopropyl Alcohol rinse (if sampling for organics);
- Air dry (if possible); and,
- Cover with plastic or wrap in aluminum foil if stored overnight.

Any deviations from these procedures will be documented in the field logbook.

Excess soils will be returned to the ground in the vicinity of the sample collection points. Decontamination water will be collected and transferred to the decontamination pad for processing with other decontamination liquids.

Disposable plastic trowels or aluminum mixing pans may be substituted when material conditions allow.

5.1.2 Treated Water

Typically water samples will be collected directly into a laboratory supplied container. No decontamination will be necessary.

6.0 SAMPLE HANDLING

All sample bags/jars/bottles will be identified by the use of sample labels with the sample identification (e.g., LPGAC-Eff-09202008, etc.). Each air sample filter cartridge will be placed into a plastic bag and labeled. Each sample label will be filled out by the sampler to avoid any possibility of sample misidentification and attached to the sample container. Indelible ink will be used to complete the sample labels. Each sample label will be completed at the time of collection with, at a minimum, the following information:

- Sample identification;
- Initials of the sample collector;
- Time and date of the sample collection;
- Site name and location number (if any);
- Requested analyses;
- Any preservative added or field preparation performed; and,
- Sample designation if this sample is a quality assurance sample.

Each member of the sampling team will use a new pair of gloves at each sample location; however, the same pair of gloves can be used when collecting samples for compositing.

The field sampler will maintain custody of the samples following the procedures outlined in the following sections until the samples are properly relinquished to the laboratory or a common carrier for delivery to the laboratory. Once at the laboratory, each sample will be assigned a unique laboratory identification number that will be used for analysis assignment, sample tracking, and data reporting while the samples are at the laboratory.

6.1 SAMPLE CUSTODY/SAMPLE CONTROL

A sample is physical evidence collected from the Site. Due to the evidentiary nature of the data generated from sampling, sample custody must be traceable from the time the empty sample

containers are prepared by the laboratory through the reporting of the results of the analyses. Therefore, sample control procedures have been established to ensure sample integrity. All sample containers and samples will be maintained under strict custody procedures throughout the investigation. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample or sample container will be considered under custody if:

- An item is in the actual possession of the person; or
- The item is in the view of the person, after being in actual possession of the person; or
- The item was in the person's actual physical possession but is now locked up or sealed in a tamper-proof manner; or
- The item is placed in a designated secured restricted area.

6.1.1 Field Custody Procedures

The field personnel in charge of collecting the samples will maintain custody of the samples collected. The field personnel will be responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory or archived. All samples scheduled for shipment to the laboratory for VOC, SVOC, or PAH analysis will be stored on ice and shipped to the laboratory in iced coolers.

6.1.2 Field Data Documentation/Field Logs

A system of logging all pertinent data collected during sampling operations will be maintained using a dedicated field logbook(s). Each page will be numbered, dated and initialed by the person making the entry. All entries will be made in indelible ink. Incorrect entries will be crossed out with a single line and verified with the recorder's initials. At the completion of the

day, if a page is not complete, a diagonal line will be drawn through the remainder of the page with the recorder's signature at the bottom.

All sample locations will be recorded in the field logbook and referenced to the site map so that each location is permanently established. Samples will be tagged with all pertinent site information at the time of sampling. Pertinent site information to be supplied in the field logbook for each task is listed below:

- Signature of recorder;
- Name and location of sample;
- Date and time of arrival and departure;
- Names of all personnel on-site and their affiliation;
- Purpose of the visit/description of the field activity;
- All field instruments used, date and time of calibration and calibration checks, method of calibration, and standards used;
- All field measurement results;
- Date, time, and location of all sampling;
- Method of sample collection;
- Any factors which could affect sample integrity;
- Name of sampler(s);
- Sample identification, sample description, and sample preservation, if any;
- Documentation of all conversations with the client, agency personnel, field decisions and approval; and,
- Weather conditions.

Field logbooks should contain only factual information entered as real-time notes, which will enable the user to recreate events on-site. In addition, chain-of-custody records will be prepared and kept as part of the field records.

6.1.3 Chain-of-Custody Procedures

The following chain-of-custody procedures will be used for this project:

- Any transfer of custody of containers of samples will be noted on a chain-of-custody record.
- Each sample collected for the event will be entered on the chain-of-custody record.
- The chain-of-custody will be completed as soon as possible after sample collection. The following information must be supplied to complete the chain-of-custody record.

  - Site specific project name and number;
  - Signature of sampler(s);
  - For each sample, sampling station number, date and time (military is preferred) of collection, grab or composite sample designation, and a brief description of the type of sample and sampling location;
  - Number of sample containers per each sample location;
  - Analysis required;
  - Type of preservative;
  - Signatures of individuals involved in sample transfer (i.e., relinquishing and accepting samples). Individuals receiving the samples shall sign, date, and note the time they received the samples/cooler on the record; and,
  - Type of carrier service.

The original chain-of-custody record will accompany the sample containers during transport to document their custody.

If custody is relinquished through a common carrier for delivery to the laboratory, the following protocol will be followed:

- In the space for the sample receiver, the name of the common carrier and the date relinquished will be written. In addition, if known, the tracking number will be included on the chain-of-custody record;
- The original completed chain-of-custody record will be placed inside the shipping package; and;
- The shipping package will be sealed with tape and custody seals affixed. The seals will be placed on the package in such a manner that the package cannot be opened without breaking the seals. The seals will serve to document that the shipping container was not opened during the shipment through the common parcel carrier.

6.1.4 Sample Shipment Procedures

At the end of each sampling day, all samples scheduled for analysis will be packaged in shipping containers for shipment to the analytical laboratory using the following steps:

1. Check each sample bag/jar/bottle for a properly completed sample identification label.

2. Place the sample bags/jars/bottles from each location in separate plastic bags, and then seal.

3. Ship the samples in a large capacity (waterproof metal or plastic) cooler, or specific laboratory prepared sample-shipping container. Place packing material on the bottom of the cooler to prevent sample bottle breakage.

4. Place the sample bottles in the shipping container in a manner such that they do not touch and will not touch during shipment. Secure with packing material as needed to fill void space.

5. Maintain samples at 4°C ±2°C during shipment. Use ice to cool these samples. A cooler with samples to be analyzed for metals only do not need to be cooled (iced) during shipping.

6. Place the original chain-of-custody record in a plastic bag, seal, and tape it to the inside of the shipping container lid.

7. Retain the pink copy of the chain-of-custody for the Advanced GeoServices QA Manager.

8. Tape the cooler drain shut. Tape the cooler or shipping container closed at a minimum of two locations.

9. Place two signed and dated custody seals across each edge of the shipping container.

10. Attach the completed shipping label to the top of the shipping container.

11. Relinquish the cooler to the courier with the required signed and dated handbill/waybill.

12. Retain receipt of the handbill/waybill as part of the permanent documentation.

If the sample coolers are not shipped but instead picked-up by the laboratory courier, step number 6 and 12 will be omitted and the chain-of-custody will be handed to and signed by the laboratory courier. The pink copy of the chain-of-custody will be maintained by the sampler and submitted to the Advanced GeoServices QA Manager.

6.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLING

To evaluate if field or laboratory conditions may be impacting analytical samples, trip blanks, equipment blanks, matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples will be collected according to the following paragraphs and the QAPP.

6.2.1 Trip Blanks

Trip blanks are analyzed for VOCs only and serve to detect possible cross-contamination of aqueous samples resulting from handling, storage, and shipment procedures. Trip blanks consist of Laboratory prepared VOC vials filled with distilled water and preserved with hydrochloric which accompany the sample bottles from delivery, through sample collection and shipment to the laboratory. One trip blank for each matrix will be included in every cooler that contains VOC samples and analyzed with the samples.

6.2.2 Temperature Blanks

Temperature blanks are typically a vial (usually plastic) filled with water. Temperature blanks are designed to address sample preservation. One temperature blank will be included in every cooler that contains VOC samples.

6.2.3 Field Duplicate Samples

A blind field duplicate sample will be collected to allow for the determination of sampling precision of the sampler and the analytical laboratory. One field duplicate sample will be collected for every twenty (20) samples per matrix and submitted for analysis of the identical parameters as the original sample. Duplicate samples will not be submitted for perimeter air samples as a duplicate sample cannot be collected.

6.2.4 Equipment Blanks

An equipment blank will be prepared when a particular piece of sampling equipment was employed for sample collection and subsequently decontaminated in the field for use in additional sampling. The equipment blank will be collected in an appropriate container for the water, and will consist of water rinse from the equipment (e.g., auger, trowel or bowl) after execution of the last step of the field decontamination protocol. Preservatives or additives will be added to the equipment blank where appropriate for the sampling parameters. One equipment blank will be collected per matrix per day of sampling and sent to the off-site laboratory for analysis for the analytes associated with the sampling for that day.

One field blank will be collected every 20 samples for perimeter air sampling. The field blank will be an unused filter from the same manufacturer and lot as the filters used to collect the samples.

6.2.5 Matrix Spike/Matrix Spike Duplicate Samples

Matrix Spike/Matrix Spike duplicates (MS/MSD) will be collected from the same location as the parent sample and will be analyzed for the same parameters as the parent sample. Each sample will be labeled with the sample identification as the original sample, designated as MS or MSD samples, and submitted to the laboratory for the appropriate analyses. MS/MSD samples determine accuracy by the recovery rates of the compounds added by the laboratory (the MS compounds are defined in the analytical methods). The MS/MSD samples also monitor any possible matrix effects specific to samples collected from the Site and the extraction/digestion efficiency. In addition, the analyses of MS and MSD samples check precision by comparison of the two spike recoveries. One MS and MSD sample will be collected for every 20 samples sent to the off-site lab for analysis. MS and MSD samples will not be submitted for perimeter air samples as the sample volume cannot be increased to create MS and MSD samples.

6.3 ANALYTICAL PARAMETERS AND TEST METHODS

Test America, Inc in Edison, New Jersey and Pittsburgh, Pennsylvania will perform analyses for soil, sediment and water in accordance with the accepted USEPA *SW-846 Test Methods for Evaluating Solid Wastes: Physical/Chemical Properties (April 1998, revision 5)* Method 8260B (VOCs), Method 8270C (SVOCs), Method 8081 (pesticides), Method 8082 (PCBs), Method 8151 (herbicides), and Methods 6010B, 6020 and/or 7000 series (metals).

The Standard Operating Procedures of each laboratory is provided in the QAPP.

TABLES

TABLE 3-1
PROPOSED AIR MONITORING SCHEDULE
CRATER RESOURCES SUPERFUND SITE - QUARRY THREE SAP

Parameters	Site Worker (Personnel Monitoring)	General Public (Perimeter and Near Field)	Method
Arsenic (inorganic)	2 Personal air samples at each work zone at least 7 days apart Additional, only if at or above Action Level, or potential exists	Background; Two 8-hour daytime periods prior to the start of construction activities First 2 days of a work activity; Random 1 day per week	NIOSH 7300 37mmMCEF 0.8 micron filter GIL-AIR personal pump (or equivalent)
Mercury	2 Personal air samples at each work zone at least 7 days apart Additional, only if at or above 50% of TLV	Background; Two 8-hour daytime periods prior to the start of construction activities First 2 days of a work activity; Random 1 day per week	NIOSH 6009 Filter/Hydrar media GIL-AIR personal pump (or equivalent)
Total VOC	2 Personal air samples at each work zone at least 7 days apart	Background; Two 8-hour daytime periods prior to the start of construction activities First 2 days of a work activity; Random 1 day per week	Modified NIOSH 1500/1501 SKC 226-01 Charcoal tube GIL-AIR personal pump (or equivalent)
Naphthalene	2 Personal air samples at each work zone at least 7 days apart Additional, only if at or above 50% of PEL	Background; Two 8-hour daytime periods prior to the start of construction activities First 2 days of a work activity; Random 1 day per week	NIOSH 1501 SKC 226-01 Charcoal tube GIL-AIR personal pump (or equivalent)
Coal Tar Pitch Volatiles	2 Personal air samples at each work zone at least 7 days apart Additional, only if at or above 50% of PEL	Background; Two 8-hour daytime periods prior to the start of construction activities First 2 days of a work activity; Random 1 day per week	OSHA 58 37mm Glass Fiber Filter GIL-AIR personal pump (or equivalent)
Total Respirable Particulates	2 Personal air samples at each work zone at least 7 days apart Additional, only if at or above PEL	Background; Two 8-hour daytime periods prior to the start of construction activities First 2 days of a work activity; Random 1 day per week	NIOSH 0500 Pre-weighted 5 micron 37mm PVC filter
Total Particulates (Real-Time)	Randomly, each day, per HASP	Prior to daily activities and every 2-hours	Casella Microdust Pro 800nm Aerosol Monitor or equivalent and Visible
Total VOC (Real-Time)	Randomly, each day, per HASP	Prior to daily activities and every 2-hours	Photo Vac 2020 Pro Plus PID or equivalent, at ionization potential (10.6)

TABLE 3-2
AIR MONITORING STANDARDS, GUIDELINES, AND ACTIONS
CRATER RESOURCES SUPERFUND SITE - QUARRY THREE SAP

	Site Worker (Personnel Monitoring)		General Public (Perimeter and Near Field)	
Parameters	**OSHA/ACGIH**	**Actions if Levels Exceeded**	**Perimeter Guidelines**	**Actions if Levels Exceeded**
Arsenic (inorganic)	10 ug/m3 PEL-TWA 5 ug/m3 Action Level	Respiratory Protection Modified Dust Control Re-sample	1 ug/m3 PEL above background	Modify dust control even if no visible dust migration
Mercury	25 ug/m3 PEL-TWA 100 ug/m3 Ceiling Level (OSHA)	Respiratory Protection Modified Dust Control Re-sample	2.5 ug/m3 TLV 10 ug/m3 Ceiling Level above background	Modify dust control even if no visible dust migration
Total VOC	Based on Top 10 Identified	Respiratory Protection Modified Dust Control Re-sample	1/10th of OSHA/ACGIH above background	Modify dust control even if no visible dust migration
Naphthalene	10 ppmV PEL-TWA 15 ppmV STEL (ACGIH)	Respiratory Protection Modified Dust Control Re-sample	1 PPM PEL above background	Modify dust control even if no visible dust migration
Coal Tar Pitch Volatiles	0.2 mg/m3 PEL-TWA	Respiratory Protection Modified Dust Control Re-sample	0.02 mg/m3 PEL above background	Modify dust control even if no visible dust migration
Total Dust	5 mg/m3 PEL-TWA	Respiratory Protection Modified Dust Control Re-sample	1.5 mg/m3 PEL above background	Modify dust control and work procedures Stop work if necessary
Total VOC (Real-Time)	10 ppmV (Naphthalene PEL)	Respiratory Protection Modified Dust Control Continue Monitoring	1 ppmV (Naphthalene PEL) above background	Modify dust control and work procedures Stop work if necessary

TABLE 3-3
PARTICULATE MATTER DATA INTERPRETATION
CRATER RESOURCES SUPERFUND SITE - QUARRY THREE SAP

Parameter	Exposure Limit (mg/m^3)	Exposure Type	Percent	Calculated Maximum Allowable Soil Concentration (mg/kg)[1]	Actual Highest Soil Concentration (mg/kg)[2]	Max. Conc./ Actual Conc. Ratio
Arsenic	0.01	PEL	0.200%	2,000.00	419	4.77
Aluminum	5	PEL	100.000%	1,000,000.00	30,200	33.11
Mercury	0.025	PEL	0.500%	5,000.00	20	245.10
Naphthalene	50	PEL	1000.000%	10,000,000.00	170	58,823.53
Coal Tar Pitch Volatiles	0.2	PEL	4.000%	40,000.00	3,000	13.33

1 Exposure limit divided by total respirable particulate limit of 5 mg/m^3 x 10^6 conversion factor
2 References Technical Memorandum Statistical Analysis of Quarry 3 Soils (RBR/AGC Mar 25, 2008)

FIGURES

CRATER RESOURCES SUPERFUND SITE

Upper Merion Township, Pennsylvania

Figure 3-1

J:\Crater Resources PRP Group\drawings\2001-847-15\Drawings\SAP(3-1).dwg

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PERIMETER AIR MONITORING STATIONS

PROJECT ENGINEER:	T.M.L.	SCALE:	NTS
CHECKED BY:	T.M.L.	PROJECT NUMBER:	2001-847-15
DRAWN BY:	J.S.D.	DATE:	3/24/08

APPENDIX I

QUALITY ASSURANCE PROJECT PLAN

(Not Included – Provided with 100% Phase 1 RD)

APPENDIX II

USEPA PAINT FILTER TEST METHOD

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 °C.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter – Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel – If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker – 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

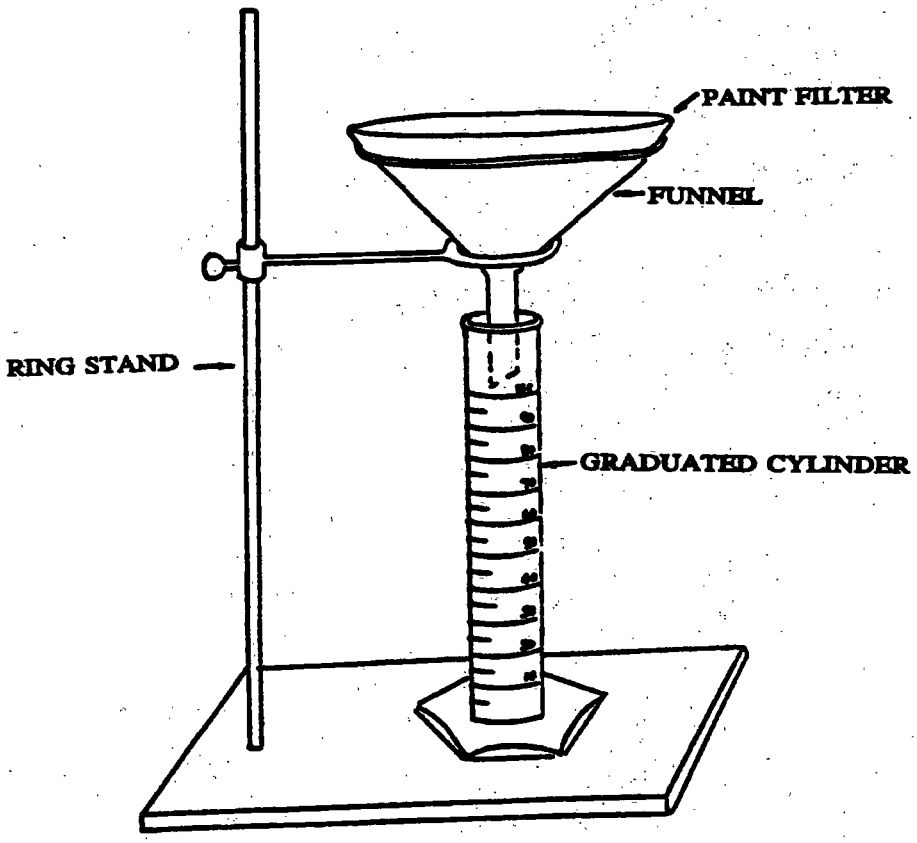
9.0 METHOD PERFORMANCE

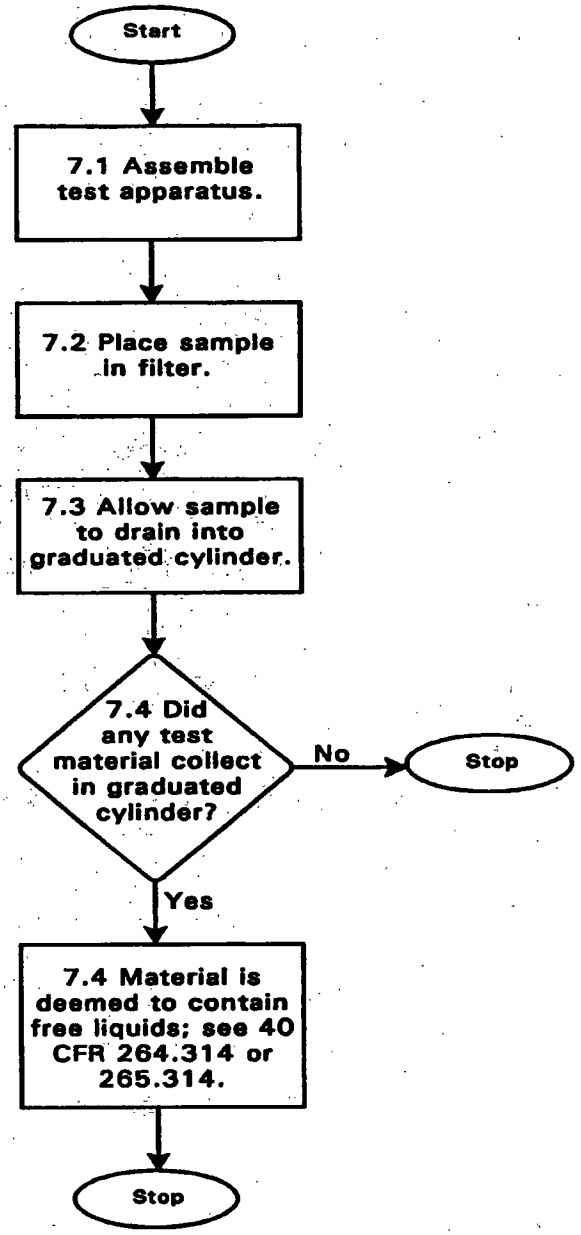
9.1 No data provided.

10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS




Start
7.1 Assemble test apparatus.
7.2 Place sample in filter.
7.3 Allow sample to drain into graduated cylinder.
7.4 Did any test material collect in graduated cylinder?
No
Stop
Yes
7.4 Material is deemed to contain free liquids; see 40 CFR 264.314 or 265.314.
Stop

APPENDIX III

PADEP CLEAN FILL CRITERIA

DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF LAND RECYCLING AND WASTE MANAGEMENT

DOCUMENT NUMBER: 258-2182-773

ANTICIPATED EFFECTIVE DATE: April 24, 2004

TITLE: Management of Fill

AUTHORITY: This document is established in accordance with the Act of July 7, 1980, as amended, 35 P.S. §§ 6018.101 *et seq.*, known as the Solid Waste Management Act (SWMA); the Act of June 22, 1937, as amended, 35 P.S. §§ 691.1 *et seq.*, known as the Clean Streams Law; the Act of April 9, 1929, Section 1917-A of the Administrative Code, 71 P.S. § 510-17; the Act of July 18, 1995, 35 P.S. §§ 6026.101 *et seq.*, known as the Land Recycling and Environmental Remediation Standards Act.

POLICY: This policy is designed to replace the Department's existing Clean Fill Policy dated February 29, 1996.

PURPOSE: This policy provides DEP's procedures for determining whether material is clean fill or regulated fill. Regulated fill may not be used unless a SWMA permit is secured by the individual or entity using the regulated fill.

APPLICABILITY: This policy shall be used to evaluate whether material qualifies as clean fill or regulated fill. This policy does not apply to mine land reclamation activities subject to a permit. Excavation, movement or reuse of fill material within a project area or right-of-way of a project is not an activity that requires a SWMA permit.

DISCLAIMER: The policies and procedures outlined in this guidance document are intended to supplement existing requirements. Nothing in the policies or procedures shall affect regulatory requirements. The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of the DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.

PAGE LENGTH: 4

LOCATION: Volume 6, Tab 40(b)

DEFINITIONS:

Act 2—The Land Recycling and Environmental Remediation Standards Act, Act of May 18, 1995 (P.L.4, No. 1995-2), 35 P.S. §§6026.101 et seq.

Clean fill— Uncontaminated, nonwater-soluble, nondecomposable inert solid material. The term includes soil, rock, stone, dredged material, used asphalt, and brick, block or concrete from construction and demolition activities that is separate from other waste and recognizable as such. (25 Pa. Code §§ 271.101 and 287.101) The term does not include materials placed in or on the waters of the Commonwealth unless otherwise authorized.

Environmental due diligence—Investigative techniques, including, but not limited to, visual property inspections, electronic data base searches, review of ownership and use history of property, Sanborn maps, environmental questionnaires, transaction screens, analytical testing, environmental assessments or audits.

Historic fill—Material (excluding landfills, waste piles and impoundments) used to bring an area to grade prior to 1988 that is a conglomeration of soil and residuals, such as ashes from the residential burning of wood and coal, incinerator ash, coal ash, slag, dredged material and construction and demolition waste. The term does not include iron or steel slag that is separate from residuals if it meets the coproduct definition and the requirements of 25 Pa. Code § 287.8. The term does not include coal ash that is separate from residuals if it is beneficially used in accordance with 25 Pa. Code § 287.661- 287.666.

Regulated fill—Soil, rock, stone, dredged material, used asphalt, historic fill, and brick, block or concrete from construction and demolition activities that is separate from other waste and recognizable as such that has been affected by a spill or release of a regulated substance and the concentrations of regulated substances exceed the values in Table FP-1a and b.

Regulated substance—The term shall include hazardous substances and contaminants regulated under the Hazardous Sites Cleanup Act, and substances covered by the Clean Streams Law, the Air Pollution Control Act, the Solid Waste Management Act, the Infectious and Chemotherapeutic Waste Law, and the Storage Tank and Spill Prevention Act.

Release—Spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing of a regulated substance into the environment in a manner not authorized by the Department of Environmental Protection. The term includes the abandonment or discarding of barrels, containers, vessels and other receptacles containing a regulated substance.

Uncontaminated material—Material unaffected by a spill or release of a regulated substance, or if affected by a spill or release, the concentrations of regulated substances are below the concentrations specified in Table FP-1a and b.

REFERENCES:

25 Pa. Code Chapters 287 to 299 (residual waste regulations)
25 Pa. Code Chapters 271 to 285 (municipal waste regulations)
Solid Waste Management Act, 35 P.S. §§ 6018.101 *et seq.*
Land Recycling and Environmental Remediation Standards Act, 35 P.S. §§ 6026.101 *et seq.*

TECHNICAL GUIDANCE:

FILL DETERMINATION

1) To determine whether fill is clean or regulated, a person must perform environmental due diligence.[1]

a) If due diligence shows no evidence of a release of a regulated substance, the material may be managed as clean fill under this policy.

b) If due diligence shows evidence of a release, the material must be tested to determine if it qualifies as clean fill. Testing must be performed in accordance with Appendix A.

i) If testing reveals that the material contains concentrations of regulated substances that are below the residential limits in Table FP-1a and b, the material must be managed as clean fill.

ii) If testing reveals that the material contains concentrations of regulated substances that exceed the limits in Table FP-1a and b, the material must be managed as regulated fill.

2) A person may not blend or mix materials to become clean fill. Materials that contain regulated substances that are intentionally released may not be managed under this policy.

MANAGEMENT OF REGULATED FILL

1) Materials identified as regulated fill are waste and must be managed in accordance with the Department's municipal or residual waste regulations, whichever is applicable, based on 25 Pa. Code §§ 287.2 or 271.2. Regulated fill may be beneficially used under General Permit WMGR096 (proposed) if the materials and the proposed activities for the fill meet the conditions of that permit. A person may apply for an industry-wide beneficial use general permit for the beneficial use of regulated fill in lieu of this general permit.

2) Regulated fill may not be placed on a greenfield property not planned for development, or on a property currently in residential use or planned for residential use unless otherwise authorized.

3) Fill containing concentrations of regulated substances that exceed the values in Table GP-1 a and b may not be managed under the provisions of this policy or General Permit WMGR096, but must be otherwise managed in accordance with the provisions of the Department's municipal or residual waste regulations.

4) A general permit is not required for remediation activities undertaken entirely on an Act 2 site pursuant to the requirements of Section 902 of the Land Recycling and Environmental Remediation Standards Act. A general permit is also not required if regulated fill from an Act 2 site is used as construction material at a receiving site that is being remediated to attain an Act 2 standard as long as the procedural and substantive requirements of Act 2 are met. Regulated

[1] Analytical assessment, testing or sampling is only required if visual inspection or reviews of historic property use indicates evidence of a release of a regulated substance.

substances contained in the regulated fill must be incorporated into the notice of intent to remediate and the final report. Movement of regulated fill between Act 2 sites must be documented in both the sending and receiving sites' cleanup plans and final reports. Placement of the regulated fill may not cause the receiving site undergoing remediation to exceed the selected Act 2 standard.

MANAGEMENT OF CLEAN FILL

1) Use of material as clean fill does not require a permit under the Solid Waste Management Act and regulations, and it may be used in an unrestricted or unregulated manner under this Act and its regulations. The use of materials as clean fill is still regulated under other environmental laws and regulations. A person using materials as clean fill under the policy is still subject to and must comply with all applicable requirements governing the placement or use of material as clean fill, such as Chapter 102 (Erosion and Sediment Control) and Chapter 105 (Dam Safety and Waterway Management).

2) Any person placing clean fill which has been affected by a release of a regulated substance on a property must certify the origin of the fill material and results of analytical testing to qualify the material as clean fill on Form FP-001. Form FP-001 must be retained by the owner of the property receiving the fill.

3) Best management practices (BMP) must be followed prior to demolition activities to remove materials like lead-based paint surface, friable asbestos and hazardous materials such as mercury switches, PCB ballasts and fluorescent light bulbs from a building if the brick, block, or concrete is used as clean fill.

4) Clean fill may not contain any free liquids based on visual inspection, and shall not create public nuisances (for example objectionable odors) to users of the receiving property or adjacent properties.

Form FP-001
CERTIFICATION OF ORIGIN OF CLEAN FILL

I, the undersigned, certify that fill material that has been determined to be clean fill has been placed on the following property:

Property Name: _____
Current Owner of Property: _____
Property Address: _____
_____
_____

This fill material will be used solely for property improvement or construction purposes. Copies of the laboratory analyses that confirm that this material is clean fill are attached to this form.

Date:

Name: _____
Title: _____
Address: _____
_____
_____
Phone: _____

This form is to be maintained by the owner of the property receiving fill material. If a property received fill from multiple sources, a separate certification form is required for each source.

Appendix A

Sampling and Analyses forof Regulated Material to be Used as Fill:

Sampling of regulated material proposed to be used as fill shall be done either by composite samples or by discrete samples. Sampling in either case shall be random and representative of the fill material being sampled. Sampling shall be in accordance with the most current version of the EPA RCRA Manual, SW-846 *(Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Office of Solid Waste and Emergency Response).*

(a) Sampling based on composite sampling procedures shall include the following:

(i) For volumes of material equal to or less than 125 cubic yards, a total of eight samples shall be collected and analyzed as follows:

(A) For analysis of all substances other than volatile organic compounds (VOCs), the samples shall be analyzed in two composites of four samples each, in accordance with the most current version of the USEPA Manual, SW-846 *(Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Office of Solid Waste and Emergency Response).*

(B) Two samples shall be selected from the 8 samples for analysis of VOCs. The samples shall be based on field screening of the eight samples to select those samples that are most likely to contain the highest concentrations of VOCs.

(C) Two grab samples shall be taken from the same areas in the material from which the two samples used for field screening of VOCs were taken, in accordance with Method 5035 from the most current version of the USEPA Manual, SW-846 *(Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Office of Solid Waste and Emergency Response).*

(ii) For volumes of material greater than 125 cubic yards and less than or equal to 3,000 cubic yards, a total of 12 samples shall be collected and analyzed as follows:

(A) For analysis of all substances other than VOCs, the samples shall be analyzed in three composites of four samples each.

(B) Three samples shall be selected from the 12 samples for analysis of VOCs. The samples shall be based on field screening of the 12 samples to select those samples that are most likely to contain the highest concentrations of VOCs.

(C) Three grab samples shall be taken from the same areas in the material from which the three samples used for field screening of VOCs were taken, in accordance with EPA, Method 5035, referenced in subparagraph (i)(C).

(iii) For each additional 3,000 cubic yards of material or part thereof over the initial 3,000 cubic yards, 12 additional samples shall be collected and analyzed as follows:

(A) For analysis of all substances other than VOCs, the samples shall be analyzed in three composites of four samples each.

(B) Three samples for analysis of VOCs shall be selected from the 12 samples for analysis of VOCs. The samples shall be based on field screening of the 12 samples to select those samples that are most likely to contain the highest concentrations of VOCs.

(C) Three grab samples shall be taken from the same areas in material from which the three samples used for field screening of VOCs were taken, in accordance with EPA Method 5035, referenced in subparagraph (i)(C).

(b) Sampling based on discrete sampling procedures shall include the following:

(i) For volumes of material equal to or less than 125 cubic yards, a minimum of eight samples shall be collected and analyzed. For volumes of material greater than 125 cubic yards and less than or equal to 3,000 cubic yards, a minimum of 12 samples shall be collected and analyzed. For each additional 3,000 cubic yards of material or part thereof over the initial 3,000 cubic yards, a minimum of 12 additional samples shall be collected and analyzed.

(ii) For VOCs analysis, grab sampling procedures shall be the procedures described in paragraph (a), for the equivalent volumes of material sampled.

(c) Analyses of results:

(1) For a composite sample taken in accordance with subsection (a), the measured numeric value for a parameter shall be less than or equal to the concentration limit listed in Table FP-1a or b for that parameter in order for the material to qualify as clean fill, or in Table GP-1a or b for that parameter in order for the fill material to qualify as regulated fill.

(2) For a grab sample, taken in accordance with subsection (a) and (b), the measured numeric value for a parameter shall be less than or equal to the concentration limit listed in Table FP-1a or b for that parameter in order for the material to qualify as clean fill, or in Table GP-1a or b for that parameter for the fill material to qualify as regulated fill.

(3) For discrete samples required in subsection (b), the measured numeric values for a substance in 75% of the discrete samples shall be equal to or less than the concentration limit listed in Table FP-1a or b, or in Table GP-1a or b for that parameter with no single sample exceeding more than twice the concentration limit for a parameter.

(d) In lieu of subsection (c), a person may use 95% Upper Confidence Limit (UCL) of the arithmetic mean to determine whether a fill material meets the appropriate concentration limits for use as clean or regulated fill. The calculated 95% UCL of the arithmetic mean must be below the appropriate concentration limit for clean or regulated fill. Sampling shall be random and representative of the material being sampled. The minimum number of samples shall be determined in accordance with EPA approved methods on statistical analysis of environmental date, as identified in 25 PA. Code, §250.707(e)(relating to statistical tests). The application of the 95% UCL of the arithmetic mean shall comply with the following performance standards:

(1) The null hypotheses (Ho) shall be that the true fill arithmetic average concentration is at or above the regulated fillappropriate concentration limit, and the alternative hypothesis (Ha) shall be that the true fill arithmetic average concentration is below the regulated fillappropriate concentration limit.

(2) The underlying assumptions of the statistical method shall be met, such as data distribution.

(3) Compositing cannot be used for volatile organic compounds.

(4) The censoring level for each nondetect shall be the assigned value randomly generated that is between zero and the limit related to the PQL.

(5) Tests shall account for spatial variability, unless otherwise approved by the Department.

(6) Statistical testing shall be done individually for each parameter present in the fill.

(7) Where a fill has distinct physical, chemical or biological characteristics, or originates from different areas, the statistical testing shall be done separately.

(8) The following information shall be documented:

(i) A description of the original areas of the fill, and physical, chemical and biological characteristics of the fill.

(ii) A description of the underlying assumptions of the statistical method.

(iii) Documentation showing that the sample data set meets the underlying assumptions of the statistical method.

(iv) Documentation of input and output data for the statistical test, presented in tables or figured, or both, as appropriate.

(v) An interpretation and conclusion of the statistical test.

(e) The Synthetic Precipitation Leaching Procedure (SPLP, per *Technical Guidance Manual*, 253-0300-100/ May 4, 2002 /Page II-26-27), is listed below:

The value for the SPLP is the concentration of a regulated substance in soil at the site that does not produce a leachate in which the concentration of the regulated substance exceeds the groundwater MSC. Since this test must be conducted on the actual site soil, no values for the SPLP could be published in the tables of MSCs in the regulations. The following procedure should be used to determine the alternative soil-to-groundwater value based upon the SPLP:

- During characterization, the remediator should obtain a minimum of ten samples from within the impacted soil area. The four samples with the highest total concentration of the regulated substance should be submitted for SPLP analysis. Samples obtained will be representative of the soil type and horizon impacted by the release of the regulated substance.
- Determine the lowest total concentration (TC) that generates a failing SPLP result. The alternative soil-to-groundwater standard will be the next lowest TC.
- If all samples result in a passing SPLP level, the alternative soil-to-groundwater standard will be the TC corresponding to the highest SPLP result. The remediator has the option of obtaining additional samples.
- If none of the samples generates a passing SPLP, the remediator can obtain additional samples and perform concurrent TC/SPLP analyses to satisfy the above requirements for establishing an alternative soil-to-groundwater standard.

Table FP-1a
Clean Fill Concentration Limits for Organics

		Clean Fill
PARAMETER	CASRN	Total Analysis
		mg/kg
ACENAPHTHENE	83-32-9	2700
ACENAPHTHYLENE	208-96-8	2500
ACEPHATE	30560-19-1	0.9
ACETALDEHYDE	75-07-0	0.23
ACETONE	67-64-1	41
ACETONITRILE	75-05-8	1.9
ACETOPHENONE	98-86-2	200
ACETYLAMINOFLUORENE, 2- (2AAF)	53-96-3	0.069
ACROLEIN	10-702-8	0.00062
ACRYLAMIDE	79-06-1	0.00057
ACRYLIC ACID	79-10-7	0.051
ACRYLONITRILE	107-13-1	0.0087
ALACHLOR	15972-60-8	0.077
ALDICARB	116-06-3	0.12
ALDRIN	309-00-2	0.10
ALLYL ALCOHOL	107-18-6	0.58
AMINOBIPHENYL, 4-	92-67-1	0.0012
AMITROLE	61-82-5	0.029
AMMONIA	7664-41-7	360
AMMONIUM SULPHAMATE	7773-06-0	24
ANILINE	62-53-3	0.16
ANTHRACENE	120-12-7	350
ATRAZINE	1912-24-9	0.13
BAYGON (PROPOXUR)	114-26-1	0.057
BENOMYL	17804-35-2	880.00
BENTAZON	25057-89-0	16
BENZENE	71-43-2	0.13
BENZIDINE	92-87-5	0.078
BENZO[A]ANTHRACENE	56-55-3	25
BENZO[A]PYRENE	50-32-8	2.5
BENZO[B]FLUORANTHENE	205-99-2	25
BENZO[GHI]PERYLENE	191-24-2	180
BENZO[K]FLUORANTHENE	207-08-9	250
BENZOIC ACID	65-85-0	2900
BENZOTRICHLORIDE	98-07-7	0.012
BENZYL ALCOHOL	100-51-6	400
BENZYL CHLORIDE	100-44-7	0.051
BHC, ALPHA-	319-84-6	0.046
BHC, BETA-	319-85-7	0.22
BHC, DELTA-	319-86-8	11
BHC, GAMMA (LINDANE)	58-89-9	0.072
BIPHENYL, 1,1-	92-52-4	790
BIS(2-CHLOROETHYL)ETHER	111-44-4	0.0039
BIS(2-CHLORO-ISOPROPYL)ETHER	108-60-1	8.0
BIS(CHLOROMETHYL)ETHER	542-88-1	0.00001
BIS[2-ETHYLHEXYL] PHTHALATE	117-81-7	130
BISPHENOL A	80-05-7	700
BROMACIL (BROMAX)	314-40-9	2
BROMOCHLOROMETHANE	74-97-5	1.6
BROMODICHLOROMETHANE	75-27-4	3.40
BROMOMETHANE	74-83-9	0.54
BROMOXYNIL	1689-84-5	63
BROMOXYNIL OCTANOATE	1689-99-2	360
BUTADIENE, 1,3-	106-99-0	0.0062
BUTYL ALCOHOL, N-	71-36-3	12.00
BUTYLATE	2008-41-5	51.0
BUTYLBENZENE, N-	104-51-8	950
BUTYLEBENZENE, SEC-	135-98-8	350
BUTYLEBENZENE, TERT-	98-06-6	270
BUTYLBENZYL PHTHALATE	85-68-7	10000
CAPTAN	133-06-2	12
CARBARYL	63-25-2	41
CARBAZOLE	86-74-8	21
CARBOFURAN	1563-66-2	0.87
CARBON DISULFIDE	75-15-0	160

Table FP-1a
Clean Fill Concentration Limits for Organics

		Clean Fill
PARAMETER	CASRN	Total Analysis
		mg/kg
CARBON TETRACHLORIDE	56-23-5	0.26
CARBOXIN	5234-68-4	53
CHLORAMBEN	133-90-4	1.6
CHLORDANE	57-74-9	49
CHLORO-1, 1-DIFLUOROETHANE, 1-	75-68-3	2300
CHLORO-1-PROPENE, 3- (ALLYL CHLORIDE)	107-05-1	0.065
CHLOROACETOPHENONE, 2-	532-27-4	0.0093
CHLOROANILINE, P-	106-47-8	19.00
CHLOROBENZENE	108-90-7	6.1
CHLOROBENZILATE	510-15-6	1.60
CHLORBUTANE, 1-	109-69-3	2300
CHLORODIBROMOMETHANE	124-48-1	3.20
CHLORODIFLUOROMETHANE	75-45-6	2.6
CHLOROETHANE	75-00-3	5.00
CHLOROFORM	67-66-3	2.50
CHLORONAPHTHALENE, 2-	91-58-7	6200
CHLORO[DI]NITROBENZENE, [2-]P-	100-00-5	4.9
CHLOROPHENOL, 2-	95-57-8	4.40
CHLOROPRENE	126-99-8	0.45
CHLROPROPANE, 2-	75-29-6	21
CHLOROTHALONIL	1897-45-6	15
CHLOROTOLUENE, O-	95-49-8	20
CHLORPYRIFOS	2921-88-2	23
CHLORSULFURON	64902-72-3	25
CHLORTHAL-DIMETHYL (DACTHAL) (DCPA)	1861-32-1	650
CHRYSENE	218-01-9	230
CRESOL(S)	1319-77-3	3.1
CRESOL, O-(METHYLPHENOL, 2-)	95-48-7	64
CRESOL, M-(METHYLPHENOL, 3-)	108-39-4	36
CRESOL, P-(METHYLPHENOL, 4-)	106-44-5	4.2
CRESOL, P-CHLORO-M-	59-50-7	37
CROTONALDEHYDE	4170-30-3	0.00099
CROTONALDEHYDE, TRANS-	123-73-9	0.00099
CUMENE (ISOPROPYL BENZENE)*	98-82-8	780
CYCLOHEXANONE	108-94-1	1400
CYFLUTHRIN	68359-37-5	33
CYROMAZINE	66215-27-8	84
DDD, 4,4'-	72-54-8	6.8
DDE, 4,4'-	72-55-9	41
DDT, 4,4'-	50-29-3	53
DI(2-ETHYLHEXYL)ADIPATE	103-23-1	10000
DIALLATE	2303-16-4	0.15
DIAMINOTOLUENE, 2,4-	95-80-7	0.0042
DIAZINON	333-41-5	0.082
DIBENZO[A,H]ANTHRACENE	53-70-3	2.50
DIBROMO-3-CHLOROPROPANE, 1,2-	96-12-8	0.0092
DIBROMOBENZENE, 1,4-	106-37-6	150
DIBROMOETHANE, 1,2- (ETHYLENE DIBROMIDE)	106-93-4	0.0012
DIBROMOMETHANE	74-95-3	3.7
DI-N-BUTYLPHTHALATE, N-	84-74-2	1500
DICHOLOR-2-B[X]UTENE, 1,4-	764-41-0	0.0009
DICHLOROBENZENE, 1,2-	95-50-1	59
DICHLOROBENZENE, 1,3-	541-73-1	61
DICHLOROBENZENE, P-	106-46-7	10
DICHLOROBENZIDINE, 3,3'-	91-94-1	8.3
DICHLORODIFLUOROMETHANE (FREON 12)	75-71-8	100
DICHLOROETHANE, 1,1-	75-34-3	0.65
DICHLOROETHANE, 1,2-	107-06-2	0.10
DICHLOROETHYLENE, 1,1-	75-35-4	0.19
DICHLOROETHYLENE, CIS-1,2-*	156-59-2	1.6
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	2.3
DICHLOROMETHANE (METHYLENE CHLORIDE)	75-09-2	0.076
DICHLOROPHENOL, 2,4-	120-83-2	1
DICHLOROPHENOXYACETIC ACID, 2,4- (2,4-D)	94-75-7	1.8

Table FP-1a
Clean Fill Concentration Limits for Organics

		Clean Fill
PARAMETER	CASRN	Total Analysis
		mg/kg
DICHLOROPROPANE, 1,2-	78-87-5	0.11
DICHLOROPROPENE, 1,3-	542-75-6	0.12
DICHLOROPROPIONIC ACID (DALAPON), 2,2-	75-99-0	5.30
DICHLORVOS	62-73-7	0.012
DICYCLOPENTADIENE	77-73-6	0.12
DIELDRIN	60-57-1	0.11
DIETHYL PHTHALATE	84-66-2	160
DIFLUBENZIRON	35367-38-5	52
DIMETHOATE	60-51-5	0.28
DIMETHOXYBENZIDINE, 3,3-	119-90-4	16
DIMETHYLAMINOAZOBENZENE, P-	60-11-7	0.037
DIMETHYLANILINE, N,N-	121-69-7	4.1
DIMETHYLBENZIDINE, 3,3-	119-93-7	0.4
DIMETHYLPHENOL, 2,4-	105-67-9	32
DINITROBENZENE, 1,3-	99-65-0	0.049
DINITROPHENOL, 2,4-	51-28-5	0.21
DINITROTOLUENE, 2,4-	121-14-2	0.050
DINITROTOLUENE, 2, 6,- (2,6-DNT)	606-20-2	1.10
DINOSEB	88-85-7	0.290
DIOXANE, 1,4-	123-91-1	0.073
DIPHENAMID	957-51-7	12
DIPHENYLAMINE	122-39-4	12
DIPHENYLHYDRAZINE, 1,2-	122-66-7	0.15
DIQUAT	85-00-7	0.24
DISULFOTON	298-04-4	0.078
DIURON	330-54-1	0.86
ENDOSULFAN	115-29-7	30.00
ENDOSULFAN I (ALPHA)	959-98-8	110
ENDOSULFAN II (BETA)	33213-65-9	130
ENDOSULFAN SULFATE	1031-07-8	70
ENDOTHALL	145-73-3	4.1
ENDRIN	72-20-8	5.5
EPICHLOROHYDRIN	106-89-8	0.056
ETHEPHON	16672-87-0	2.1
ETHION	563-12-2	39
ETHOXYETHANOL, 2- (EGEE)	110-80-5	7.80
ETHYL ACETATE	141-78-6	220
ETHYL ACRYLATE	140-88-5	0.12
ETHYL BENZENE	100-41-4	46
ETHYL DIPROPYL THIOCARBAMATE, S- (EPTC)	759-94-4	65
ETHYL ETHER	60-29-7	53
ETHYLMETHACRYLATE	97-63-2	14
ETHYLENE GLYCOL	107-21-1	170
ETHYLENE THIOUREA (ETU)	96-45-7	0.034
ETHYL P-NITROPHENYL PHENYLPHOSPHOROTHIOATE	2104-64-5	0.12
FENAMIPHOS	22224-92-6	0.17
FENVALERATE (PYDRIN)	51630-58-1	94
FLUOMETURON (FLUORNETRON IN EPA FEB 96)	2164-17-2	2.5
FLUORANTHENE	206-44-0	3200
FLUORENE	86-73-7	3000
FLUOROTROCHLOROMETHANE (FREON 11)	75-69-4	87
FONOFOS	944-22-9	2.9
FORMALDEHYDE	50-00-0	12
FORMIC ACID	64-18-6	210
FOSETYL-AL	039148-24-8	9700
FURAN	110-00-9	0.42
FURFURAL	98-01-1	1.4
GLYPHOSATE	1071-83-6	620
HEPTACHLOR	76-44-8	0.68
HEPTACHLOR EPOXIDE	1024-57-3	1.1
HEXACHLOROBENZENE	118-74-1	0.96
HEXACHLOROBUTADIENE	87-68-3	1.20
HEXACHLOROCYCLOPENTADIENE	77-47-4	91
HEXACHLOROETHANE	67-72-1	0.560

Table FP-1a
Clean Fill Concentration Limits for Organics

		Clean Fill
PARAMETER	CASRN	Total Analysis
		mg/kg
HEXANE	110-54-3	500
HEXYTHIAZOX (SAVEY)	78587-05-0	820
HYDRAZINE/HYDRAZINE SULFATE	302-01-2	0.000098
HYDROQUINONE	123-31-9	20
INDENO[1,2,3-CD]PYRENE	193-39-5	25
IPRODIONE	36734-19-7	430
ISOBUTYL ALCOHOL	78-83-1	76
ISOPHORONE	78-59-1	1.90
KEPONE	143-50-0	0.56
MALATHION	121-75-5	34
MALEIC HYDRAZIDE	123-33-1	47
MANEB	12427-38-2	2
MERPHOS OXIDE	78-48-8	6.6
METHACRYLONITRILE	126-98-7	0.031
METHAMIDOPHOS	10265-92-6	0.022
METHANOL	67-56-1	58.00
METHOMYL	16752-77-5	3.20
METHOXYCHLOR	72-43-5	630
METHOXYETHANOL, 2-	109-86-4	0.41
METHYL ACETATE	79-20-9	690
METHYL ACRYLATE	96-33-3	27
METHYL CHLORIDE	74-87-3	0.038
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	54
METHYL ISOBUTYL KETONE	108-10-1	2.90
METHYL METHACRYLATE	80-62-6	26.0
METHYL METHANESULFONATE	66-27-3	0.083
METHYL PARATHION	298-00-0	0.42
METHYL STYRENE (MIXED ISOMERS)	25013-15-4	120
METHYL TERT-BUTYL ETHER (MTBE)	1634-04-4	0.28
METHYLENE BIS(2-CHLOROANILINE), 4,4'-	101-14-4	3.9
METHYLNAPHTHALENE, 2-	91-57-6	2900
METHYLSTYRENE, ALPHA	98-83-9	120
NAPHTHALENE*	91-20-3	25
NAPHTHYLAMINE, 1-	134-32-7	0.30
NAPHTHYLAMINE, 2-	91-59-8	0.01
NAPROPAMIDE	15299-99-7	860
NITROANILINE, M-	99-09-2	0.033
NITROANILINE, O-	88-74-4	0.038
NITROANILINE, P-	100-01-6	0.031
NITROBENZENE	98-95-3	0.79
NITROPHENOL, 2-	88-75-5	5.90
NITROPHENOL, 4-	100-02-7	4.1
NITROPROPANE, 2-	79-46-9	0.000260
NITROSODIETHYLAMINE, N-	55-18-5	0.000018
NITROSODIMETHYLAMINE, N-	62-75-9	0.000041
NITROSO-DI-N-BUTYLAMINE, N-	924-16-3	0.0033
NITROSODI-N-PROPYLAMINE, N-	621-64-7	0.0013
NITROSODIPHENYLAMINE, N-	86-30-6	20.00
NITROSO-N-ETHYLUREA, N-	759-73-9	0.000054
OCTYL PHTHALATE, DI-N-	117-84-0	4400
OXAMYL (VYDATE)	23135-22-0	2.60
PARATHION	56-38-2	130
PCB-1016 (AROCLOR)	12674-11-2	15
PCB-1221 (AROCLOR)	11104-28-2	0.63
PCB-1232 (AROCLOR)	11141-16-5	0.50
PCB-1242 (AROCLOR)	53469-21-9	16
PCB-1248 (AROCLOR)	12672-29-6	9.90
PCB-1254 (AROCLOR)	11097-69-1	4.40
PCB-1260 (AROCLOR)	11096-82-5	30
PEBULATE	1114-71-2	300
PENTACHLOROBENZENE	608-93-5	180
PENTACHLORONITROBENZENE	82-68-8	5.00
PENTACHLOROPHENOL	87-86-5	5.00
PHENACETIN	62-44-2	12.00

Table FP-1a
Clean Fill Concentration Limits for Organics

PARAMETER	CASRN	Clean Fill Total Analysis mg/kg
PHENANTHRENE	85-01-8	10000
PHENOL	108-95-2	66.00
PHENYLENEDIAMINE, M-	108-45-2	3.10
PHENYLPHENOL, 2-	90-43-7	490
PHORATE	298-02-2	0.41
PHTHALIC ANHYDRIDE	85-44-9	2300
PICLORAM	1918-02-1	7.4
PRONAMIDE	23950-58-5	3.1
PROPANIL	709-98-8	9.2
PROPHAM	122-42-9	17
PROPYLBENZENE, N-	103-65-1	290
PROPYLENE OXIDE	75-56-9	0.049
PYRENE	129-00-0	2200
PYRIDINE	110-86-1	0.11
QUINOLINE	91-22-5	0.018
QUIZALOFOP (ASSURE)	76578-14-8	47
RONNEL	299-84-3	280
SIMAZINE	122-34-9	0.15
STRYCHNINE	57-24-9	0.89
STYRENE	100-42-5	24
TEBUTHIURON	34014-18-1	83
TERBACIL	5902-51-2	2.2
TERBUFOS	13071-79-9	0.12
TETRACHLOROBENZENE, 1,2,4,5-	95-94-3	5.1
TETRACHLORODIBENZO-P-DIOXIN, 2,3,7,8- (TCDD)	1746-01-6	0.00012
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	18
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	0.0093
TETRACHLOROETHYLENE (PCE)	127-18-4	0.43
TETRACHLOROPHENOL, 2,3,4,6-	58-90-2	450.00
TETRAETHYL LEAD	78-00-2	0.0046
TETRAETHYLDITHIOPYROPHOSPHATE	3689-24-5	0.73
THIOFANOX	39196-18-4	0.12
THIRAM	137-26-8	47
TOLUENE	108-88-3	44
TOLUIDINE, M-	108-44-1	0.13
TOLUIDINE, O-	95-53-4	0.32
TOLUIDINE, P-	106-49-0	0.32
TOXAPHENE	8001-35-2	1.20
TRIALLATE	2303-17-5	240
TRIBROMOMETHANE (BROMOFORM)	75-25-2	4.4
TRICHLORO- 1,2,2-TRIFLUOROETHANE, 1,1,2-	76-13-1	26000
TRICHLOROBENZENE, 1,2,4-	120-82-1	27
TRICHLOROBENZENE, 1,3,5-	108-70-3	31
TRICHLOROETHANE, 1,1,1-	71-55-6	7.20
TRICHLOROETHANE, 1,1,2-	79-00-5	0.15
TRICHLOROETHYLENE (TCE)	79-01-6	0.17
TRICHLOROPHENOL, 2,4,5-	95-95-4	2300
TRICHLOROPHENOL, 2,4,6-	88-06-2	3.1
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	93-76-5	1.50
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)(SILV	93-72-1	22
TRICHLOROPROPANE, 1,1,2-	598-77-6	3.1
TRICHLOROPROPANE, 1,2,3-	96-18-4	1.6
TRICHLOROPROPENE, 1,2,3-	96-19-5	11
TRIFLURALIN	1582-09-8	0.96
TRIMEHTYLBENZENE, 1,3,4- (TRIMETHYLBENZENE, 1,2,4-)	95-63-6	9
TRIMETHYLBENZENE, 1,3,5-	108-67-8	2.8
TRINITROTOLUENE, 2,4,6-	118-96-7	0.023
VINYL ACETATE	108-05-4	6.50
VINYL BROMIDE (BROMOMETHANE)	593-60-2	0.068
VINYL CHLORIDE	75-01-4	0.03
WARFARIN	81-81-2	2.60
XYLENES (TOTAL)	1330-20-7	990
ZINEB	12122-67-7	29

Table FP-1b

Clean Fill Concentration Limits For Metals and Inorganics

PARAMETER	Unregulated Fill Total Analysis mg/kg
ANTIMONY	27
ARSENIC[1]	12
BARIUM AND COMPOUNDS	8,200
BERYLLIUM	320
BORON AND COMPOUNDS	6.7
CADMIUM	38
CHLORIDES	na
CHROMIUM III	190,000
CHROMIUM VI	94
COBALT	8.1
COPPER	8,200
CYANIDE FREE	200
LEAD	450
MANGANESE	31,000
MERCURY	10
NICKEL	650
NITRATE NITROGEN	na
NITRITE NITROGEN	na
SELENIUM	26
SILVER	84
SULFATE	na
THALLIUM	14
TIN	240
VANADIUM	1,500
ZINC	12,000

[1] The limit of 12 mg/kg applies to all releases of arsenic. A limit of 20 mg/kg applies to certain construction materials not subject to direct contact upon completion of construction. The limit of 20 mg/kg can only be used if a Department approved Best Management Practices Plan for Earthwork and General Construction is followed by all parties involved in supplying and using materials on the construction project.

APPENDIX H

Construction Quality Control Plan
(Not Included - Provided With 100% Phase 1 RD)

APPENDIX I

Design Calculations
(Not Included - Provided With 100% Phase 1 RD)

APPENDIX J

PADEP Temporary Authorization to Discharge To Matsunk Creek (Not Included - Provided With 100% Phase 1 RD)

APPENDIX K

Approved PADEP Form U Application
(Not Included - Provided With 100% Phase 1 RD)

APPENDIX L

Access Agreements
(Not Included - Provided With 100% Phase 1 RD)

APPENDIX M

Memorandum: Post-Excavation Verification of Compliance

Risk-Based Remedies

RBR Consulting, Inc.

650 Shady Drive
Beaver Falls, PA 15010

Phone: 724-846-4096
Fax: 724-846-6974

MEMORANDUM

TO: Crater Resources Cooperating Respondent Group

FROM: Bruce Fishman

DATE: January 16, 2009

SUBJECT: Proposed Approach: Post-Excavation Verification of Compliance
Crater Resources Superfund Site – Gulph Mills, Pennsylvania

Overview

This memorandum has been prepared to provide a response to the question raised in the USEPA Comment letter of July 14, 2008 (on the Quarry 3 90% design submittal) and in direct communication with USEPA regarding the Group's proposed approach for confirming the successful completion of excavation work in Quarry 3. The Group proposes to employ a statistical approach that is typical of such demonstrations as well as familiar to USEPA. The approach will consist of statistical comparisons of pooled existing data (dismissing excavated data) and confirmatory data to Record of Decision (ROD) standards or other standards that have since been established as acceptable comparison values for specific constituents (e.g., a revised leaching-based value for naphthalene and background concentrations for arsenic).

The Group will delay backfilling excavations for each area until compliance with ROD standards and/or other standards can be verified based on the statistical analyses. In addition, the Group proposes to backfill excavations immediately if each confirmatory datum for an excavation is lower than its respective comparison value.

The following presents a proposed approach for evaluating post-excavation confirmatory soil data for compliance with the ROD standards or other appropriate comparison values for the site.

Post-Excavation Verification of Compliance

The following sections describe the available soil data previously collected from Quarry 3, and outline the specific statistical approaches that will be used to evaluate the post-excavation data sets for three groups of constituents: (1) potentially carcinogenic polyaromatic hydrocarbons (PAHs); (2) naphthalene; and (3) arsenic. These three groups of constituents were identified as having

concentrations in soil which exceed ROD standards or other established comparison values, and thus require mitigation.

Soil Data Collected from Quarry 3

Soil samples have been collected from locations throughout Quarry 3, including areas referred to in the ROD (USEPA, 2000) as the "plateau area", "the sediments" (the material below the three ponds) and the remaining soil. The ROD and other site documents treat the plateau area, the pond sediments, and the remaining soil areas separately. Because the plateau area and the pond area are planned for mitigation, existing analytical samples from these areas will not be considered herein (although, post-excavation confirmatory data from beneath the mitigated areas will be included in the statistical analyses). The soil samples available for the remaining soil area in Quarry 3 were collected in 2003 by Advanced GeoServices Corporation (AGC) during the Pre-Design Investigation (AGC, 2004).

Surface and subsurface soil samples included in the statistical evaluations were collected from 27 soil borings in and around Quarry 3. The borings are identified as SB-1 through SB-29. Boring SB-21 is considered to represent the plateau area and therefore is not included, and boring SB-27 has already been mitigated, and is also not included. A list of samples included in the evaluation is provided in Table 1, and the complete analytical data are provided in Attachment A. Note that for this assessment, surface soil is defined as soil within the 0 to 2 foot depth interval.

Approach for Evaluation of Potentially Carcinogenic PAHs

As outlined in the "Technical Memorandum: Statistical Analysis of Quarry 3 Soils" (RBR/AGC, March 2008), the following potentially carcinogenic PAHs were identified for mitigation based on the results of a preliminary statistical analysis: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. (It should be noted that other PAHs, including 2-methylnaphthalene, had individual sample results exceeding the ROD standard, but the preliminary statistical analysis indicated that no further evaluation was required). The analytical results for the soil samples were evaluated to determine which samples contained the highest concentrations of constituents that were resulting in representative concentrations which exceeded the ROD cleanup standards. The goal of the evaluation was to determine the minimum number of samples with the minimum volume of soil that would need to be mitigated in order to meet the ROD standards.

The evaluation was performed by iteratively removing data associated with samples having the highest concentrations, and re-calculating representative concentrations [based on 95% upper confidence limits (UCLs)], until the representative concentrations met the ROD standards. Using this approach, the analysis indicated that soil associated with ten samples from eight locations should be mitigated to address the potentially carcinogenic PAHs. These samples are listed in Table 2.

Soil associated with these sample locations is targeted for excavation. As each excavation is completed, confirmatory samples will be collected from the sidewalls and/or bottom of the excavation. Upon receipt of confirmatory data, a statistical evaluation will be completed as follows:

1. Soil analytical results that are associated with samples collected from excavated areas will be removed from the post-excavation database. This will include results that exceeded ROD standards and were the original basis of the excavation activity, as well as results that may have been less than ROD standards, but which no longer represent that area.
2. Soil analytical results that are associated with confirmatory samples will be added to the post-excavation database.
3. 95% UCL concentrations will be calculated for the potentially carcinogenic PAHs identified above using the post-excavation soil database. The USEPA (2008) statistical software, ProUCL Version 4.00.02, will be utilized for calculation of 95% UCLs.
4. The 95% UCL concentrations will be compared to the ROD standards for each constituent. If the 95% UCL for any one constituent exceeds the ROD standard, the sample or samples that are driving the 95% UCL to exceed the ROD standard will be identified for further mitigation.

Upon completion of subsequent mitigation activities, if any, additional confirmatory samples will be collected and analyzed, and the 95% UCL concentrations will be recalculated and tested for compliance in a manner consistent with the steps outlined above. If the 95% UCL concentration for each constituent is lower than its respective ROD standard, the constituents will be deemed to be in compliance with the ROD standards, and soil will require no further excavation.

Approach for Evaluation of Naphthalene

For naphthalene, a subsurface soil cleanup standard of 0.2 mg/kg was originally presented in the ROD (USEPA, 2000). Based on an evaluation of migration from soil to groundwater (Key Environmental, Inc., 2008), this standard has been revised to 48.0 mg/kg. Compliance with this standard is determined based on a comparison to the arithmetic mean concentration for naphthalene.

An evaluation of the analytical data for Quarry 3 indicates that there are no existing subsurface soil samples with naphthalene concentrations greater than the leaching-based value. However, post-excavation confirmatory samples will be analyzed for naphthalene to ensure compliance with the leaching-based value. Upon receipt of confirmatory data, a statistical evaluation will be completed as follows:

1. Soil analytical results for naphthalene that are associated with samples collected from excavated areas will be removed from the post-excavation database.
2. Soil analytical results that are associated with confirmatory samples will be added to the post-excavation database.
3. The 95% UCL concentration will be calculated for naphthalene using the post-excavation soil database (subsurface soil data only). ProUCL (USEPA, 2008) will be utilized for calculation of the 95% UCL concentration.
4. The 95% UCL concentration will be compared to the leaching-based value of 48.0 mg/kg. If the 95% UCL exceeds the leaching-based value, the sample or samples that are driving the mean concentration to exceed the leaching-based value will be identified for further mitigation.

Upon completion of subsequent mitigation activities, if any, additional confirmatory samples will be collected and analyzed, and the 95% UCL concentration will be recalculated and tested for compliance in a manner consistent with the steps outlined above. If the 95% UCL concentration of naphthalene is lower than the leaching-based value, naphthalene will be deemed to be in compliance with the established standard, and soil will require no further excavation.

Approach for Evaluation of Arsenic

As outlined in the "Technical Memorandum: Statistical Analysis of Quarry 3 Soils" (RBR/AGC, March 2008), the 95% UCL concentrations of arsenic in surface and subsurface soil were greater than the ROD standards. Since the ROD cleanup standards for arsenic were below naturally occurring background levels, the benchmark was adjusted to background based on a study of site-specific background concentrations. A subsequent statistical evaluation was performed to determine if the site data sets were significantly greater than background data. The analysis applied statistical methodologies to compare the post-mitigation soil data set (i.e., the soil data set excluding results associated with the ten samples identified for mitigation based on potentially carcinogenic PAHs) with site-specific background concentrations [as documented in correspondence from AGC (2003)]. The data were evaluated using the null hypothesis that site concentrations of arsenic were not greater than background concentrations.

The statistical background analysis indicated that the site data for arsenic do not exceed background (RBR/AGC, March 2008). However, mitigation of soil associated with one outlier sample and the sample located physically above the outlier was recommended. In addition, to comply with USEPA's request for mitigation of additional samples, mitigation of soil associated with two additional sample locations was recommended. These samples are listed in Table 2.

Soil associated with these sample locations is targeted for excavation. As each excavation is completed, confirmatory samples will be collected from the sidewalls and/or bottom of the excavation. Upon receipt of confirmatory data, a statistical background analysis will be completed as follows:

1. Soil analytical results for arsenic that are associated with samples collected from excavated areas will be removed from the post-excavation database. These results will be replaced with a randomly generated concentration within the range of 0 to 13.1 mg/kg [representing the upper tolerance limit (UTL) of arsenic concentrations in 18 site-specific background samples, as per AGC (2003)]. This approach is consistent with the statistical analysis completed by RBR/AGC (2008). If actual data from the imported soils are available in sufficient sample size, these data will be used in preference to the randomly generated numbers.
2. Soil analytical results that are associated with confirmatory samples will be added to the post-excavation database.
3. Walsh's test will be conducted on the post-excavation data set to analyze the data for possible outliers. Outliers at the upper end of the distribution may be considered "hot spots" (USEPA, 2006) and may also warrant mitigation.
4. The data sets will be evaluated using the Wilcoxon-Mann-Whitney (WMW) Test (utilizing ProUCL) to determine whether a difference exists between the two population distributions

(i.e., site and background). The level of significance (α) used for the background evaluation will be 0.1, consistent with the statistical analysis completed by RBR/AGC (2008).

5. If the results of the WMW Test indicate that the site data set is significantly greater than background, the sample or samples with the highest arsenic concentrations will be identified for further mitigation.

Upon completion of subsequent mitigation activities, if any, additional confirmatory samples will be collected and analyzed, and the background evaluation will be repeated in a manner consistent with the steps outlined above. If the site data set does not exceed background, arsenic will be deemed to be in compliance with the established standard, and soil will require no further excavation.

Excavation Process

The excavation process will proceed until complete for all areas of Quarry 3. Upon completion, all analytical results associated with excavated sample locations will have been removed from the database, and all analytical results associated with confirmatory samples will have been added to the database. This approach would combine confirmatory samples underlying the plateau area as well as all relevant post-excavation samples from peripheral soil areas. The statistical evaluations will be conducted as described above. If the need for further mitigation is identified, the following approaches will be followed.

- To conduct additional mitigation for a sidewall sample, the excavation would be widened by five feet from the midpoint between the failing and compliant samples in the sidewall.
- To conduct additional mitigation for a bottom sample, the excavation would be deepened by six inches over the area defined by the midpoints between the failing sample and the surrounding compliant samples.

The Group will delay backfilling excavations for each area until compliance with ROD standards and/or other standards can be verified based on the statistical analyses. In addition, the Group proposes to backfill excavations immediately if each confirmatory datum for an excavation is lower than its respective comparison value.

The estimated time for excavation and sampling for the peripheral areas is three to five days, and for the plateau area is one to two months. For the peripheral area, sampling will occur every two days or as often as is appropriate when a suitable area is available for sampling. For the plateau area, sampling will occur approximately every week.

A final post-excavation confirmatory report will be submitted to USEPA to document the results of the excavation and confirmatory sampling activities and the associated statistical evaluations. The final report may be a stand-alone document or a component of the Remedial Action Completion Report.

References

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RBR Consulting, Inc. and Advanced GeoServices Corporation (RBR/AGC; 2008) Technical Memorandum: Statistical Analysis of Quarry 3 Soils. Crater Resources Superfund Site – Gulph Mills, Pennsylvania. March 2008.

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United States Environmental Protection Agency (USEPA; 2006) Data Quality Assessment: Statistical Methods for Practitioners. EPA QA/G-9S. Office of Environmental Information, EPA/240/B-06/003, February.

United States Environmental Protection Agency (USEPA; 2008) ProUCL Version 4.00.02. Software package and guidance manual developed by Lockheed Martin Environmental Services, and distributed by USEPA, Office or Research and Development.

TABLES

TABLE 1
SOIL SAMPLES FROM QUARRY 3 PERIPHERAL SOILS
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Area	Medium	Sample Numbers and Dates			
Quarry 3	Surface Soil	SB-1(0-0.5 Feet)	7/28/2003	SB-14(1-2 Feet)	7/31/2003
		SB-1(1-2 Feet)	7/28/2003	SB-15(0-0.5 Feet)	7/31/2003
		SB-2(0-0.5 Feet)	7/28/2003	SB-15(1-2 Feet)	7/31/2003
		SB-2(1-2 Feet)	7/28/2003	SB-16(0-0.5 Feet)	7/31/2003
		SB-3(0-0.5 Feet)	7/28/2003	SB-16(1-2 Feet)	7/31/2003
		SB-3(1-2 Feet)	7/28/2003	SB-17(0-0.5 Feet)	7/31/2003
		SB-4(0-0.5 Feet)	7/28/2003	SB-17(1-2 Feet)	7/31/2003
		SB-4(1-2 Feet)	7/28/2003	SB-18(0-0.5 Feet)	8/1/2003
		SB-5(0-0.5 Feet)	7/28/2003	SB-18(1-2 Feet)	8/1/2003
		SB-5(1-2 Feet)	7/28/2003	SB-19(0-0.5 Feet)	8/1/2003
		SB-6(0-0.5 Feet)	7/28/2003	SB-19(1-2 Feet)	8/1/2003
		SB-6D(0-0.5 Feet)*	7/28/2003	SB-20(0-0.5 Feet)	8/1/2003
		SB-6(1-2 Feet)	7/28/2003	SB-20(1-2 Feet)	8/1/2003
		SB-7(0-0.5 Feet)	7/29/2003	SB-22(0-0.5 Feet)	8/1/2003
		SB-7(1-2 Feet)	7/29/2003	SB-22(1-2 Feet)	8/1/2003
		SB-8(0-0.5 Feet)	7/29/2003	SB-23(0-0.5 Feet)	8/1/2003
		SB-8(1-2 Feet)	7/29/2003	SB-23(1-2 Feet)	8/1/2003
		SB-9(0-0.5 Feet)	7/29/2003	SB-24(0-0.5 Feet)	8/4/2003
		SB-9(1-2 Feet)	7/29/2003	SB-24(1-2 Feet)	8/4/2003
		SB-10(0-0.5 Feet)	7/31/2003	SB-25(0-0.5 Feet)	8/4/2003
		SB-10(1-2 Feet)	7/31/2003	SB-25(1-2 Feet)	8/4/2003
		SB-11(0-0.5 Feet)	7/30/2003	SB-26(0-0.5 Feet)	8/4/2003
		SB-12(0-0.5 Feet)	7/30/2003	SB-26(1-2 Feet)	8/4/2003
		SB-12(1-2 Feet)	7/30/2003	SB-28(0-0.5 Feet)	8/4/2003
		SB-13(0-0.5 Feet)	7/30/2003	SB-28(1-2 Feet)	8/4/2003
		SB-13(1-2 Feet)	7/30/2003	SB-28D(1-2 Feet)*	8/4/2003
		SB-13D(1-2 Feet)*	7/30/2003	SB-29(0-0.5 Feet)	8/5/2003
		SB-14(0-0.5 Feet)	7/31/2003	SB-29(1-2 Feet)	8/5/2003

TABLE 1
SOIL SAMPLES FROM QUARRY 3 PERIPHERAL SOILS
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Area	Medium	Sample Numbers and Dates			
Quarry 3	Subsurface Soil	SB-1(3-4 Feet)	7/28/2003	SB-18D(3-4 Feet)*	8/1/2003
		SB-1(5-6 Feet)	7/28/2003	SB-18(5-6 Feet)	8/1/2003
		SB-1(10-11.5 Feet)	7/28/2003	SB-18(16-17 Feet)	8/1/2003
		SB-2(3-4 Feet)	7/28/2003	SB-19(3-4 Feet)	8/1/2003
		SB-2(5-6 Feet)	7/28/2003	SB-19(5-6 Feet)	8/1/2003
		SB-3(3-4 Feet)	7/28/2003	SB-19(9-10 Feet)	8/1/2003
		SB-3(5-6 Feet)	7/28/2003	SB-20(3-4 Feet)	8/1/2003
		SB-3(9-10 Feet)	7/28/2003	SB-20(5-6 Feet)	8/1/2003
		SB-6(3-4 Feet)	7/28/2003	SB-20(8-9 Feet)	8/1/2003
		SB-7(3-4 Feet)	7/29/2003	SB-22(3-4 Feet)	8/1/2003
		SB-7(5-6 Feet)	7/29/2003	SB-22(5-6 Feet)	8/1/2003
		SB-8(3-4 Feet)	7/29/2003	SB-22(18-19 Feet)	8/1/2003
		SB-8(5-6 Feet)	7/29/2003	SB-23(3-4 Feet)	8/1/2003
		SB-8(11-12 Feet)	7/29/2003	SB-23(5-6 Feet)	8/1/2003
		SB-9(3-4 Feet)	7/29/2003	SB-23D(5-6 Feet)*	8/1/2003
		SB-9(5-6 Feet)	7/29/2003	SB-23(14-15 Feet)	8/1/2003
		SB-10(3-4 Feet)	7/31/2003	SB-24(3-4 Feet)	8/4/2003
		SB-10(5-6 Feet)	7/31/2003	SB-24(5-6 Feet)	8/4/2003
		SB-10(13-14 Feet)	7/31/2003	SB-24(14-15 Feet)	8/4/2003
		SB-12(3-4 Feet)	7/30/2003	SB-25(3-4 Feet)	8/4/2003
		SB-13(3-4 Feet)	7/30/2003	SB-25(5-6 Feet)	8/4/2003
		SB-13(5-6 Feet)	7/30/2003	SB-25(19-20 Feet)	8/4/2003
		SB-15(3-4 Feet)	7/31/2003	SB-26(3-4 Feet)	8/4/2003
		SB-15(5-6 Feet)	7/31/2003	SB-26(5-6 Feet)	8/4/2003
		SB-17(3-4 Feet)	7/31/2003	SB-26(23-24 Feet)	8/4/2003
		SB-17(5-6 Feet)	7/31/2003	SB-28(3-4 Feet)	8/4/2003
		SB-17(19-20 Feet)	7/31/2003	SB-28(5-6 Feet)	8/4/2003
		SB-18(3-4 Feet)	8/1/2003	SB-28(19-20 Feet)	8/4/2003

Note:
* Denotes samples of duplicate pair.

TABLE 2
SAMPLES SELECTED FOR MITIGATION FROM QUARRY 3 PERIPHERAL SOILS TO MEET ROD STANDARDS OR OTHER ESTABLISHED COMPARISON VALUES
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Boring Location	Sample Depth (ft)	Rationale for Mitigation
SB-1	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
	1 - 2	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
SB-2	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
SB-3 [1]	0 - 0.5	Located physically above outlier sample
	1 - 2	Outlier sample for arsenic (concentration = 74.1 mg/kg)
SB-5	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
SB-7	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards [2]
	1 - 2	Arsenic result identified for removal by USEPA (concentration = 44 mg/kg)
SB-8	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
SB-17	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
	1 - 2	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards
	3 - 4	Arsenic result identified for removal by USEPA (concentration = 42.4 mg/kg)
SB-19	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards [2]
SB-20	0 - 0.5	Potentially carcinogenic PAHs with concentrations leading to 95% UCLs above ROD standards

[1] Samples from borings SB-3 are identified for mitigation based only on the presence of potential outlier sample results.
[2] Samples SB-7 (0-0.5), SB-17 (1-2), and SB-19 (0-0.5) were identified for mitigation primarily based on the concentrations of potentially carcinogenic PAHs. However, these three samples also had the highest concentrations of arsenic in the pre-mitigation data set (all exceeding 100 mg/kg).

ATTACHMENT A

ANALYTICAL SOIL DATA

Table A-1 **Quarry 3 Surface Soil Data**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(0-0.5 Feet)	SB-1(1-2 Feet)	SB-2(0-0.5 Feet)	SB-2(1-2 Feet)	SB-3(0-0.5 Feet)	SB-3(1-2 Feet)	SB-4(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
1,1,2,2-Tetrachloroethane	< 0.001	< 0.001	< 0.0011	< 0.001	< 0.0012	< 0.0012	< 0.001
1,1,2-Trichloroethane	< 0.003	< 0.0031	< 0.0032	< 0.0031	< 0.0037	< 0.0036	< 0.0029
1,1-Dichloroethane	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
1,1-Dichloroethene	< 0.002	< 0.0021	< 0.0022	< 0.0021	< 0.0024	< 0.0024	< 0.0019
1,2-Dichloroethane	< 0.002	< 0.0021	< 0.0022	< 0.0021	< 0.0024	< 0.0024	< 0.0019
1,2-Dichloropropane	< 0.001	< 0.001	< 0.0011	< 0.001	< 0.0012	< 0.0012	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
4-Methyl-2-Pentanone	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Acetone	0.048	0.075	0.05	0.016	0.058	0.079	NA
Benzene	0.0005 J	< 0.001	0.0007 J	< 0.001	< 0.0012	< 0.0012	< 0.001
Bromodichloromethane	< 0.001	< 0.001	< 0.0011	< 0.001	< 0.0012	< 0.0012	< 0.001
Bromoform	< 0.004	< 0.0041	0.0008 J	0.0009 J	< 0.0049	< 0.0047	< 0.0038
Bromomethane	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Carbon Disulfide	< 0.005	0.0006 J	0.0007 J	< 0.0052	< 0.0061	< 0.0059	0.0011 J
Carbon Tetrachloride	< 0.002	< 0.0021	< 0.0022	< 0.0021	< 0.0024	< 0.0024	< 0.0019
Chlorobenzene	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Chloroethane	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Chloroform	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Chloromethane	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
cis-1,2-Dichloroethene	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
cis-1,3-Dichloropropene	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Dibromochloromethane	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Ethylbenzene	0.0039 J	< 0.0041	< 0.0043	< 0.0042	< 0.0049	< 0.0047	< 0.0038
Methylene Chloride	< 0.003	< 0.0031	< 0.0032	< 0.0031	< 0.0037	< 0.0036	< 0.0029
Styrene	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Tetrachloroethene	< 0.001	< 0.001	< 0.0011	< 0.001	< 0.0012	< 0.0012	< 0.001
Toluene	0.0044 J	0.0009 J	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
trans-1,2-Dichloroethene	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
trans-1,3-Dichloropropene	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Trichloroethene	< 0.001	< 0.001	< 0.0011	< 0.001	< 0.0012	< 0.0012	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.005	< 0.0052	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048
Xylene (Total)	0.024	0.0024 J	< 0.0054	< 0.0052	< 0.0061	< 0.0059	< 0.0048

Table A-1 **Quarry 3 Surface Soil Data**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(0-0.5 Feet)	SB-1(1-2 Feet)	SB-2(0-0.5 Feet)	SB-2(1-2 Feet)	SB-3(0-0.5 Feet)	SB-3(1-2 Feet)	SB-4(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.038	< 1.9	< 40	< 0.04	< 0.039	< 0.042	< 0.035
1,2-Dichlorobenzene	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
1,3-Dichlorobenzene	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
1,4-Dichlorobenzene	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
2,4,5-Trichlorophenol	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
2,4,6-Trichlorophenol	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
2,4-Dichlorophenol	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
2,4-Dimethylphenol	< 0.38	< 19	24 J	0.02 J	0.051 J	< 0.42	< 0.35
2,4-Dinitrophenol	< 1.5	< 75	< 1600	< 1.6	< 1.6	< 1.7	< 1.4
2,4-Dinitrotoluene	< 0.077	< 3.8	< 81	< 0.079	< 0.078	< 0.083	< 0.07
2,6-Dinitrotoluene	< 0.077	< 3.8	< 81	< 0.079	< 0.078	< 0.083	< 0.07
2-Chloronaphthalene	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
2-Chlorophenol	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
2-Methylnaphthalene	0.22 J	0.92 J	43 J	< 0.4	0.04 J	0.35 J	< 0.35
2-Methylphenol	0.029 J	0.5 J	30 J	0.041 J	0.061 J	0.01 J	0.0088 J
2-Nitroaniline	< 0.77	< 38	< 810	< 0.79	< 0.78	< 0.83	< 0.7
2-Nitrophenol	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
3,3'-Dichlorobenzidine	< 0.77	< 38	< 810	< 0.79	< 0.78	< 0.83	< 0.7
3-Nitroaniline	< 0.77	< 38	< 810	< 0.79	< 0.78	< 0.83	< 0.7
4,6-Dinitro-2-methylphenol	< 1.5	< 75	< 1600	< 1.6	< 1.6	< 1.7	< 1.4
4-Bromophenyl-phenylether	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
4-Chloro-3-methylphenol	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
4-Chloroaniline	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
4-Chlorophenyl-phenylether	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
4-Methylphenol	0.12 J	1.8 J	94 J	0.12 J	0.19 J	0.027 J	0.043 J
4-Nitroaniline	< 0.77	< 38	< 810	< 0.79	< 0.78	< 0.83	< 0.7
4-Nitrophenol	< 1.5	< 75	< 1600	< 1.6	< 1.6	< 1.7	< 1.4
Acenaphthene	0.038 J	0.91 J	32 J	< 0.4	0.036 J	0.037 J	0.0096 J
Acenaphthylene	1	25	940	0.19 J	1.1	1.1	0.15 J
Anthracene	0.68	22	1000	0.09 J	0.52	0.74	0.12 J
Benzo(a)anthracene	1.9	66	2400	0.42	1	1.7	0.42
Benzo(a)pyrene	2.5	85	2800	0.58	2	2	0.56
Benzo(b)fluoranthene	2.3	81	3000	0.51	2.7	1.7	0.69
Benzo(g,h,i)perylene	2	39	1400	0.69	0.86	0.92	0.55
Benzo(k)fluoranthene	2.2 J	97 J	2500 J	0.65	2.9 J	2	0.69 J
bis(2-Chloroethoxy)methane	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
bis(2-Chloroethyl)ether	< 0.038	< 1.9	< 40	< 0.04	< 0.039	< 0.042	< 0.035
bis(2-chloroisopropyl)ether	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35

Table A-1 **Quarry 3 Surface Soil Data**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(0-0.5 Feet)	SB-1(1-2 Feet)	SB-2(0-0.5 Feet)	SB-2(1-2 Feet)	SB-3(0-0.5 Feet)	SB-3(1-2 Feet)	SB-4(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	0.075 J
Butylbenzylphthalate	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Carbazole	0.55	39	1100	0.1 J	0.57	0.048 J	0.049 J
Chrysene	2.2	76	2500	0.45	1.1	1.8	0.54
Dibenz(a,h)anthracene	0.49	3	110	0.037 J	0.08	0.11	0.032 J
Dibenzofuran	0.14 J	4.2 J	150 J	0.012 J	0.089 J	0.069 J	< 0.35
Diethylphthalate	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Dimethylphthalate	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Di-n-butylphthalate	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Di-n-octylphthalate	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Fluoranthene	3.4	150	5500	0.62	2	1.4	0.74
Fluorene	0.19 J	6.1 J	270 J	0.018 J	0.18 J	< 0.42	0.014 J
Hexachlorobenzene	< 0.038	< 1.9	< 40	< 0.04	< 0.039	< 0.042	< 0.035
Hexachlorobutadiene	< 0.077	< 3.8	< 81	< 0.079	< 0.078	< 0.083	< 0.07
Hexachlorocyclopentadiene	NA	NA	NA	< 0.4	NA	< 0.42	NA
Hexachloroethane	< 0.038	< 1.9	< 40	< 0.04	< 0.039	< 0.042	< 0.035
Indeno(1,2,3-cd)pyrene	< 0.038	40	1500	0.58	0.94	0.85	0.48
Isophorone	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Naphthalene	1.5	4 J	170 J	0.085 J	0.2 J	0.38 J	0.025 J
Nitrobenzene	< 0.038	< 1.9	< 40	< 0.04	< 0.039	< 0.042	< 0.035
N-Nitroso-di-n-propylamine	< 0.038	< 1.9	< 40	< 0.04	< 0.039	< 0.042	< 0.035
N-Nitrosodiphenylamine	< 0.38	< 19	< 400	< 0.4	< 0.39	< 0.42	< 0.35
Pentachlorophenol	< 1.5	< 75	< 1600	< 1.6	< 1.6	< 1.7	< 1.4
Phenanthrene	1.4	88	3000	0.17 J	1.2	1	0.24 J
Phenol	< 0.38	< 19	< 400	0.18 J	< 0.39	< 0.42	0.049 J
Pyrene	2.9	120	4300	0.63	1.6	2.8	0.62
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1

Quarry 3 Surface Soil Data
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(0-0.5 Feet)	SB-1(1-2 Feet)	SB-2(0-0.5 Feet)	SB-2(1-2 Feet)	SB-3(0-0.5 Feet)	SB-3(1-2 Feet)	SB-4(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	4910	4140	4820	2900	30200	15300	5470
Antimony	< 1.4	< 1.2	< 1.3	< 0.93	< 1.4	< 4.9	< 0.83
Arsenic	6.1	9.2	38.1	8.7	1.8	74.1	3.1 J
Barium	58.5 J	45.4 J	64.1 J	14.3 J	458	232 J	38.1 J
Beryllium	3.8 J	3.7 J	4 J	4.1 J	0.73 J	6.5 J	0.68
Cadmium	0.6 J	0.66 J	< 0.13	< 0.095	< 0.14	1.1 J	< 0.085
Calcium	7310	7490	71200	26700	3810	37000	1640
Chromium	13.4	13.3	14.4	6.6	53.3	28.6	6.9
Cobalt	46.5	25.9	22.1	16.6	17.3 J	23.4 J	3.8 J
Copper	112	92.1	100	43.9	37.8	57.2	9.4 J
Iron	90000	75300	66100	32100	46600	48400	10600
Lead	76	82.4	148	27.7	< 0.78	46.9	18.8
Magnesium	3000	3320	3770	12200	14500	9460	1300 J
Manganese	689	456	677	139	433	753	144
Mercury	0.12	0.71	4.1	0.08	0.09	2.9	0.04
Nickel	50.2	43.6	35.9	35.3	24.7	63.5	5.3 J
Potassium	< 36.8	< 32.7	< 35	< 25.3	12600	4270 J	1210
Selenium	< 4.5	6	53.4	7.7	2.2	20.2	2.4
Silver	< 0.24	< 0.22	< 0.23	< 0.17	< 0.25	< 0.87	< 0.15
Sodium	< 125	< 111	< 119	< 86.1	< 127	< 450	75.7 J
Thallium	< 1.5	< 1.4	< 1.5	< 1	< 1.6	< 1.1	< 0.93
Vanadium	17.6	15 J	16.9	10.4 J	100	45.3 J	10.8
Zinc	617	510	654	244	101	539	37.6 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-4(1-2 Feet)	SB-5(0-0.5 Feet)	SB-5(1-2 Feet)	SB-6(0-0.5 Feet)	SB-6D(0-0.5 Feet)	SB-6(1-2 Feet)	SB-7(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/29/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
1,1,2,2-Tetrachloroethane	< 0.092	< 0.0015	< 0.0009	< 0.0011	< 0.0015	< 0.001	< 0.0016
1,1,2-Trichloroethane	< 0.28	< 0.0045	< 0.0027	< 0.0034	< 0.0044	< 0.003	< 0.005
1,1-Dichloroethane	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
1,1-Dichloroethene	< 0.18	< 0.003	< 0.0018	< 0.0022	< 0.003	< 0.002	< 0.0033
1,2-Dichloroethane	< 0.18	< 0.003	< 0.0018	< 0.0022	< 0.003	< 0.002	< 0.0033
1,2-Dichloropropane	< 0.092	< 0.0015	< 0.0009	< 0.0011	< 0.0015	< 0.001	< 0.0016
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
4-Methyl-2-Pentanone	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Acetone	< 0.46	NA	0.042	NA	NA	0.066	NA
Benzene	< 0.092	< 0.0015	< 0.0009	< 0.0011	< 0.0015	< 0.001	< 0.0016
Bromodichloromethane	< 0.092	< 0.0015	< 0.0009	< 0.0011	< 0.0015	< 0.001	< 0.0016
Bromoform	< 0.37	< 0.006	< 0.0036	< 0.0045	< 0.0059	< 0.0041	< 0.0066
Bromomethane	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Carbon Disulfide	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	0.0004 J	< 0.0083
Carbon Tetrachloride	< 0.18	< 0.003	< 0.0018	< 0.0022	< 0.003	< 0.002	< 0.0033
Chlorobenzene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Chloroethane	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Chloroform	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Chloromethane	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
cis-1,2-Dichloroethene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
cis-1,3-Dichloropropene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Dibromochloromethane	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Ethylbenzene	< 0.37	< 0.006	< 0.0036	< 0.0045	< 0.0059	< 0.0041	< 0.0066
Methylene Chloride	< 0.28	< 0.0045	< 0.0027	< 0.0034	< 0.0044	< 0.003	< 0.005
Styrene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Tetrachloroethene	< 0.092	< 0.0015	< 0.0009	< 0.0011	< 0.0015	< 0.001	< 0.0016
Toluene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
trans-1,2-Dichloroethene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
trans-1,3-Dichloropropene	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Trichloroethene	< 0.092	< 0.0015	< 0.0009	< 0.0011	< 0.0015	< 0.001	< 0.0016
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083
Xylene (Total)	< 0.46	< 0.0076	< 0.0045	< 0.0056	< 0.0074	< 0.0051	< 0.0083

Table A-1 Quarry 3 Surface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-4(1-2 Feet)	SB-5(0-0.5 Feet)	SB-5(1-2 Feet)	SB-6(0-0.5 Feet)	SB-6D(0-0.5 Feet)	SB-6(1-2 Feet)	SB-7(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/29/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.035	< 0.5	< 0.036	< 0.037	< 0.038	< 0.036	< 0.6
1,2-Dichlorobenzene	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
1,3-Dichlorobenzene	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
1,4-Dichlorobenzene	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
2,4,5-Trichlorophenol	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
2,4,6-Trichlorophenol	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
2,4-Dichlorophenol	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
2,4-Dimethylphenol	< 0.35	0.63 J	0.026 J	0.013 J	< 0.38	< 0.36	3.4 J
2,4-Dinitrophenol	< 1.4	< 20	< 1.4	< 1.5	< 1.5	< 1.5	< 24
2,4-Dinitrotoluene	< 0.07	< 0.99	< 0.072	< 0.074	< 0.075	< 0.073	< 1.2
2,6-Dinitrotoluene	< 0.07	< 0.99	< 0.072	< 0.074	< 0.075	< 0.073	< 1.2
2-Chloronaphthalene	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
2-Chlorophenol	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
2-Methylnaphthalene	< 0.35	0.25 J	0.018 J	0.02 J	0.021 J	< 0.36	1.4 J
2-Methylphenol	< 0.35	0.76 J	0.052 J	0.028 J	0.028 J	< 0.36	4 J
2-Nitroaniline	< 0.7	< 9.9	< 0.72	< 0.74	< 0.75	< 0.73	< 12
2-Nitrophenol	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
3,3'-Dichlorobenzidine	< 0.7	< 9.9	< 0.72	< 0.74	< 0.75	< 0.73	< 12
3-Nitroaniline	< 0.7	< 9.9	< 0.72	< 0.74	< 0.75	< 0.73	< 12
4,6-Dinitro-2-methylphenol	< 1.4	< 20	< 1.4	< 1.5	< 1.5	< 1.5	< 24
4-Bromophenyl-phenylether	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
4-Chloro-3-methylphenol	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
4-Chloroaniline	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
4-Chlorophenyl-phenylether	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
4-Methylphenol	< 0.35	2.6 J	0.21 J	0.096 J	0.1 J	< 0.36	13
4-Nitroaniline	< 0.7	< 9.9	< 0.72	< 0.74	< 0.75	< 0.73	< 12
4-Nitrophenol	< 1.4	< 20	< 1.4	< 1.5	< 1.5	< 1.5	< 24
Acenaphthene	< 0.35	0.39 J	0.0094 J	< 0.37	< 0.38	< 0.36	< 6
Acenaphthylene	0.013 J	15	0.62	0.079 J	0.09 J	< 0.36	39
Anthracene	0.019 J	6.6	0.37	0.039 J	0.045 J	< 0.36	8.1
Benzo(a)anthracene	0.098	27	1.5	0.13	0.15	< 0.036	17
Benzo(a)pyrene	0.11	30	1.9	0.17	0.19	< 0.036	24
Benzo(b)fluoranthene	0.12	31	2.1	0.24	0.29	< 0.036	24
Benzo(g,h,i)perylene	0.081 J	27	1.4	0.15 J	0.16 J	< 0.36	16
Benzo(k)fluoranthene	0.14 J	32	1.8 J	0.26 J	0.29 J	< 0.036	27
bis(2-Chloroethoxy)methane	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
bis(2-Chloroethyl)ether	< 0.035	< 0.5	< 0.036	< 0.037	< 0.038	< 0.036	< 0.6
bis(2-chloroisopropyl)ether	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-4(1-2 Feet)	SB-5(0-0.5 Feet)	SB-5(1-2 Feet)	SB-6(0-0.5 Feet)	SB-6D(0-0.5 Feet)	SB-6(1-2 Feet)	SB-7(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/29/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Butylbenzylphthalate	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Carbazole	0.0096 J	8.4	0.45	0.047 J	0.054 J	< 0.36	7
Chrysene	0.12 J	28	1.7	0.2 J	0.21 J	< 0.36	17
Dibenz(a,h)anthracene	< 0.035	1.7	0.1	< 0.037	< 0.038	< 0.036	1.5
Dibenzofuran	< 0.35	0.56 J	0.048 J	0.0094 J	0.011 J	< 0.36	0.6 J
Diethylphthalate	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Dimethylphthalate	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Di-n-butylphthalate	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Di-n-octylphthalate	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Fluoranthene	0.17 J	42	2.6	0.22 J	0.25 J	< 0.36	18
Fluorene	< 0.35	0.82 J	0.06 J	< 0.37	< 0.38	< 0.36	0.73 J
Hexachlorobenzene	< 0.035	< 0.5	< 0.036	< 0.037	< 0.038	< 0.036	< 0.6
Hexachlorobutadiene	< 0.07	< 0.99	< 0.072	< 0.074	< 0.075	< 0.073	< 1.2
Hexachlorocyclopentadiene	NA	< 5	NA	NA	NA	NA	< 6
Hexachloroethane	< 0.035	< 0.5	< 0.036	< 0.037	< 0.038	< 0.036	< 0.6
Indeno(1,2,3-cd)pyrene	0.079	26	1.3	0.14	0.16	< 0.036	17
Isophorone	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Naphthalene	< 0.00292	1.8 J	0.16 J	0.036 J	0.043 J	< 0.00292	10
Nitrobenzene	< 0.035	< 0.5	< 0.036	< 0.037	< 0.038	< 0.036	< 0.6
N-Nitroso-di-n-propylamine	< 0.035	< 0.5	< 0.036	< 0.037	< 0.038	< 0.036	< 0.6
N-Nitrosodiphenylamine	< 0.35	< 5	< 0.36	< 0.37	< 0.38	< 0.36	< 6
Pentachlorophenol	< 1.4	< 20	< 1.4	< 1.5	< 1.5	< 1.5	< 24
Phenanthrene	0.065 J	13	0.81	0.096 J	0.1 J	< 0.36	6.4
Phenol	< 0.35	3.1 J	< 0.36	0.077 J	0.08 J	< 0.36	15
Pyrene	0.15 J	44	2.5	0.17 J	0.2 J	< 0.36	17
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-4(1-2 Feet)	SB-5(0-0.5 Feet)	SB-5(1-2 Feet)	SB-6(0-0.5 Feet)	SB-6D(0-0.5 Feet)	SB-6(1-2 Feet)	SB-7(0-0.5 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/29/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	6300	6980	3360	6340	6670	4620	13900
Antimony	< 0.82	< 1.2	< 0.77	< 0.87	< 0.88	< 0.86	4.1 J
Arsenic	4.5 J	39.4 J	9 J	11.5 J	12.7 J	10.9 J	419 J
Barium	47.7	32.7 J	12.7 J	11.1 J	11 J	13.6 J	61.7 J
Beryllium	0.9	2.8	2.6	5.9	6	10.4	1.8
Cadmium	< 0.084	< 0.12	< 0.079	< 0.089	< 0.09	0.64 J	0.81 J
Calcium	667 J	130200	132200	3050	1060 J	9430	198000
Chromium	10	8.9	3.7	7.9	8.8	4.3	17
Cobalt	6.1 J	20.8	18.6	9.3 J	9.6 J	28.5	7.8 J
Copper	7.3 J	43.4 J	22.3 J	20.1 J	19.5 J	23.2 J	93 J
Iron	12400	26600	23000	23200	24200	23700	24400
Lead	16.4	114	28.8	59	62.8	20.7	376
Magnesium	1350 J	37900 J	44900 J	4260 J	3190 J	4390 J	3650 J
Manganese	156	392	335	114	126	480	499
Mercury	< 0.017	1.2	0.05	0.14	0.14	0.07	20.4
Nickel	4.9 J	35.2	32	52.5	53.5	69.5	29.6
Potassium	1040 J	624 J	283 J	755 J	761 J	417 J	579 J
Selenium	0.85 J	39.4	4.3	2.4	3.1	0.9 J	82.8
Silver	< 0.15	< 0.21	< 0.14	< 0.16	< 0.16	< 0.15	< 0.25
Sodium	< 75.7	< 107	< 71.1	< 80.1	< 81.7	< 79.3	162 J
Thallium	< 0.92	< 1.3	< 0.87	< 0.98	< 1	1 J	< 1.6
Vanadium	11.8	11.4 J	6.1 J	13	14.4	8.2 J	14.4 J
Zinc	23.6 J	209 J	143 J	275 J	287 J	323 J	283 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-7(1-2 Feet)	SB-8(0-0.5 Feet)	SB-8(1-2 Feet)	SB-9(0-0.5 Feet)	SB-9(1-2 Feet)	SB-10(0-0.5 Feet)	SB-10(1-2 Feet)
Date Collected	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
1,1,2,2-Tetrachloroethane	< 0.0018	< 0.0011	< 0.0011	< 0.0014	< 0.0011	< 0.0012	< 0.001
1,1,2-Trichloroethane	< 0.0054	< 0.0033	< 0.0033	< 0.0041	< 0.0033	< 0.0036	< 0.0032
1,1-Dichloroethane	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
1,1-Dichloroethene	< 0.0036	< 0.0022	< 0.0022	< 0.0028	< 0.0022	< 0.0024	< 0.0021
1,2-Dichloroethane	< 0.0036	< 0.0022	< 0.0022	< 0.0028	< 0.0022	< 0.0024	< 0.0021
1,2-Dichloropropane	< 0.0018	< 0.0011	< 0.0011	< 0.0014	< 0.0011	< 0.0012	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
4-Methyl-2-Pentanone	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Acetone	NA	NA	NA	0.093	0.052	0.012 J	0.022 J
Benzene	0.0012 J	< 0.0011	< 0.0011	< 0.0014	< 0.0011	< 0.0012	< 0.001
Bromodichloromethane	< 0.0018	< 0.0011	< 0.0011	< 0.0014	< 0.0011	< 0.0012	< 0.001
Bromoform	< 0.0073	< 0.0044	< 0.0044	< 0.0055	< 0.0044	< 0.0048	< 0.0042
Bromomethane	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Carbon Disulfide	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Carbon Tetrachloride	< 0.0036	< 0.0022	< 0.0022	< 0.0028	< 0.0022	< 0.0024	< 0.0021
Chlorobenzene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Chloroethane	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Chloroform	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Chloromethane	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
cis-1,2-Dichloroethene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
cis-1,3-Dichloropropene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Dibromochloromethane	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Ethylbenzene	< 0.0073	< 0.0044	< 0.0044	< 0.0055	< 0.0044	< 0.0048	< 0.0042
Methylene Chloride	< 0.0054	< 0.0033	< 0.0033	< 0.0041	< 0.0033	< 0.0036	< 0.0032
Styrene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Tetrachloroethene	< 0.0018	< 0.0011	< 0.0011	< 0.0014	< 0.0011	< 0.0012	< 0.001
Toluene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
trans-1,2-Dichloroethene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
trans-1,3-Dichloropropene	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Trichloroethene	< 0.0018	< 0.0011	< 0.0011	< 0.0014	0.0006 J	< 0.0012	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053
Xylene (Total)	< 0.0091	< 0.0055	< 0.0055	< 0.0069	< 0.0055	< 0.006	< 0.0053

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-7(1-2 Feet)	SB-8(0-0.5 Feet)	SB-8(1-2 Feet)	SB-9(0-0.5 Feet)	SB-9(1-2 Feet)	SB-10(0-0.5 Feet)	SB-10(1-2 Feet)
Date Collected	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.4	< 0.38	< 0.037	< 0.05	< 0.037	< 0.04	< 0.038
1,2-Dichlorobenzene	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
1,3-Dichlorobenzene	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
1,4-Dichlorobenzene	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2,4,5-Trichlorophenol	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2,4,6-Trichlorophenol	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2,4-Dichlorophenol	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2,4-Dimethylphenol	1.3 J	0.24 J	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2,4-Dinitrophenol	< 16	< 15	< 1.5	< 2	< 1.5	< 1.6	< 1.5
2,4-Dinitrotoluene	< 0.81	< 0.75	< 0.074	< 0.1	< 0.074	< 0.08	< 0.076
2,6-Dinitrotoluene	< 0.81	< 0.75	< 0.074	< 0.1	< 0.074	< 0.08	< 0.076
2-Chloronaphthalene	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2-Chlorophenol	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
2-Methylnaphthalene	4 J	0.33 J	< 0.37	0.027 J	< 0.37	< 0.4	< 0.38
2-Methylphenol	4.1	0.27 J	< 0.37	0.072 J	< 0.37	< 0.4	< 0.38
2-Nitroaniline	< 8.1	< 7.5	< 0.74	< 1	< 0.74	< 0.8	< 0.76
2-Nitrophenol	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
3,3'-Dichlorobenzidine	< 8.1	< 7.5	< 0.74	< 1	< 0.74	< 0.8	< 0.76
3-Nitroaniline	< 8.1	< 7.5	< 0.74	< 1	< 0.74	< 0.8	< 0.76
4,6-Dinitro-2-methylphenol	< 16	< 15	< 1.5	< 2	< 1.5	< 1.6	< 1.5
4-Bromophenyl-phenylether	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
4-Chloro-3-methylphenol	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
4-Chloroaniline	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
4-Chlorophenyl-phenylether	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
4-Methylphenol	16	0.87 J	< 0.37	0.26 J	< 0.37	< 0.4	< 0.38
4-Nitroaniline	< 8.1	< 7.5	< 0.74	< 1	< 0.74	< 0.8	< 0.76
4-Nitrophenol	< 16	< 15	< 1.5	< 2	< 1.5	< 1.6	< 1.5
Acenaphthene	0.11 J	0.31 J	< 0.37	0.018 J	< 0.37	< 0.4	< 0.38
Acenaphthylene	2.7 J	8	< 0.37	0.32 J	< 0.37	0.011 J	< 0.38
Anthracene	0.74 J	11 J	0.019 J	0.16 J	< 0.37	< 0.4	< 0.38
Benzo(a)anthracene	0.67	30 J	0.08 J	0.45	< 0.037	0.039 J	0.014 J
Benzo(a)pyrene	0.93	28 J	0.082 J	0.77	< 0.037	0.045 J	0.016 J
Benzo(b)fluoranthene	1	30 J	0.07	1	< 0.037	0.052 J	0.016 J
Benzo(g,h,i)perylene	1.2 J	22 J	< 0.37	0.37 J	< 0.37	0.038 J	0.011 J
Benzo(k)fluoranthene	1.1	24 J	0.087 J	1.2 J	< 0.037	0.05 J	0.019 J
bis(2-Chloroethoxy)methane	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
bis(2-Chloroethyl)ether	< 0.4	< 0.38	< 0.037	< 0.05	< 0.037	< 0.04	< 0.038
bis(2-chloroisopropyl)ether	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-7(1-2 Feet)	SB-8(0-0.5 Feet)	SB-8(1-2 Feet)	SB-9(0-0.5 Feet)	SB-9(1-2 Feet)	SB-10(0-0.5 Feet)	SB-10(1-2 Feet)
Date Collected	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Butylbenzylphthalate	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Carbazole	2.4 J	17 J	0.029 J	0.14 J	< 0.37	< 0.4	< 0.38
Chrysene	0.81 J	32 J	0.086 J	0.64	< 0.37	0.057 J	0.025 J
Dibenz(a,h)anthracene	0.26 J	< 0.38	< 0.037	0.14	< 0.037	0.012 J	< 0.038
Dibenzofuran	1.2 J	1.2 J	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Diethylphthalate	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Dimethylphthalate	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Di-n-butylphthalate	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Di-n-octylphthalate	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Fluoranthene	1 J	69 J	0.17 J	0.66	< 0.37	0.07 J	0.021 J
Fluorene	0.23 J	2.5 J	< 0.37	0.033 J	< 0.37	< 0.4	< 0.38
Hexachlorobenzene	< 0.4	< 0.38	< 0.037	< 0.05	< 0.037	< 0.04	< 0.038
Hexachlorobutadiene	< 0.81	< 0.75	< 0.074	< 0.1	< 0.074	< 0.08	< 0.076
Hexachlorocyclopentadiene	< 4	< 3.8	< 0.37	NA	NA	< 0.4	< 0.38
Hexachloroethane	< 0.4	< 0.38	< 0.037	< 0.05	< 0.037	< 0.04	< 0.038
Indeno(1,2,3-cd)pyrene	1.3	21 J	0.057	0.43	< 0.037	0.034 J	0.011 J
Isophorone	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Naphthalene	51	1.6 J	< 0.00292	0.064 J	< 0.00292	< 0.00292	< 0.00292
Nitrobenzene	< 0.4	< 0.38	< 0.037	< 0.05	< 0.037	< 0.04	< 0.038
N-Nitroso-di-n-propylamine	< 0.4	< 0.38	< 0.037	< 0.05	< 0.037	< 0.04	< 0.038
N-Nitrosodiphenylamine	< 4	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Pentachlorophenol	< 16	< 15	< 1.5	< 2	< 1.5	< 1.6	< 1.5
Phenanthrene	2 J	33 J	0.062 J	0.31 J	< 0.37	0.033 J	< 0.38
Phenol	27	< 3.8	< 0.37	< 0.5	< 0.37	< 0.4	< 0.38
Pyrene	0.81 J	50 J	0.13 J	0.54	< 0.37	0.062 J	0.018 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-7(1-2 Feet)	SB-8(0-0.5 Feet)	SB-8(1-2 Feet)	SB-9(0-0.5 Feet)	SB-9(1-2 Feet)	SB-10(0-0.5 Feet)	SB-10(1-2 Feet)
Date Collected	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	4400	2790	2160	1210	1170	2510	2810
Antimony	1.7 J	< 0.8	< 0.79	< 1.2	< 0.78	< 1.4	< 1.3
Arsenic	44 J	9.5 J	8.9 J	5.4	1.1	8.6	9
Barium	128	19.5 J	7.8 J	15.6 J	22.6 J	21.4 J	78.9
Beryllium	1.2	3.4	1.2	< 0.03	0.43 J	0.97	1.8
Cadmium	< 0.088	< 0.082	< 0.081	< 0.12	< 0.08	< 0.14	< 0.14
Calcium	4240	3600	805 J	1080 J	73.2 J	235 J	141 J
Chromium	10.3	14.5	14.8	11.5	8.6	14.6 J	10.6 J
Cobalt	6.8 J	20.8	4.3 J	2.8 J	2 J	25.8 J	36.7 J
Copper	72.6 J	87.9 J	57.9 J	33.1	41.3	68.2 J	74.6 J
Iron	24400	41300	35800	13300	16400	61100	76800
Lead	158	39.7	32.1	72.9	12.9	46.5 J	30 J
Magnesium	749 J	1810 J	395 J	161 J	45.8 J	92.8 J	109 J
Manganese	109	186	67	218	24.8	394 J	625 J
Mercury	0.47	0.18	0.02 J	0.21	0.03	0.08	0.07
Nickel	16.6	31.6	7.4 J	5.7 J	5.2 J	31.6 J	54.6 J
Potassium	264 J	101 J	< 21.5	< 31.8	< 21.4	63.5 J	59.5 J
Selenium	25.6	6.4	1.9	5.1	< 0.78	< 1.4	< 1.3
Silver	< 0.15	< 0.14	< 0.14	< 0.21	< 0.14	< 0.25	< 0.24
Sodium	140 J	< 74.2	< 72.9	< 108	< 72.6	< 130	< 123
Thallium	< 0.97	< 0.9	< 0.89	< 1.3	< 0.88	< 1.6	< 1.5
Vanadium	13.2	15.8	31.6	16	9.7 J	14.7 J	11.5 J
Zinc	75.1 J	188 J	44.7 J	67.7	51.2	191 J	329 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-11(0-0.5 Feet)	SB-12(0-0.5 Feet)	SB-12(1-2 Feet)	SB-13(0-0.5 Feet)	SB-13(1-2 Feet)	SB-13D(1-2 Feet)	SB-14(0-0.5 Feet)
Date Collected	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/31/2003
Depth	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
1,1,2,2-Tetrachloroethane	< 0.0011	< 0.0013	< 0.0012	< 0.0016	< 0.001	< 0.0011	< 0.0014
1,1,2-Trichloroethane	< 0.0033	< 0.004	< 0.0036	< 0.0046	< 0.0031	< 0.0034	< 0.0042
1,1-Dichloroethane	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
1,1-Dichloroethene	< 0.0022	< 0.0027	< 0.0024	< 0.0031	< 0.0021	< 0.0022	< 0.0028
1,2-Dichloroethane	< 0.0022	< 0.0027	< 0.0024	< 0.0031	< 0.0021	< 0.0022	< 0.0028
1,2-Dichloropropane	< 0.0011	< 0.0013	< 0.0012	< 0.0016	< 0.001	< 0.0011	< 0.0014
2-Butanone	NA	NA	NA	NA	NA	NA	0.014 J
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
4-Methyl-2-Pentanone	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Acetone	NA	0.14 J	0.058 J	0.081 J	0.022 J	0.032 J	0.2 J
Benzene	< 0.0011	< 0.0013	< 0.0012	< 0.0016	< 0.001	< 0.0011	< 0.0014
Bromodichloromethane	< 0.0011	< 0.0013	< 0.0012	< 0.0016	< 0.001	< 0.0011	< 0.0014
Bromoform	< 0.0044	< 0.0053	< 0.0049	< 0.0062	< 0.0041	< 0.0045	< 0.0056
Bromomethane	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Carbon Disulfide	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Carbon Tetrachloride	< 0.0022	< 0.0027	< 0.0024	< 0.0031	< 0.0021	< 0.0022	< 0.0028
Chlorobenzene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Chloroethane	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Chloroform	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Chloromethane	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
cis-1,2-Dichloroethene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
cis-1,3-Dichloropropene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Dibromochloromethane	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Ethylbenzene	< 0.0044	< 0.0053	< 0.0049	< 0.0062	< 0.0041	< 0.0045	< 0.0056
Methylene Chloride	< 0.0033	< 0.004	< 0.0036	< 0.0046	< 0.0031	< 0.0034	< 0.0042
Styrene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Tetrachloroethene	0.0042	< 0.0013	< 0.0012	< 0.0016	0.0011	< 0.0011	< 0.0014
Toluene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
trans-1,2-Dichloroethene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
trans-1,3-Dichloropropene	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Trichloroethene	< 0.0011	< 0.0013	< 0.0012	< 0.0016	< 0.001	< 0.0011	< 0.0014
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007
Xylene (Total)	< 0.0056	< 0.0067	< 0.0061	< 0.0078	< 0.0052	< 0.0056	< 0.007

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-11(0-0.5 Feet)	SB-12(0-0.5 Feet)	SB-12(1-2 Feet)	SB-13(0-0.5 Feet)	SB-13(1-2 Feet)	SB-13D(1-2 Feet)	SB-14(0-0.5 Feet)
Date Collected	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/31/2003
Depth	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.035	< 0.039	< 0.038	< 0.038	< 0.038	< 0.038	< 0.039
1,2-Dichlorobenzene	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
1,3-Dichlorobenzene	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
1,4-Dichlorobenzene	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2,4,5-Trichlorophenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2,4,6-Trichlorophenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2,4-Dichlorophenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2,4-Dimethylphenol	0.051 J	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2,4-Dinitrophenol	< 1.4	< 1.6	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6
2,4-Dinitrotoluene	< 0.07	< 0.078	< 0.076	< 0.076	< 0.076	< 0.075	< 0.078
2,6-Dinitrotoluene	< 0.07	< 0.078	< 0.076	< 0.076	< 0.076	< 0.075	< 0.078
2-Chloronaphthalene	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2-Chlorophenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2-Methylnaphthalene	0.036 J	0.018 J	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
2-Methylphenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	0.01 J
2-Nitroaniline	< 0.7	< 0.78	< 0.76	< 0.76	< 0.76	< 0.75	< 0.78
2-Nitrophenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
3,3'-Dichlorobenzidine	< 0.7	< 0.78	< 0.76	< 0.76	< 0.76	< 0.75	< 0.78
3-Nitroaniline	< 0.7	< 0.78	< 0.76	< 0.76	< 0.76	< 0.75	< 0.78
4,6-Dinitro-2-methylphenol	< 1.4	< 1.6	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6
4-Bromophenyl-phenylether	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
4-Chloro-3-methylphenol	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
4-Chloroaniline	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
4-Chlorophenyl-phenylether	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
4-Methylphenol	0.18 J	0.12 J	< 0.38	< 0.38	< 0.38	< 0.38	0.05 J
4-Nitroaniline	< 0.7	< 0.78	< 0.76	< 0.76	< 0.76	< 0.75	< 0.78
4-Nitrophenol	< 1.4	< 1.6	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6
Acenaphthene	0.11 J	0.011 J	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Acenaphthylene	1.1 J	0.13 J	< 0.38	0.02 J	< 0.38	< 0.38	0.048 J
Anthracene	0.5 J	0.076 J	< 0.38	< 0.38	< 0.38	< 0.38	0.029 J
Benzo(a)anthracene	3	0.22	< 0.038	0.04	< 0.038	< 0.038	0.11
Benzo(a)pyrene	5.1	0.38	< 0.038	0.085	< 0.038	< 0.038	0.16
Benzo(b)fluoranthene	5.8 J	0.4 J	< 0.038	0.085 J	< 0.038	< 0.038	0.25 J
Benzo(g,h,i)perylene	4.2	0.42	< 0.38	0.0008 J	< 0.38	< 0.38	0.16 J
Benzo(k)fluoranthene	4.8	0.5	< 0.038	0.099	< 0.038	< 0.038	0.25
bis(2-Chloroethoxy)methane	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
bis(2-Chloroethyl)ether	< 0.035	< 0.039	< 0.038	< 0.038	< 0.038	< 0.038	< 0.039
bis(2-chloroisopropyl)ether	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39

Table A-1

Quarry 3 Surface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-11(0-0.5 Feet)	SB-12(0-0.5 Feet)	SB-12(1-2 Feet)	SB-13(0-0.5 Feet)	SB-13(1-2 Feet)	SB-13D(1-2 Feet)	SB-14(0-0.5 Feet)
Date Collected	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/31/2003
Depth	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Butylbenzylphthalate	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Carbazole	0.45	0.074 J	< 0.38	< 0.38	< 0.38	< 0.38	0.046 J
Chrysene	3.8	0.33 J	< 0.38	0.068 J	< 0.38	< 0.38	0.21 J
Dibenz(a,h)anthracene	1.2 J	0.13 J	< 0.038	< 0.038	< 0.038	< 0.038	0.052
Dibenzofuran	0.059 J	0.012 J	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Diethylphthalate	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Dimethylphthalate	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Di-n-butylphthalate	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Di-n-octylphthalate	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Fluoranthene	5.1 J	0.36 J	< 0.38	0.063 J	< 0.38	< 0.38	0.15 J
Fluorene	0.095 J	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Hexachlorobenzene	< 0.035	< 0.039	< 0.038	< 0.038	< 0.038	< 0.038	< 0.039
Hexachlorobutadiene	< 0.07	< 0.078	< 0.076	< 0.076	< 0.076	< 0.075	< 0.078
Hexachlorocyclopentadiene	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Hexachloroethane	< 0.035	< 0.039	< 0.038	< 0.038	< 0.038	< 0.038	< 0.039
Indeno(1,2,3-cd)pyrene	3.9	0.36	< 0.038	0.066	< 0.038	< 0.038	0.15
Isophorone	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Naphthalene	0.16 J	0.043 J	< 0.00292	< 0.00292	< 0.00292	< 0.00292	0.022 J
Nitrobenzene	< 0.035	< 0.039	< 0.038	< 0.038	< 0.038	< 0.038	< 0.039
N-Nitroso-di-n-propylamine	< 0.035	< 0.039	< 0.038	< 0.038	< 0.038	< 0.038	< 0.039
N-Nitrosodiphenylamine	< 0.35	< 0.39	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Pentachlorophenol	< 1.4	< 1.6	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6
Phenanthrene	0.97 J	0.15 J	< 0.38	0.019 J	< 0.38	< 0.38	0.07 J
Phenol	< 0.35	0.11 J	< 0.38	< 0.38	< 0.38	< 0.38	< 0.39
Pyrene	4.7 J	0.36 J	< 0.38	0.063 J	< 0.38	< 0.38	0.15 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-11(0-0.5 Feet)	SB-12(0-0.5 Feet)	SB-12(1-2 Feet)	SB-13(0-0.5 Feet)	SB-13(1-2 Feet)	SB-13D(1-2 Feet)	SB-14(0-0.5 Feet)
Date Collected	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/30/2003	7/31/2003
Depth	0-0.5 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	6390 J	4160 J	5140 J	2930 J	4900 J	5170 J	6610
Antimony	< 1.2	< 1.2	< 1.3	1.6 J	< 1.3	< 1.3	< 1.4
Arsenic	2.5 J	5.8 J	2.7 J	< 0.73	1.7 J	1.8 J	12.9 J
Barium	45.9	54.1	61.7	40.8 J	77	74.8	13.7 J
Beryllium	0.69	4.2	4	1.4	3	3.8	1.9
Cadmium	< 0.085	0.84 J	0.25 J	< 0.091	0.18 J	0.35 J	< 0.093
Calcium	738 J	1590 J	6400 J	368 J	672 J	721 J	853 J
Chromium	10.7 J	13.9 J	11.1 J	10 J	10.7 J	10.9 J	7.7 J
Cobalt	3.6 J	21.9	26.8	13.1	17.4	15.6	20.6
Copper	8.3	41.9	35.6	32.8	44.5	55.1	18.8
Iron	12100	53000	54000	31400	38500	49700	33700
Lead	18.8 J	105 J	49.8 J	38 J	39.1 J	44.2 J	44.7 J
Magnesium	1540 J	544 J	3620 J	136 J	496 J	530 J	1320 J
Manganese	177	470	445	324	319	247	152
Mercury	0.14	0.15	0.07	0.06	0.06	0.06	0.13
Nickel	6.8 J	34.3	37.5	14.3	24.8	27	30.7
Potassium	1270 J	155 J	159 J	141 J	112 J	103 J	281 J
Selenium	2.4	2.2	1 J	< 0.96	< 0.95	< 0.95	45.5
Silver	< 0.3	< 0.3	< 0.32	< 0.32	< 0.32	< 0.32	< 0.33
Sodium	< 83.7	< 83.7	< 89.6	< 90.3	< 89.9	< 89.5	< 92.4
Thallium	< 0.99	< 1.5	< 1.6	< 1.1	< 1.1	< 1.6	< 1.1
Vanadium	13.8	18.7	14.6	9.7 J	13.1	14.4	24.1
Zinc	31.1 J	491 J	448 J	191 J	255 J	366 J	178 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-14(1-2 Feet)	SB-15(0-0.5 Feet)	SB-15(1-2 Feet)	SB-16(0-0.5 Feet)	SB-16(1-2 Feet)	SB-17(0-0.5 Feet)	SB-17(1-2 Feet)
Date Collected	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
1,1,2,2-Tetrachloroethane	< 0.0013	< 0.0012	< 0.0012	< 0.0012	< 0.001	< 0.0018	< 0.0013
1,1,2-Trichloroethane	< 0.0039	< 0.0036	< 0.0035	< 0.0037	< 0.0031	< 0.0055	< 0.0039
1,1-Dichloroethane	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
1,1-Dichloroethene	< 0.0026	< 0.0024	< 0.0023	< 0.0025	< 0.0021	< 0.0036	< 0.0026
1,2-Dichloroethane	< 0.0026	< 0.0024	< 0.0023	< 0.0025	< 0.0021	< 0.0036	< 0.0026
1,2-Dichloropropane	< 0.0013	< 0.0012	< 0.0012	< 0.0012	< 0.001	< 0.0018	< 0.0013
2-Butanone	NA	NA	NA	NA	NA	0.015 J	0.016 J
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
4-Methyl-2-Pentanone	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Acetone	0.075 J	0.12 J	0.071 J	0.19 J	0.063 J	0.25 J	0.17 J
Benzene	< 0.0013	< 0.0012	< 0.0012	0.001 J	0.0007 J	< 0.0018	< 0.0013
Bromodichloromethane	< 0.0013	< 0.0012	< 0.0012	< 0.0012	< 0.001	< 0.0018	< 0.0013
Bromoform	< 0.0052	< 0.0048	< 0.0046	< 0.0049	< 0.0042	< 0.0073	< 0.0052
Bromomethane	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Carbon Disulfide	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Carbon Tetrachloride	< 0.0026	< 0.0024	< 0.0023	< 0.0025	< 0.0021	< 0.0036	< 0.0026
Chlorobenzene	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Chloroethane	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Chloroform	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Chloromethane	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
cis-1,2-Dichloroethene	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
cis-1,3-Dichloropropene	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Dibromochloromethane	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Ethylbenzene	< 0.0052	0.0005 J	< 0.0046	< 0.0049	< 0.0042	< 0.0073	< 0.0052
Methylene Chloride	< 0.0039	< 0.0036	< 0.0035	< 0.0037	< 0.0031	< 0.0055	< 0.0039
Styrene	< 0.0065	0.0004 J	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Tetrachloroethene	< 0.0013	< 0.0012	< 0.0012	< 0.0012	< 0.001	< 0.0018	< 0.0013
Toluene	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
trans-1,2-Dichloroethene	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
trans-1,3-Dichloropropene	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Trichloroethene	< 0.0013	< 0.0012	< 0.0012	< 0.0012	< 0.001	< 0.0018	< 0.0013
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0065	< 0.006	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066
Xylene (Total)	< 0.0065	0.0017 J	< 0.0058	< 0.0062	< 0.0052	< 0.0091	< 0.0066

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-14(1-2 Feet)	SB-15(0-0.5 Feet)	SB-15(1-2 Feet)	SB-16(0-0.5 Feet)	SB-16(1-2 Feet)	SB-17(0-0.5 Feet)	SB-17(1-2 Feet)
Date Collected	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.036	< 0.043	< 0.044	< 0.038	< 0.039	< 2.5	< 0.44
1,2-Dichlorobenzene	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
1,3-Dichlorobenzene	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
1,4-Dichlorobenzene	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
2,4,5-Trichlorophenol	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
2,4,6-Trichlorophenol	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
2,4-Dichlorophenol	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
2,4-Dimethylphenol	0.018 J	< 0.43	< 0.44	< 0.38	0.024 J	9 J	1.5 J
2,4-Dinitrophenol	< 1.4	< 1.7	< 1.7	< 1.5	< 1.6	< 100	< 17
2,4-Dinitrotoluene	< 0.072	< 0.086	< 0.087	< 0.075	< 0.079	< 5.1	< 0.87
2,6-Dinitrotoluene	< 0.072	< 0.086	< 0.087	< 0.075	< 0.079	< 5.1	< 0.87
2-Chloronaphthalene	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
2-Chlorophenol	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
2-Methylnaphthalene	< 0.36	< 0.43	< 0.44	0.019 J	0.037 J	2 J	0.73 J
2-Methylphenol	0.034 J	< 0.43	< 0.44	< 0.38	0.048 J	< 25	< 4.4
2-Nitroaniline	< 0.72	< 0.86	< 0.87	< 0.75	< 0.79	< 51	< 8.7
2-Nitrophenol	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
3,3'-Dichlorobenzidine	< 0.72	< 0.86	< 0.87	< 0.75	< 0.79	< 51	< 8.7
3-Nitroaniline	< 0.72	< 0.86	< 0.87	< 0.75	< 0.79	< 51	< 8.7
4,6-Dinitro-2-methylphenol	< 1.4	< 1.7	< 1.7	< 1.5	< 1.6	< 100	< 17
4-Bromophenyl-phenylether	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
4-Chloro-3-methylphenol	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
4-Chloroaniline	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
4-Chlorophenyl-phenylether	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
4-Methylphenol	0.15 J	< 0.43	< 0.44	< 0.38	0.17 J	24 J	6.1
4-Nitroaniline	< 0.72	< 0.86	< 0.87	< 0.75	< 0.79	< 51	< 8.7
4-Nitrophenol	< 1.4	< 1.7	< 1.7	< 1.5	< 1.6	< 100	< 17
Acenaphthene	0.028 J	< 0.43	< 0.44	0.01 J	0.053 J	3.4 J	0.62 J
Acenaphthylene	0.1 J	< 0.43	< 0.44	0.074 J	1.4 J	110	22
Anthracene	0.057 J	< 0.43	< 0.44	0.073 J	0.63 J	62	16
Benzo(a)anthracene	0.1	0.01 J	< 0.044	0.26	0.63	130 J	43 J
Benzo(a)pyrene	0.27	0.015 J	< 0.044	0.37	1.1	190	43
Benzo(b)fluoranthene	0.27 J	0.017 J	< 0.044	0.28 J	0.98 J	210	44
Benzo(g,h,i)perylene	0.22 J	< 0.43	< 0.44	0.24 J	1.8	180	25
Benzo(k)fluoranthene	0.33	0.021 J	< 0.044	0.35	1.2	160 J	39 J
bis(2-Chloroethoxy)methane	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
bis(2-Chloroethyl)ether	< 0.036	< 0.043	< 0.044	< 0.038	< 0.039	< 2.5	< 0.44
bis(2-chloroisopropyl)ether	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-14(1-2 Feet)	SB-15(0-0.5 Feet)	SB-15(1-2 Feet)	SB-16(0-0.5 Feet)	SB-16(1-2 Feet)	SB-17(0-0.5 Feet)	SB-17(1-2 Feet)
Date Collected	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Butylbenzylphthalate	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Carbazole	0.047 J	< 0.43	< 0.44	0.022 J	0.68	88	11
Chrysene	0.21 J	0.018 J	< 0.44	0.32 J	0.86	150	45
Dibenz(a,h)anthracene	0.076	< 0.043	< 0.044	0.084 J	0.36 J	48	9.3
Dibenzofuran	< 0.36	< 0.43	< 0.44	0.013 J	0.07 J	7.7 J	1.4 J
Diethylphthalate	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Dimethylphthalate	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Di-n-butylphthalate	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Di-n-octylphthalate	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Fluoranthene	0.083 J	0.024 J	< 0.44	0.47 J	1.6 J	240	55
Fluorene	0.0095 J	< 0.43	< 0.44	0.017 J	0.085 J	7.2 J	2.7 J
Hexachlorobenzene	< 0.036	< 0.043	< 0.044	< 0.038	< 0.039	< 2.5	< 0.44
Hexachlorobutadiene	< 0.072	< 0.086	< 0.087	< 0.075	< 0.079	< 5.1	< 0.87
Hexachlorocyclopentadiene	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Hexachloroethane	< 0.036	< 0.043	< 0.044	< 0.038	< 0.039	< 2.5	< 0.44
Indeno(1,2,3-cd)pyrene	< 0.036	< 0.043	< 0.044	0.22	1.3	170	28
Isophorone	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Naphthalene	0.016 J	< 0.00292	< 0.00292	< 0.00292	0.23 J	9.4 J	4.3 J
Nitrobenzene	< 0.036	< 0.043	< 0.044	< 0.038	< 0.039	< 2.5	< 0.44
N-Nitroso-di-n-propylamine	< 0.036	< 0.043	< 0.044	< 0.038	< 0.039	< 2.5	< 0.44
N-Nitrosodiphenylamine	< 0.36	< 0.43	< 0.44	< 0.38	< 0.39	< 25	< 4.4
Pentachlorophenol	< 1.4	< 1.7	< 1.7	< 1.5	< 1.6	< 100	< 17
Phenanthrene	0.07 J	0.009 J	< 0.44	0.23 J	0.72 J	120	18
Phenol	< 0.36	< 0.43	< 0.44	< 0.38	0.22 J	19 J	5.8
Pyrene	0.076 J	0.022 J	< 0.44	0.42 J	1.3 J	200	42
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-14(1-2 Feet)	SB-15(0-0.5 Feet)	SB-15(1-2 Feet)	SB-16(0-0.5 Feet)	SB-16(1-2 Feet)	SB-17(0-0.5 Feet)	SB-17(1-2 Feet)
Date Collected	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	2790	3600	4910	3710	3520	5140	7610
Antimony	< 1.2	< 1.4	< 1.5	< 1.3	< 1.4	< 1.8	< 0.93
Arsenic	3.6 J	2.3 J	2.6 J	2.8 J	6.8 J	25.1	113
Barium	7.9 J	200	162	57.3	32.2 J	22.2 J	28.7 J
Beryllium	0.98	4	4.2	1.8	4.6	2.9	1.6
Cadmium	< 0.086	0.97 J	0.97 J	< 0.09	0.79 J	< 0.18	< 0.095
Calcium	204 J	150 J	140 J	7120 J	17500 J	5610	106400
Chromium	4.5 J	11.5 J	15.4 J	9.1 J	9.2 J	9.9 J	9.6 J
Cobalt	6.9 J	59.3	51.4	31.6	22.7	15.3 J	11.3 J
Copper	10.5	72.5	65.8	87.8	46.2	52.9 J	38.7 J
Iron	15100	106900	94000	62700	44000	32300	13800
Lead	16.6 J	62.9 J	65.6 J	58.7 J	84.1 J	71.1 J	87.7 J
Magnesium	349 J	398 J	513 J	3140 J	9430 J	827 J	1890
Manganese	51.3	3180	1820	622	356	435 J	416 J
Mercury	0.06	0.05	0.05	0.06	0.32	4	5.4
Nickel	10.8	70.3	81.9	36.2	48.9	27.5 J	21 J
Potassium	68.5 J	181 J	456 J	209 J	170 J	709 J	389 J
Selenium	10.9	< 0.98	< 1.1	< 0.95	1.7	45.4	106
Silver	< 0.3	< 0.33	< 0.37	< 0.32	< 0.33	< 0.32	< 0.17
Sodium	< 85.1	< 92.5	< 104	< 89.2	< 93.4	318 J	152 J
Thallium	< 1	< 2.7	< 3.1	< 2.6	< 1.1	< 2	< 1
Vanadium	7.2 J	14.4	18.7	13.9	13.1	13.8 J	8.9 J
Zinc	60.9 J	805 J	867 J	352 J	493 J	380 J	164 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18(0-0.5 Feet)	SB-18(1-2 Feet)	SB-19(0-0.5 Feet)	SB-19(1-2 Feet)	SB-20(0-0.5 Feet)	SB-20(1-2 Feet)	SB-22(0-0.5 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
1,1,2,2-Tetrachloroethane	< 0.001	< 0.001	< 0.0021	< 0.0011	< 0.0013	< 0.0011	< 0.15
1,1,2-Trichloroethane	< 0.0029	< 0.0031	< 0.0062	< 0.0032	< 0.0039	< 0.0032	< 0.46
1,1-Dichloroethane	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
1,1-Dichloroethene	< 0.0019	< 0.0021	< 0.0042	< 0.0021	< 0.0026	< 0.0021	< 0.3
1,2-Dichloroethane	< 0.0019	< 0.0021	< 0.0042	< 0.0021	< 0.0026	< 0.0021	< 0.3
1,2-Dichloropropane	< 0.001	< 0.001	< 0.0021	< 0.0011	< 0.0013	< 0.0011	< 0.15
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
4-Methyl-2-Pentanone	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Acetone	0.075 J	0.037 J	0.13 J	0.091 J	0.12 J	0.026 J	< 0.76
Benzene	0.0007 J	< 0.001	< 0.0021	< 0.0011	< 0.0013	< 0.0011	< 0.15
Bromodichloromethane	< 0.001	< 0.001	< 0.0021	< 0.0011	< 0.0013	< 0.0011	< 0.15
Bromoform	< 0.0039	< 0.0041	< 0.0083	< 0.0043	< 0.0052	< 0.0043	< 0.61
Bromomethane	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Carbon Disulfide	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Carbon Tetrachloride	< 0.0019	< 0.0021	< 0.0042	< 0.0021	< 0.0026	< 0.0021	< 0.3
Chlorobenzene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Chloroethane	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Chloroform	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Chloromethane	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
cis-1,2-Dichloroethene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
cis-1,3-Dichloropropene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Dibromochloromethane	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Ethylbenzene	< 0.0039	< 0.0041	< 0.0083	< 0.0043	< 0.0052	< 0.0043	< 0.61
Methylene Chloride	< 0.0029	< 0.0031	< 0.0062	< 0.0032	< 0.0039	< 0.0032	< 0.46
Styrene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Tetrachloroethene	< 0.001	< 0.001	< 0.0021	< 0.0011	< 0.0013	< 0.0011	< 0.15
Toluene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
trans-1,2-Dichloroethene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
trans-1,3-Dichloropropene	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Trichloroethene	< 0.001	< 0.001	< 0.0021	< 0.0011	< 0.0013	< 0.0011	< 0.15
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76
Xylene (Total)	< 0.0048	< 0.0052	< 0.01	< 0.0054	< 0.0065	< 0.0053	< 0.76

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18(0-0.5 Feet)	SB-18(1-2 Feet)	SB-19(0-0.5 Feet)	SB-19(1-2 Feet)	SB-20(0-0.5 Feet)	SB-20(1-2 Feet)	SB-22(0-0.5 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.19	< 0.036	< 0.28	< 0.043	< 1.1	< 0.036	< 0.046
1,2-Dichlorobenzene	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
1,3-Dichlorobenzene	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
1,4-Dichlorobenzene	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
2,4,5-Trichlorophenol	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
2,4,6-Trichlorophenol	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
2,4-Dichlorophenol	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
2,4-Dimethylphenol	0.093 J	< 0.36	1.3 J	0.1 J	0.64 J	0.012 J	0.014 J
2,4-Dinitrophenol	< 7.5	< 1.4	< 11	< 1.7	< 43	< 1.4	< 1.8
2,4-Dinitrotoluene	< 0.37	< 0.072	< 0.55	< 0.085	< 2.1	< 0.071	< 0.091
2,6-Dinitrotoluene	< 0.37	< 0.072	< 0.55	< 0.085	< 2.1	< 0.071	< 0.091
2-Chloronaphthalene	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
2-Chlorophenol	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
2-Methylnaphthalene	0.078 J	< 0.36	0.98 J	0.27 J	0.69 J	0.0088 J	0.027 J
2-Methylphenol	0.17 J	0.0072 J	< 2.8	0.25 J	0.89 J	0.01 J	0.026 J
2-Nitroaniline	< 3.7	< 0.72	< 5.5	< 0.85	< 21	< 0.71	< 0.91
2-Nitrophenol	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
3,3'-Dichlorobenzidine	< 3.7	< 0.72	< 5.5	< 0.85	< 21	< 0.71	< 0.91
3-Nitroaniline	< 3.7	< 0.72	< 5.5	< 0.85	< 21	< 0.71	< 0.91
4,6-Dinitro-2-methylphenol	< 7.5	< 1.4	< 11	< 1.7	< 43	< 1.4	< 1.8
4-Bromophenyl-phenylether	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
4-Chloro-3-methylphenol	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
4-Chloroaniline	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
4-Chlorophenyl-phenylether	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
4-Methylphenol	0.68 J	0.04 J	5.5	1	2.1 J	0.034 J	0.086 J
4-Nitroaniline	< 3.7	< 0.72	< 5.5	< 0.85	< 21	< 0.71	< 0.91
4-Nitrophenol	< 7.5	< 1.4	< 11	< 1.7	< 43	< 1.4	< 1.8
Acenaphthene	0.16 J	< 0.36	0.54 J	< 0.43	0.93 J	< 0.36	< 0.46
Acenaphthylene	4	0.089 J	21	0.17 J	27	0.41	0.064 J
Anthracene	2.1	0.026 J	9.9	0.074 J	18	0.13 J	0.028 J
Benzo(a)anthracene	9.9 J	0.12 J	25 J	0.12 J	95	0.73 J	0.12
Benzo(a)pyrene	11	0.16	24	0.14	110	1.1 J	0.12
Benzo(b)fluoranthene	10	0.16	23	0.17	110	0.83 J	0.12
Benzo(g,h,i)perylene	8.6	0.18 J	15	0.17 J	85	1 J	0.16 J
Benzo(k)fluoranthene	12 J	0.17 J	23 J	0.15 J	89	1 J	0.12
bis(2-Chloroethoxy)methane	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
bis(2-Chloroethyl)ether	< 0.19	< 0.036	< 0.28	< 0.043	< 1.1	< 0.036	< 0.046
bis(2-chloroisopropyl)ether	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18(0-0.5 Feet)	SB-18(1-2 Feet)	SB-19(0-0.5 Feet)	SB-19(1-2 Feet)	SB-20(0-0.5 Feet)	SB-20(1-2 Feet)	SB-22(0-0.5 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Butylbenzylphthalate	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Carbazole	2.4	0.044 J	4.2	0.068 J	15	0.11 J	0.025 J
Chrysene	11	0.13 J	24	0.14 J	91	0.81 J	0.13 J
Dibenz(a,h)anthracene	< 0.19	< 0.036	5.9	< 0.043	22	0.24 J	0.037 J
Dibenzofuran	0.15 J	< 0.36	1.1 J	0.083 J	2.8 J	0.016 J	0.013 J
Diethylphthalate	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Dimethylphthalate	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Di-n-butylphthalate	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Di-n-octylphthalate	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Fluoranthene	18	0.2 J	33	0.21 J	140	1	0.15 J
Fluorene	0.26 J	< 0.36	2.6 J	0.024 J	3.7 J	0.02 J	0.01 J
Hexachlorobenzene	< 0.19	< 0.036	< 0.28	< 0.043	< 1.1	< 0.036	< 0.046
Hexachlorobutadiene	< 0.37	< 0.072	< 0.55	< 0.085	< 2.1	< 0.071	< 0.091
Hexachlorocyclopentadiene	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Hexachloroethane	< 0.19	< 0.036	< 0.28	< 0.043	< 1.1	< 0.036	< 0.046
Indeno(1,2,3-cd)pyrene	8	0.15	17	0.16	75	0.89 J	0.12
Isophorone	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Naphthalene	0.89 J	0.057 J	4.8	2.4	4.1 J	0.054 J	0.26 J
Nitrobenzene	< 0.19	< 0.036	< 0.28	< 0.043	< 1.1	< 0.036	< 0.046
N-Nitroso-di-n-propylamine	< 0.19	< 0.036	< 0.28	< 0.043	< 1.1	< 0.036	< 0.046
N-Nitrosodiphenylamine	< 1.9	< 0.36	< 2.8	< 0.43	< 11	< 0.36	< 0.46
Pentachlorophenol	< 7.5	< 1.4	< 11	< 1.7	< 43	< 1.4	< 1.8
Phenanthrene	4.8	0.071 J	15	0.18 J	59	0.2 J	0.083 J
Phenol	0.86 J	0.077 J	4.5	0.73	2.2 J	0.041 J	0.06 J
Pyrene	17	0.17 J	26	0.14 J	130	0.81	0.13 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18(0-0.5 Feet)	SB-18(1-2 Feet)	SB-19(0-0.5 Feet)	SB-19(1-2 Feet)	SB-20(0-0.5 Feet)	SB-20(1-2 Feet)	SB-22(0-0.5 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	5260	5750	10300	6330	2650	1400	3800
Antimony	< 0.8	< 0.76	< 1.8	< 1.5	< 1.5	< 1.2	< 2.2
Arsenic	12.6	9.3	122	15.6	8.5	8.4	9.6
Barium	14 J	15.2 J	30.7 J	16.4 J	26.8 J	46.3	25.4 J
Beryllium	3.8	3.3	7.8	6.9	2.2	1.9	4.5
Cadmium	< 0.082	< 0.078	0.35 J	0.17 J	< 0.1	< 0.085	0.22 J
Calcium	110800	116300	62800 J	17800 J	1490	582 J	42700
Chromium	5.1 J	5 J	16.4 J	9.2 J	11.6	11	9.8
Cobalt	33.1 J	21.5 J	35 J	32.5 J	22.1	17.7	30
Copper	28 J	27.4 J	47 J	34.9 J	35.9	28.7	43.4
Iron	26900	24500	44200	37700	34700	36300	51800
Lead	34.8 J	22.4 J	50.3 J	27 J	48.4	15.4	56.6
Magnesium	31200	35500	5080 J	5650 J	420 J	189 J	19600
Manganese	511 J	361 J	647 J	546 J	336	154	731
Mercury	0.27	0.17	6.8 J	0.22 J	0.71	0.13	0.18
Nickel	47.2 J	41.4 J	72.4	67.9	27.2	22.9	53.5
Potassium	502 J	653 J	313 J	< 80.7	220 J	< 67.3	< 118
Selenium	< 4	< 3.8	25.4	31.3	14	3.1	4.4
Silver	< 0.14	< 0.14	< 0.42	< 0.36	< 0.36	< 0.3	< 0.52
Sodium	< 73.7	< 70.7	< 119	< 101	135 J	97.1 J	< 148
Thallium	< 0.9	< 0.86	< 1.4	< 1.2	< 1.2	< 1	< 1.8
Vanadium	8.4 J	8.6 J	17.9	13.6	10.3 J	7.5 J	13 J
Zinc	202 J	164 J	395	358	276	240	280
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-22(1-2 Feet)	SB-23(0-0.5 Feet)	SB-23(1-2 Feet)	SB-24(0-0.5 Feet)	SB-24(1-2 Feet)	SB-25(0-0.5 Feet)	SB-25(1-2 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
1,1,2,2-Tetrachloroethane	< 0.001	< 0.002	< 0.001	< 0.0013	< 0.0013	< 0.0013	< 0.0012
1,1,2-Trichloroethane	< 0.003	< 0.006	< 0.0032	< 0.0038	< 0.0039	< 0.004	< 0.0037
1,1-Dichloroethane	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
1,1-Dichloroethene	< 0.002	< 0.004	< 0.0021	< 0.0025	< 0.0026	< 0.0027	< 0.0025
1,2-Dichloroethane	< 0.002	< 0.004	< 0.0021	< 0.0025	< 0.0026	< 0.0027	< 0.0025
1,2-Dichloropropane	< 0.001	< 0.002	< 0.001	< 0.0013	< 0.0013	< 0.0013	< 0.0012
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
4-Methyl-2-Pentanone	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Acetone	0.14 J	0.24 J	NA	0.2 J	0.08 J	0.2 J	0.12 J
Benzene	0.0008 J	< 0.002	< 0.001	< 0.0013	< 0.0013	< 0.0013	< 0.0012
Bromodichloromethane	< 0.001	< 0.002	< 0.001	< 0.0013	< 0.0013	< 0.0013	< 0.0012
Bromoform	< 0.004	< 0.008	< 0.0042	< 0.0051	< 0.0052	< 0.0054	< 0.0049
Bromomethane	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Carbon Disulfide	0.0011 J	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Carbon Tetrachloride	< 0.002	< 0.004	< 0.0021	< 0.0025	< 0.0026	< 0.0027	< 0.0025
Chlorobenzene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Chloroethane	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Chloroform	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Chloromethane	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
cis-1,2-Dichloroethene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
cis-1,3-Dichloropropene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Dibromochloromethane	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Ethylbenzene	< 0.004	< 0.008	< 0.0042	< 0.0051	< 0.0052	< 0.0054	< 0.0049
Methylene Chloride	< 0.003	< 0.006	< 0.0032	< 0.0038	< 0.0039	0.0041	< 0.0037
Styrene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Tetrachloroethene	< 0.001	< 0.002	< 0.001	< 0.0013	< 0.0013	< 0.0013	< 0.0012
Toluene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	0.0011 J	< 0.0062
trans-1,2-Dichloroethene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
trans-1,3-Dichloropropene	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Trichloroethene	< 0.001	< 0.002	< 0.001	< 0.0013	< 0.0013	< 0.0013	< 0.0012
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062
Xylene (Total)	< 0.005	< 0.01	< 0.0053	< 0.0063	< 0.0065	< 0.0067	< 0.0062

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-22(1-2 Feet)	SB-23(0-0.5 Feet)	SB-23(1-2 Feet)	SB-24(0-0.5 Feet)	SB-24(1-2 Feet)	SB-25(0-0.5 Feet)	SB-25(1-2 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.038	< 0.057	< 0.039	< 0.04	< 0.038	< 0.044	< 0.04
1,2-Dichlorobenzene	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
1,3-Dichlorobenzene	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
1,4-Dichlorobenzene	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
2,4,5-Trichlorophenol	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
2,4,6-Trichlorophenol	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
2,4-Dichlorophenol	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
2,4-Dimethylphenol	< 0.38	< 0.57	< 0.39	0.016 J	< 0.38	< 0.44	0.023 J
2,4-Dinitrophenol	< 1.5	< 2.3	< 1.6	< 1.6	< 1.5	< 1.7	< 1.6
2,4-Dinitrotoluene	< 0.077	< 0.11	< 0.078	< 0.08	< 0.075	< 0.087	< 0.08
2,6-Dinitrotoluene	< 0.077	< 0.11	< 0.078	< 0.08	< 0.075	< 0.087	< 0.08
2-Chloronaphthalene	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
2-Chlorophenol	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
2-Methylnaphthalene	< 0.38	< 0.57	< 0.39	0.0086 J	< 0.38	0.033 J	0.15 J
2-Methylphenol	< 0.38	< 0.57	< 0.39	0.022 J	< 0.38	0.0089 J	0.035 J
2-Nitroaniline	< 0.77	< 1.1	< 0.78	< 0.8	< 0.75	< 0.87	< 0.8
2-Nitrophenol	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
3,3'-Dichlorobenzidine	< 0.77	< 1.1	< 0.78	< 0.8	< 0.75	< 0.87	< 0.8
3-Nitroaniline	< 0.77	< 1.1	< 0.78	< 0.8	< 0.75	< 0.87	< 0.8
4,6-Dinitro-2-methylphenol	< 1.5	< 2.3	< 1.6	< 1.6	< 1.5	< 1.7	< 1.6
4-Bromophenyl-phenylether	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
4-Chloro-3-methylphenol	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
4-Chloroaniline	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
4-Chlorophenyl-phenylether	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
4-Methylphenol	< 0.38	< 0.57	< 0.39	0.079 J	0.011 J	0.047 J	0.096 J
4-Nitroaniline	< 0.77	< 1.1	< 0.78	< 0.8	< 0.75	< 0.87	< 0.8
4-Nitrophenol	< 1.5	< 2.3	< 1.6	< 1.6	< 1.5	< 1.7	< 1.6
Acenaphthene	< 0.38	< 0.57	< 0.39	0.014 J	< 0.38	< 0.44	0.019 J
Acenaphthylene	0.014 J	< 0.57	< 0.39	0.12 J	< 0.38	0.14 J	0.32 J
Anthracene	0.0088 J	< 0.57	< 0.39	0.065 J	< 0.38	0.066 J	0.14 J
Benzo(a)anthracene	0.022 J	0.024 J	< 0.039	0.27	0.022 J	0.21 J	0.35 J
Benzo(a)pyrene	0.019 J	0.039 J	< 0.039	0.29	0.02 J	0.27 J	0.37 J
Benzo(b)fluoranthene	0.017 J	0.038 J	< 0.039	0.38	0.029 J	0.27 J	0.47 J
Benzo(g,h,i)perylene	< 0.38	< 0.57	< 0.39	0.3 J	< 0.38	0.22 J	0.29 J
Benzo(k)fluoranthene	0.019 J	0.044 J	< 0.039	0.46	0.036 J	0.36 J	0.6 J
bis(2-Chloroethoxy)methane	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
bis(2-Chloroethyl)ether	< 0.038	< 0.057	< 0.039	< 0.04	< 0.038	< 0.044	< 0.04
bis(2-chloroisopropyl)ether	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-22(1-2 Feet)	SB-23(0-0.5 Feet)	SB-23(1-2 Feet)	SB-24(0-0.5 Feet)	SB-24(1-2 Feet)	SB-25(0-0.5 Feet)	SB-25(1-2 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Butylbenzylphthalate	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Carbazole	< 0.38	< 0.57	< 0.39	0.046 J	< 0.38	0.044 J	0.11 J
Chrysene	0.021 J	0.038 J	< 0.39	0.34 J	0.034 J	0.25 J	0.47 J
Dibenz(a,h)anthracene	< 0.038	< 0.057	< 0.039	0.026 J	< 0.038	0.065 J	0.1 J
Dibenzofuran	< 0.38	< 0.57	< 0.39	0.0095 J	< 0.38	0.021 J	0.088 J
Diethylphthalate	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Dimethylphthalate	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Di-n-butylphthalate	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Di-n-octylphthalate	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Fluoranthene	0.031 J	0.046 J	< 0.39	0.37 J	0.049 J	0.39 J	0.75 J
Fluorene	< 0.38	< 0.57	< 0.39	0.015 J	< 0.38	< 0.44	0.045 J
Hexachlorobenzene	< 0.038	< 0.057	< 0.039	< 0.04	< 0.038	< 0.044	< 0.04
Hexachlorobutadiene	< 0.077	< 0.11	< 0.078	< 0.08	< 0.075	< 0.087	< 0.08
Hexachlorocyclopentadiene	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Hexachloroethane	< 0.038	< 0.057	< 0.039	< 0.04	< 0.038	< 0.044	< 0.04
Indeno(1,2,3-cd)pyrene	< 0.038	< 0.057	< 0.039	0.28	< 0.038	0.22	0.31 J
Isophorone	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Naphthalene	0.033 J	< 0.00292	< 0.00292	0.02 J	< 0.00292	0.15 J	0.75
Nitrobenzene	< 0.038	< 0.057	< 0.039	< 0.04	< 0.038	< 0.044	< 0.04
N-Nitroso-di-n-propylamine	< 0.038	< 0.057	< 0.039	< 0.04	< 0.038	< 0.044	< 0.04
N-Nitrosodiphenylamine	< 0.38	< 0.57	< 0.39	< 0.4	< 0.38	< 0.44	< 0.4
Pentachlorophenol	< 1.5	< 2.3	< 1.6	< 1.6	< 1.5	< 1.7	0.023 J
Phenanthrene	0.034 J	0.023 J	< 0.39	0.15 J	0.023 J	0.17 J	0.55
Phenol	< 0.38	< 0.57	< 0.39	0.098 J	< 0.38	0.05 J	0.12 J
Pyrene	0.026 J	0.043 J	< 0.39	0.35 J	0.037 J	0.33 J	0.58 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-22(1-2 Feet)	SB-23(0-0.5 Feet)	SB-23(1-2 Feet)	SB-24(0-0.5 Feet)	SB-24(1-2 Feet)	SB-25(0-0.5 Feet)	SB-25(1-2 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	4450	2810	1180	2470	1360	2600	3300
Antimony	< 1.8	< 2	< 12.3	< 1.4	< 0.8	< 1	< 0.94
Arsenic	7.5	4.1	< 6.8	4.7	2.4	5.8	9.8
Barium	31.2 J	22.4 J	< 3.6	85.3 J	41.8 J	37.6 J	53.7 J
Beryllium	5.3	1.4	< 0.64	2.4 J	1 J	2 J	1.6 J
Cadmium	< 0.13	< 0.14	< 0.85	< 0.14	< 0.082	< 0.1	< 0.096
Calcium	13400	1350 J	< 90.1	699 J	251 J	728 J	228 J
Chromium	7.8	12.2	19 J	9.2	9.5	11.1	9.7
Cobalt	36.8	20	106	25.1	6.9 J	31.2	21
Copper	36.3	41.2	88.6	42.8	39.2	50.2	49.2
Iron	58600	51400	152700	57200 J	29800 J	45200 J	38200 J
Lead	32	67.2	32.3	52.7	47.7	49.9	59.3
Magnesium	7350	303 J	< 88.2	324 J	101 J	329 J	249 J
Manganese	693	339	551	800	209	705	151
Mercury	0.06	0.19	< 0.017	0.12	0.06	0.1	0.17
Nickel	70.2	34.1	30.2 J	39.8	13.3	38.7	39.5
Potassium	< 99.1	150 J	< 668	148 J	79 J	126 J	122 J
Selenium	2.5	2.8	11.4	2.9	< 0.8	2.1	4.3
Silver	< 0.44	< 0.48	< 3	< 0.25	< 0.14	< 0.18	< 0.17
Sodium	< 124	< 136	< 838	< 130	99.3 J	< 94.4	< 86.7
Thallium	< 1.5	< 1.6	< 10	< 1.6	< 0.9	< 1.2	< 1.1
Vanadium	10.1 J	14.3 J	6.2 J	13.4 J	9.8 J	12.8 J	16.4
Zinc	311	189	770	469	190	252	168
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-26(0-0.5 Feet)	SB-26(1-2 Feet)	SB-28(0-0.5 Feet)	SB-28(1-2 Feet)	SB-28D(1-2 Feet)	SB-29(0-0.5 Feet)	SB-29(1-2 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/5/2003	8/5/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
1,1,2,2-Tetrachloroethane	< 0.0015	< 0.001	< 0.0012	< 0.0014	< 0.0016	< 0.0011	< 0.001
1,1,2-Trichloroethane	< 0.0044	< 0.0031	< 0.0035	< 0.0042	< 0.0047	< 0.0032	< 0.0031
1,1-Dichloroethane	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
1,1-Dichloroethene	< 0.0029	< 0.0021	< 0.0023	< 0.0028	< 0.0031	< 0.0021	< 0.0021
1,2-Dichloroethane	< 0.0029	< 0.0021	< 0.0023	< 0.0028	< 0.0031	< 0.0021	< 0.0021
1,2-Dichloropropane	< 0.0015	< 0.001	< 0.0012	< 0.0014	< 0.0016	< 0.0011	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
4-Methyl-2-Pentanone	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Acetone	0.29 J	0.21 J	0.11 J	0.097 J	0.14 J	0.051 J	0.028 J
Benzene	< 0.0015	< 0.001	< 0.0012	< 0.0014	< 0.0016	< 0.0011	< 0.001
Bromodichloromethane	< 0.0015	< 0.001	< 0.0012	< 0.0014	< 0.0016	< 0.0011	< 0.001
Bromoform	< 0.0059	< 0.0042	< 0.0046	< 0.0056	< 0.0063	< 0.0043	< 0.0042
Bromomethane	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Carbon Disulfide	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Carbon Tetrachloride	< 0.0029	< 0.0021	< 0.0023	< 0.0028	< 0.0031	< 0.0021	< 0.0021
Chlorobenzene	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Chloroethane	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Chloroform	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Chloromethane	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
cis-1,2-Dichloroethene	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
cis-1,3-Dichloropropene	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Dibromochloromethane	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Ethylbenzene	< 0.0059	< 0.0042	< 0.0046	< 0.0056	< 0.0063	< 0.0043	< 0.0042
Methylene Chloride	< 0.0044	< 0.0031	< 0.0035	< 0.0042	< 0.0047	< 0.0032	< 0.0031
Styrene	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Tetrachloroethene	< 0.0015	< 0.001	< 0.0012	< 0.0014	< 0.0016	< 0.0011	< 0.001
Toluene	< 0.0073	0.0006 J	0.001 J	0.0008 J	< 0.0079	0.0008 J	0.0007 J
trans-1,2-Dichloroethene	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
trans-1,3-Dichloropropene	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Trichloroethene	< 0.0015	< 0.001	< 0.0012	< 0.0014	< 0.0016	< 0.0011	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052
Xylene (Total)	< 0.0073	< 0.0052	< 0.0058	< 0.0069	< 0.0079	< 0.0053	< 0.0052

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-26(0-0.5 Feet)	SB-26(1-2 Feet)	SB-28(0-0.5 Feet)	SB-28(1-2 Feet)	SB-28D(1-2 Feet)	SB-29(0-0.5 Feet)	SB-29(1-2 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/5/2003	8/5/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.046	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
1,2-Dichlorobenzene	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
1,3-Dichlorobenzene	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
1,4-Dichlorobenzene	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2,4,5-Trichlorophenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2,4,6-Trichlorophenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2,4-Dichlorophenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2,4-Dimethylphenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	0.15 J
2,4-Dinitrophenol	< 1.8	< 1.5	< 1.6	< 1.8	< 1.7	< 1.5	< 1.5
2,4-Dinitrotoluene	< 0.091	< 0.076	< 0.082	< 0.088	< 0.086	< 0.075	< 0.073
2,6-Dinitrotoluene	< 0.091	< 0.076	< 0.082	< 0.088	< 0.086	< 0.075	< 0.073
2-Chloronaphthalene	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2-Chlorophenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2-Methylnaphthalene	0.027 J	0.011 J	< 0.41	< 0.44	< 0.43	< 0.38	0.021 J
2-Methylphenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
2-Nitroaniline	< 0.91	< 0.76	< 0.82	< 0.88	< 0.86	< 0.75	< 0.73
2-Nitrophenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
3,3'-Dichlorobenzidine	< 0.91	< 0.76	< 0.82	< 0.88	< 0.86	< 0.75	< 0.73
3-Nitroaniline	< 0.91	< 0.76	< 0.82	< 0.88	< 0.86	< 0.75	< 0.73
4,6-Dinitro-2-methylphenol	< 1.8	< 1.5	< 1.6	< 1.8	< 1.7	< 1.5	< 1.5
4-Bromophenyl-phenylether	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
4-Chloro-3-methylphenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
4-Chloroaniline	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
4-Chlorophenyl-phenylether	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
4-Methylphenol	< 0.46	0.0076 J	< 0.41	< 0.44	< 0.43	< 0.38	0.53
4-Nitroaniline	< 0.91	< 0.76	< 0.82	< 0.88	< 0.86	< 0.75	< 0.73
4-Nitrophenol	0.013 J	< 1.5	< 1.6	< 1.8	< 1.7	< 1.5	< 1.5
Acenaphthene	0.08 J	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Acenaphthylene	0.049 J	< 0.38	0.036 J	< 0.44	< 0.43	0.041 J	0.9
Anthracene	0.16 J	< 0.38	0.024 J	< 0.44	< 0.43	0.04 J	0.13 J
Benzo(a)anthracene	0.52 J	0.05 J	0.084 J	< 0.044	< 0.043	0.14 J	0.15 J
Benzo(a)pyrene	0.53 J	0.054 J	0.11 J	< 0.044	< 0.043	0.092 J	0.18
Benzo(b)fluoranthene	0.43 J	0.058 J	0.086 J	< 0.044	< 0.043	0.078	0.19
Benzo(g,h,i)perylene	0.28 J	0.035 J	0.074 J	< 0.44	< 0.43	0.048 J	0.19 J
Benzo(k)fluoranthene	0.54 J	0.054 J	0.088 J	< 0.044	< 0.043	0.12 J	0.22 J
bis(2-Chloroethoxy)methane	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
bis(2-Chloroethyl)ether	< 0.046	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
bis(2-chloroisopropyl)ether	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-26(0-0.5 Feet)	SB-26(1-2 Feet)	SB-28(0-0.5 Feet)	SB-28(1-2 Feet)	SB-28D(1-2 Feet)	SB-29(0-0.5 Feet)	SB-29(1-2 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/5/2003	8/5/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Butylbenzylphthalate	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Carbazole	0.09 J	< 0.38	0.012 J	< 0.44	< 0.43	0.015 J	0.15 J
Chrysene	0.58 J	0.074 J	0.09 J	< 0.44	< 0.43	0.13 J	0.16 J
Dibenz(a,h)anthracene	0.031 J	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
Dibenzofuran	0.044 J	< 0.38	0.012 J	< 0.44	< 0.43	0.0077 J	< 0.36
Diethylphthalate	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Dimethylphthalate	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Di-n-butylphthalate	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Di-n-octylphthalate	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Fluoranthene	0.91	0.14 J	0.18 J	< 0.44	< 0.43	0.31 J	0.18 J
Fluorene	0.086 J	< 0.38	0.01 J	< 0.44	< 0.43	0.013 J	< 0.36
Hexachlorobenzene	< 0.046	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
Hexachlorobutadiene	< 0.091	< 0.076	< 0.082	< 0.088	< 0.086	< 0.075	< 0.073
Hexachlorocyclopentadiene	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Hexachloroethane	< 0.046	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
Indeno(1,2,3-cd)pyrene	0.25 J	0.033 J	0.063 J	< 0.044	< 0.043	0.052	0.19
Isophorone	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Naphthalene	0.047 J	< 0.00292	0.034 J	< 0.00292	< 0.00292	< 0.00292	0.18 J
Nitrobenzene	< 0.046	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
N-Nitroso-di-n-propylamine	< 0.046	< 0.038	< 0.041	< 0.044	< 0.043	< 0.038	< 0.036
N-Nitrosodiphenylamine	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	< 0.36
Pentachlorophenol	< 1.8	< 1.5	< 1.6	< 1.8	< 1.7	< 1.5	< 1.5
Phenanthrene	0.63	0.074 J	0.079 J	< 0.44	< 0.43	0.18 J	0.054 J
Phenol	< 0.46	< 0.38	< 0.41	< 0.44	< 0.43	< 0.38	0.4
Pyrene	0.73	0.099 J	0.14 J	< 0.44	< 0.43	0.21 J	0.18 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-1 **Quarry 3 Surface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-26(0-0.5 Feet)	SB-26(1-2 Feet)	SB-28(0-0.5 Feet)	SB-28(1-2 Feet)	SB-28D(1-2 Feet)	SB-29(0-0.5 Feet)	SB-29(1-2 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/5/2003	8/5/2003
Depth	0-0.5 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet	1-2 Feet	0-0.5 Feet	1-2 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Duplicate	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Surface	Surface	Surface	Surface	Surface	Surface	Surface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	8200	4470	3560	4010	3900	2500	2480
Antimony	< 1.1	< 0.89	< 1.4	< 1.5	< 1.5	< 1.2	< 1.3
Arsenic	9.2	9.3	5.1	4	4.2	3.3	13.5
Barium	70 J	36.1 J	107 J	127	131	59.4 J	24.9 J
Beryllium	1.6 J	3.4 J	3.2 J	3.3	3.5	2.1	3.8
Cadmium	0.88 J	< 0.091	< 0.15	0.32 J	0.37 J	< 0.082	< 0.088
Calcium	3810	1020 J	< 27.6	196 J	187 J	5430 J	14800 J
Chromium	21.1	10.6	12.5	10.8 J	10.2 J	7.9 J	6.1 J
Cobalt	24.4	51.9	50.4	51.3 J	55.2 J	39.3 J	30.5 J
Copper	43.3	31.9	41.5	42.9 J	42.3 J	93.2 J	31.4 J
Iron	37800 J	35400 J	57500 J	69500	70500	80900	39100
Lead	215	52.3	37.3	37.9 J	37.1 J	72.1 J	50.5 J
Magnesium	1310 J	580 J	360 J	426 J	416 J	1970 J	5390 J
Manganese	934	678	1540	1900 J	2030 J	799 J	420 J
Mercury	0.1	0.12	0.02 J	< 0.022	< 0.021	< 0.019	0.19 J
Nickel	32.9	49.9	58	71	75.3	41.3	42.4
Potassium	731 J	166 J	142 J	164 J	160 J	229 J	337 J
Selenium	< 1.1	< 0.89	< 1.4	< 1.1	< 1.1	< 0.86	< 0.92
Silver	< 0.19	< 0.16	< 0.26	< 0.37	< 0.36	< 0.29	< 0.31
Sodium	< 98.9	< 82	< 134	< 104	< 102	< 81.3	97.1 J
Thallium	< 1.2	< 1	< 1.6	< 1.2	< 1.2	< 0.97	< 1
Vanadium	26.8	16	13.7 J	14.4	13.6	11	7 J
Zinc	597	288	411	626	662	470	364
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(3-4 Feet)	SB-1(5-6 Feet)	SB-1(10-11.5 Feet)	SB-2(3-4 Feet)	SB-2(5-6 Feet)	SB-3(3-4 Feet)	SB-3(5-6 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	3-4 Feet	5-6 Feet	10-11.5 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
1,1,2,2-Tetrachloroethane	< 0.001	< 0.001	< 0.0009	< 0.0012	< 0.001	< 0.0011	< 0.001
1,1,2-Trichloroethane	< 0.003	< 0.003	< 0.0027	< 0.0038	< 0.003	< 0.0032	< 0.003
1,1-Dichloroethane	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
1,1-Dichloroethene	< 0.002	< 0.002	< 0.0018	< 0.0025	< 0.002	< 0.0022	< 0.002
1,2-Dichloroethane	< 0.002	< 0.002	< 0.0018	< 0.0025	< 0.002	< 0.0022	< 0.002
1,2-Dichloropropane	< 0.001	< 0.001	< 0.0009	< 0.0012	< 0.001	< 0.0011	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
4-Methyl-2-Pentanone	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Acetone	0.036	0.044	NA	0.056	0.032	0.035	0.068
Benzene	0.0005 J	0.0042	0.0016	0.0018	< 0.001	< 0.0011	< 0.001
Bromodichloromethane	< 0.001	< 0.001	< 0.0009	< 0.0012	< 0.001	< 0.0011	< 0.001
Bromoform	< 0.004	< 0.004	< 0.0036	< 0.005	< 0.004	< 0.0043	< 0.004
Bromomethane	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Carbon Disulfide	0.0009 J	0.0031 J	< 0.0045	0.0011 J	< 0.005	< 0.0054	< 0.005
Carbon Tetrachloride	< 0.002	< 0.002	< 0.0018	< 0.0025	< 0.002	< 0.0022	< 0.002
Chlorobenzene	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Chloroethane	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Chloroform	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Chloromethane	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
cis-1,2-Dichloroethene	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
cis-1,3-Dichloropropene	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Dibromochloromethane	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Ethylbenzene	< 0.004	< 0.004	< 0.0036	< 0.005	< 0.004	< 0.0043	< 0.004
Methylene Chloride	< 0.003	< 0.003	< 0.0027	< 0.0038	< 0.003	< 0.0032	< 0.003
Styrene	< 0.005	< 0.005	0.0001 J	< 0.0063	< 0.005	< 0.0054	< 0.005
Tetrachloroethene	< 0.001	< 0.001	< 0.0009	< 0.0012	< 0.001	< 0.0011	< 0.001
Toluene	0.0006 J	0.0006 J	0.0011 J	0.0008 J	< 0.005	< 0.0054	< 0.005
trans-1,2-Dichloroethene	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
trans-1,3-Dichloropropene	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Trichloroethene	< 0.001	< 0.001	< 0.0009	< 0.0012	< 0.001	< 0.0011	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.005	< 0.005	< 0.0045	< 0.0063	< 0.005	< 0.0054	< 0.005
Xylene (Total)	0.0008 J	< 0.005	0.0007 J	< 0.0063	< 0.005	< 0.0054	< 0.005

Table A-2

Quarry 3 Subsurface Soil Data
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(3-4 Feet)	SB-1(5-6 Feet)	SB-1(10-11.5 Feet)	SB-2(3-4 Feet)	SB-2(5-6 Feet)	SB-3(3-4 Feet)	SB-3(5-6 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	3-4 Feet	5-6 Feet	10-11.5 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.79	< 0.04	< 0.039	< 0.081	< 0.039	< 0.077	< 0.074
1,2-Dichlorobenzene	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
1,3-Dichlorobenzene	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
1,4-Dichlorobenzene	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
2,4,5-Trichlorophenol	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
2,4,6-Trichlorophenol	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
2,4-Dichlorophenol	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
2,4-Dimethylphenol	0.66 J	0.0089 J	0.023 J	< 0.81	0.01 J	0.061 J	0.092 J
2,4-Dinitrophenol	< 32	< 1.6	< 1.6	< 3.2	< 1.6	< 3.1	< 3
2,4-Dinitrotoluene	< 1.6	< 0.08	< 0.079	< 0.16	< 0.078	< 0.15	< 0.15
2,6-Dinitrotoluene	< 1.6	< 0.08	< 0.079	< 0.16	< 0.078	< 0.15	< 0.15
2-Chloronaphthalene	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
2-Chlorophenol	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
2-Methylnaphthalene	1 J	0.091 J	0.15 J	0.04 J	< 0.39	0.034 J	0.067 J
2-Methylphenol	0.57 J	< 0.4	0.033 J	0.11 J	0.033 J	0.065 J	0.1 J
2-Nitroaniline	< 16	< 0.8	< 0.79	< 1.6	< 0.78	< 1.5	< 1.5
2-Nitrophenol	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
3,3'-Dichlorobenzidine	< 16	< 0.8	< 0.79	< 1.6	< 0.78	< 1.5	< 1.5
3-Nitroaniline	< 16	< 0.8	< 0.79	< 1.6	< 0.78	< 1.5	< 1.5
4,6-Dinitro-2-methylphenol	< 32	< 1.6	< 1.6	< 3.2	< 1.6	< 3.1	< 3
4-Bromophenyl-phenylether	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
4-Chloro-3-methylphenol	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
4-Chloroaniline	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
4-Chlorophenyl-phenylether	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
4-Methylphenol	1.8 J	< 0.4	0.092 J	0.4 J	0.13 J	0.21 J	0.31 J
4-Nitroaniline	< 16	< 0.8	< 0.79	< 1.6	< 0.78	< 1.5	< 1.5
4-Nitrophenol	< 32	< 1.6	< 1.6	< 3.2	< 1.6	< 3.1	< 3
Acenaphthene	< 7.9	< 0.4	0.07 J	0.043 J	< 0.39	< 0.77	0.1 J
Acenaphthylene	17	0.073 J	0.7	1.7	0.0098 J	1.7	2.7
Anthracene	11	0.092 J	1.1	1.6	< 0.39	2.1	2.6
Benzo(a)anthracene	26	0.018 J	1.2	4.3	0.016 J	2.8	6.4
Benzo(a)pyrene	39	0.012 J	1	5.3	0.017 J	2.9	6.6
Benzo(b)fluoranthene	38	0.011 J	0.95	6.1	0.017 J	2.7	7
Benzo(g,h,i)perylene	7.4 J	< 0.4	0.33 J	2.6	0.019 J	0.99	3.2
Benzo(k)fluoranthene	47	0.011 J	1.2 J	6 J	0.017 J	3.7 J	5.7
bis(2-Chloroethoxy)methane	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
bis(2-Chloroethyl)ether	< 0.79	< 0.04	< 0.039	< 0.081	< 0.039	< 0.077	< 0.074
bis(2-chloroisopropyl)ether	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74

Table A-2 **Quarry 3 Subsurface Soil Data**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(3-4 Feet)	SB-1(5-6 Feet)	SB-1(10-11.5 Feet)	SB-2(3-4 Feet)	SB-2(5-6 Feet)	SB-3(3-4 Feet)	SB-3(5-6 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	3-4 Feet	5-6 Feet	10-11.5 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Butylbenzylphthalate	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Carbazole	4.2 J	0.53	1.5	1.9	0.0086 J	1.8	4.2
Chrysene	26	0.013 J	1.2	4.9	0.019 J	3.1	6.1
Dibenz(a,h)anthracene	1.6	< 0.04	0.04	0.2	< 0.039	0.097	0.3
Dibenzofuran	2 J	0.058 J	0.53	0.17 J	< 0.39	0.21 J	0.26 J
Diethylphthalate	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Dimethylphthalate	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Di-n-butylphthalate	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Di-n-octylphthalate	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Fluoranthene	44	0.066 J	3.6	9.7	0.021 J	8.2	12
Fluorene	3.9 J	0.12 J	0.82	0.35 J	< 0.39	0.52 J	0.52 J
Hexachlorobenzene	< 0.79	< 0.04	< 0.039	< 0.081	< 0.039	< 0.077	< 0.074
Hexachlorobutadiene	< 1.6	< 0.08	< 0.079	< 0.16	< 0.078	< 0.15	< 0.15
Hexachlorocyclopentadiene	< 7.9	NA	NA	NA	< 0.39	NA	< 0.74
Hexachloroethane	< 0.79	< 0.04	< 0.039	< 0.081	< 0.039	< 0.077	< 0.074
Indeno(1,2,3-cd)pyrene	9.4	< 0.04	0.38	2.7	0.013 J	1.1	3.2
Isophorone	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Naphthalene	3.3 J	2.3	0.45	0.24 J	0.096 J	0.14 J	0.29 J
Nitrobenzene	< 0.79	< 0.04	< 0.039	< 0.081	< 0.039	< 0.077	< 0.074
N-Nitroso-di-n-propylamine	< 0.79	< 0.04	< 0.039	< 0.081	< 0.039	< 0.077	< 0.074
N-Nitrosodiphenylamine	< 7.9	< 0.4	< 0.39	< 0.81	< 0.39	< 0.77	< 0.74
Pentachlorophenol	< 32	< 1.6	< 1.6	< 3.2	< 1.6	< 3.1	< 3
Phenanthrene	14	0.14 J	4.6	5.2	0.0085 J	5.5	6.5
Phenol	1.7 J	< 0.4	< 0.39	0.44 J	0.17 J	0.19 J	0.32 J
Pyrene	25	0.046 J	2.7	7.7	0.02 J	6.3	12
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-1(3-4 Feet)	SB-1(5-6 Feet)	SB-1(10-11.5 Feet)	SB-2(3-4 Feet)	SB-2(5-6 Feet)	SB-3(3-4 Feet)	SB-3(5-6 Feet)
Date Collected	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003	7/28/2003
Depth	3-4 Feet	5-6 Feet	10-11.5 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	5140	2190	1730	3090	2550	7790	7520
Antimony	< 0.92	< 1.4	< 0.84	< 0.94	< 0.83	< 4.5	< 0.86
Arsenic	23	3	< 0.73	7	3.5	25.3	23.7
Barium	22.9 J	44.3 J	69.8	25.3 J	28.6 J	21.7 J	72.4
Beryllium	4.1 J	11.5 J	4.6 J	4.2 J	3.5 J	8.7 J	6.7 J
Cadmium	< 0.095	1 J	< 0.086	< 0.097	< 0.085	0.44 J	< 0.089
Calcium	14900	5580	449 J	21900	31000	43600	39200
Chromium	8.4	7.8	12	7.5	6.4	6.8	11.1
Cobalt	31	28.5	24.4	22.5	16	19.2	18.8
Copper	74.5	41.7	41.2	42.6	41.5	24.2	27.1
Iron	53600	95300	36400	31400	22800	41100	34900
Lead	78	94	96.8	31.1	20.1	17.5	20.3
Magnesium	2190	150 J	56.3 J	9090	8960	9770	18300
Manganese	236	570	279	257	230	342	342
Mercury	3.6	0.04 J	0.04 J	0.13	0.07	0.16	0.13
Nickel	42.1	55.9	27.1	35.5	32.2	89.8	57.3
Potassium	< 25.2	< 38.2	< 22.9	< 25.7	< 22.6	< 36.9	1720
Selenium	52	7.1	1.5	8.8	4.1	< 4.5	3
Silver	< 0.17	< 0.25	< 0.15	< 0.17	< 0.15	< 0.24	< 0.16
Sodium	< 85.5	< 130	< 77.8	< 87.4	< 76.7	< 125	< 80
Thallium	< 1	< 1.6	< 0.95	< 1.1	< 0.93	< 1.5	< 0.98
Vanadium	12	14.9 J	17.2	11.3 J	10.2 J	10.5 J	18.2
Zinc	460	844	329	261	191	760	444
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-3(9-10 Feet)	SB-6(3-4 Feet)	SB-7(3-4 Feet)	SB-7(5-6 Feet)	SB-8(3-4 Feet)	SB-8(5-6 Feet)	SB-8(11-12 Feet)
Date Collected	7/28/2003	7/28/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003
Depth	9-10 Feet	3-4 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	11-12 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
1,1,2,2-Tetrachloroethane	< 0.0012	< 0.0009	< 0.0009	< 0.001	< 0.001	< 0.001	< 0.0011
1,1,2-Trichloroethane	< 0.0036	< 0.0028	< 0.0028	< 0.0029	< 0.0031	< 0.0031	< 0.0034
1,1-Dichloroethane	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
1,1-Dichloroethene	< 0.0024	< 0.0018	< 0.0018	< 0.0019	< 0.0021	< 0.002	< 0.0023
1,2-Dichloroethane	< 0.0024	< 0.0018	< 0.0018	< 0.0019	< 0.0021	< 0.002	< 0.0023
1,2-Dichloropropane	< 0.0012	< 0.0009	< 0.0009	< 0.001	< 0.001	< 0.001	< 0.0011
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
4-Methyl-2-Pentanone	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Acetone	0.054	NA	NA	0.023	NA	NA	NA
Benzene	< 0.0012	< 0.0009	< 0.0009	< 0.001	< 0.001	< 0.001	< 0.0011
Bromodichloromethane	< 0.0012	< 0.0009	< 0.0009	< 0.001	< 0.001	< 0.001	< 0.0011
Bromoform	< 0.0048	< 0.0037	< 0.0037	< 0.0038	< 0.0042	< 0.0041	< 0.0046
Bromomethane	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Carbon Disulfide	< 0.006	0.0003 J	0.0018 J	0.0007 J	0.0007 J	< 0.0051	< 0.0057
Carbon Tetrachloride	< 0.0024	< 0.0018	< 0.0018	< 0.0019	< 0.0021	< 0.002	< 0.0023
Chlorobenzene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Chloroethane	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Chloroform	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Chloromethane	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
cis-1,2-Dichloroethene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
cis-1,3-Dichloropropene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Dibromochloromethane	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Ethylbenzene	< 0.0048	< 0.0037	< 0.0037	< 0.0038	< 0.0042	< 0.0041	< 0.0046
Methylene Chloride	< 0.0036	< 0.0028	< 0.0028	< 0.0029	< 0.0031	< 0.0031	< 0.0034
Styrene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Tetrachloroethene	< 0.0012	< 0.0009	0.0005 J	< 0.001	< 0.001	< 0.001	< 0.0011
Toluene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
trans-1,2-Dichloroethene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
trans-1,3-Dichloropropene	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Trichloroethene	< 0.0012	0.0004 J	< 0.0009	< 0.001	< 0.001	< 0.001	< 0.0011
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057
Xylene (Total)	< 0.006	< 0.0046	< 0.0046	< 0.0048	< 0.0052	< 0.0051	< 0.0057

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-3(9-10 Feet)	SB-6(3-4 Feet)	SB-7(3-4 Feet)	SB-7(5-6 Feet)	SB-8(3-4 Feet)	SB-8(5-6 Feet)	SB-8(11-12 Feet)
Date Collected	7/28/2003	7/28/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003
Depth	9-10 Feet	3-4 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	11-12 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
1,2-Dichlorobenzene	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
1,3-Dichlorobenzene	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
1,4-Dichlorobenzene	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
2,4,5-Trichlorophenol	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
2,4,6-Trichlorophenol	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
2,4-Dichlorophenol	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
2,4-Dimethylphenol	< 0.43	< 0.36	0.15 J	< 0.36	< 0.4	< 0.4	< 0.42
2,4-Dinitrophenol	< 1.7	< 1.4	< 1.5	< 1.4	< 1.6	< 1.6	< 1.7
2,4-Dinitrotoluene	< 0.086	< 0.073	< 0.077	< 0.072	< 0.081	< 0.081	< 0.084
2,6-Dinitrotoluene	< 0.086	< 0.073	< 0.077	< 0.072	< 0.081	< 0.081	< 0.084
2-Chloronaphthalene	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
2-Chlorophenol	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
2-Methylnaphthalene	< 0.43	< 0.36	0.52	0.054 J	< 0.4	< 0.4	< 0.42
2-Methylphenol	< 0.43	< 0.36	0.41	< 0.36	< 0.4	< 0.4	< 0.42
2-Nitroaniline	< 0.86	< 0.73	< 0.77	< 0.72	< 0.81	< 0.81	< 0.84
2-Nitrophenol	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
3,3'-Dichlorobenzidine	< 0.86	< 0.73	< 0.77	< 0.72	< 0.81	< 0.81	< 0.84
3-Nitroaniline	< 0.86	< 0.73	< 0.77	< 0.72	< 0.81	< 0.81	< 0.84
4,6-Dinitro-2-methylphenol	< 1.7	< 1.4	< 1.5	< 1.4	< 1.6	< 1.6	< 1.7
4-Bromophenyl-phenylether	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
4-Chloro-3-methylphenol	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
4-Chloroaniline	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
4-Chlorophenyl-phenylether	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
4-Methylphenol	0.054 J	< 0.36	1.7	0.026 J	< 0.4	< 0.4	< 0.42
4-Nitroaniline	< 0.86	< 0.73	< 0.77	< 0.72	< 0.81	< 0.81	< 0.84
4-Nitrophenol	< 1.7	< 1.4	< 1.5	< 1.4	< 1.6	< 1.6	< 1.7
Acenaphthene	< 0.43	< 0.36	0.013 J	0.05 J	< 0.4	< 0.4	< 0.42
Acenaphthylene	0.045 J	< 0.36	0.16 J	0.087 J	< 0.4	0.0082 J	< 0.42
Anthracene	< 0.43	< 0.36	0.058 J	0.024 J	< 0.4	< 0.4	< 0.42
Benzo(a)anthracene	< 0.043	< 0.036	0.037 J	< 0.036	0.017 J	0.028 J	0.015 J
Benzo(a)pyrene	< 0.043	< 0.036	0.055	< 0.036	0.017 J	0.029 J	0.021 J
Benzo(b)fluoranthene	< 0.043	< 0.036	0.07	< 0.036	0.014 J	0.023 J	0.015 J
Benzo(g,h,i)perylene	< 0.43	< 0.36	0.091 J	0.006 J	0.012 J	0.021 J	< 0.42
Benzo(k)fluoranthene	< 0.043	< 0.036	0.061 J	< 0.036	0.019 J	0.031 J	0.02 J
bis(2-Chloroethoxy)methane	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
bis(2-Chloroethyl)ether	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
bis(2-chloroisopropyl)ether	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location Date Collected Depth Sample Type Area Soil Type Constituent	SB-3(9-10 Feet) 7/28/2003 9-10 Feet Investigation Quarry 3 Subsurface	SB-6(3-4 Feet) 7/28/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-7(3-4 Feet) 7/29/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-7(5-6 Feet) 7/29/2003 5-6 Feet Investigation Quarry 3 Subsurface	SB-8(3-4 Feet) 7/29/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-8(5-6 Feet) 7/29/2003 5-6 Feet Investigation Quarry 3 Subsurface	SB-8(11-12 Feet) 7/29/2003 11-12 Feet Investigation Quarry 3 Subsurface
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Butylbenzylphthalate	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Carbazole	0.044 J	< 0.36	0.82	0.72 J	< 0.4	0.011 J	< 0.42
Chrysene	< 0.43	< 0.36	0.044 J	< 0.36	0.015 J	0.031 J	0.023 J
Dibenz(a,h)anthracene	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
Dibenzofuran	< 0.43	< 0.36	0.16 J	0.13 J	< 0.4	< 0.4	< 0.42
Diethylphthalate	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Dimethylphthalate	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Di-n-butylphthalate	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Di-n-octylphthalate	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Fluoranthene	< 0.43	< 0.36	0.11 J	0.029 J	0.028 J	0.049 J	0.02 J
Fluorene	< 0.43	< 0.36	0.064 J	0.099 J	< 0.4	< 0.4	< 0.42
Hexachlorobenzene	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
Hexachlorobutadiene	< 0.086	< 0.073	< 0.077	< 0.072	< 0.081	< 0.081	< 0.084
Hexachlorocyclopentadiene	NA	NA	NA	< 0.36	< 0.4	< 0.4	< 0.42
Hexachloroethane	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
Indeno(1,2,3-cd)pyrene	< 0.043	< 0.036	0.086	< 0.036	0.011 J	0.02 J	0.017 J
Isophorone	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Naphthalene	0.059 J	< 0.00292	3.8	0.36 J	< 0.00292	< 0.00292	0.05 J
Nitrobenzene	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
N-Nitroso-di-n-propylamine	< 0.043	< 0.036	< 0.038	< 0.036	< 0.04	< 0.04	< 0.042
N-Nitrosodiphenylamine	< 0.43	< 0.36	< 0.38	< 0.36	< 0.4	< 0.4	< 0.42
Pentachlorophenol	< 1.7	< 1.4	< 1.5	< 1.4	< 1.6	< 1.6	< 1.7
Phenanthrene	0.014 J	< 0.36	0.3 J	0.23 J	0.012 J	0.019 J	< 0.42
Phenol	< 0.43	< 0.36	1.7	< 0.36	< 0.4	< 0.4	< 0.42
Pyrene	< 0.43	< 0.36	0.072 J	0.018 J	0.022 J	0.041 J	0.018 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-3(9-10 Feet)	SB-6(3-4 Feet)	SB-7(3-4 Feet)	SB-7(5-6 Feet)	SB-8(3-4 Feet)	SB-8(5-6 Feet)	SB-8(11-12 Feet)
Date Collected	7/28/2003	7/28/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003	7/29/2003
Depth	9-10 Feet	3-4 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	11-12 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	7140	6250	2700	3060	3590	2430	5470
Antimony	< 4.6	< 0.85	< 0.9	< 2.1	< 0.86	< 0.94	< 0.98
Arsenic	6.8	8.9 J	22.7 J	2.6 J	8 J	7.5 J	8.8 J
Barium	95.6 J	22.8 J	14.3 J	40 J	90.4 J	34 J	76.5
Beryllium	7.9 J	5.9	3.8	4.4	7.3	8	5.2
Cadmium	< 0.47	< 0.087	< 0.092	0.24 J	0.57 J	1.1 J	< 0.1
Calcium	6440	54800	9820	32500	7110	3460	5810
Chromium	13.4	5.5	7.4	5.6	7.9	6.5	7.7
Cobalt	37.3 J	24.6 J	20.2	23.4 J	37	93.2	59
Copper	57.3	24.5 J	36.6 J	33 J	62.6 J	73 J	60 J
Iron	54600	26400	30200	33800	54300	59100	48100
Lead	63.3	21.2	24.1	25.5	28.1	37.4	27
Magnesium	2330 J	21500 J	4040 J	12700 J	3700 J	1270 J	1430 J
Manganese	873	629	222	540	858	1140	688
Mercury	0.05	0.05	0.1	0.07	0.06	0.08	0.15
Nickel	81	51	42.6	44.4	65.4	95.4	67.2
Potassium	< 124	492 J	74.7 J	106 J	39.3 J	< 25.7	142 J
Selenium	6.9	1.1	11.6	2.1 J	1.5	1.8	1.4
Silver	< 0.82	< 0.15	< 0.16	< 0.38	< 0.15	< 0.17	< 0.18
Sodium	< 422	< 78.9	< 83.2	< 196	< 79.4	< 87.3	< 91.2
Thallium	< 1	< 0.96	< 1	< 0.96	< 0.97	< 1.1	< 1.1
Vanadium	20.5 J	10.3 J	8.9 J	8.6 J	9.9 J	8.6 J	11.7 J
Zinc	657	166 J	214 J	312 J	334 J	385 J	311 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-9(3-4 Feet)	SB-9(5-6 Feet)	SB-10(3-4 Feet)	SB-10(5-6 Feet)	SB-10(13-14 Feet)	SB-12(3-4 Feet)	SB-13(3-4 Feet)
Date Collected	7/29/2003	7/29/2003	7/31/2003	7/31/2003	7/31/2003	7/30/2003	7/30/2003
Depth	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	13-14 Feet	3-4 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
1,1,2,2-Tetrachloroethane	< 0.001	< 0.0011	< 0.001	< 0.001	< 0.001	< 0.0011	< 0.0011
1,1,2-Trichloroethane	< 0.0031	< 0.0032	< 0.0031	< 0.003	< 0.003	< 0.0034	< 0.0033
1,1-Dichloroethane	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
1,1-Dichloroethene	< 0.0021	< 0.0022	< 0.0021	< 0.002	< 0.002	< 0.0023	< 0.0022
1,2-Dichloroethane	< 0.0021	< 0.0022	< 0.0021	< 0.002	< 0.002	< 0.0023	< 0.0022
1,2-Dichloropropane	< 0.001	< 0.0011	< 0.001	< 0.001	< 0.001	< 0.0011	< 0.0011
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
4-Methyl-2-Pentanone	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Acetone	NA	NA	0.025 J	0.02 J	0.03 J	0.082 J	NA
Benzene	< 0.001	< 0.0011	< 0.001	< 0.001	< 0.001	< 0.0011	< 0.0011
Bromodichloromethane	< 0.001	< 0.0011	< 0.001	< 0.001	< 0.001	< 0.0011	< 0.0011
Bromoform	< 0.0041	< 0.0043	< 0.0041	< 0.004	< 0.0039	< 0.0046	< 0.0044
Bromomethane	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Carbon Disulfide	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	0.0007 J	< 0.0055
Carbon Tetrachloride	< 0.0021	< 0.0022	< 0.0021	< 0.002	< 0.002	< 0.0023	< 0.0022
Chlorobenzene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Chloroethane	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Chloroform	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Chloromethane	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
cis-1,2-Dichloroethene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
cis-1,3-Dichloropropene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Dibromochloromethane	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Ethylbenzene	< 0.0041	< 0.0043	< 0.0041	< 0.004	< 0.0039	< 0.0046	< 0.0044
Methylene Chloride	< 0.0031	< 0.0032	< 0.0031	< 0.003	< 0.003	< 0.0034	< 0.0033
Styrene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Tetrachloroethene	< 0.001	< 0.0011	< 0.001	< 0.001	< 0.001	< 0.0011	< 0.0011
Toluene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
trans-1,2-Dichloroethene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
trans-1,3-Dichloropropene	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Trichloroethene	< 0.001	< 0.0011	< 0.001	< 0.001	< 0.001	< 0.0011	< 0.0011
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055
Xylene (Total)	< 0.0052	< 0.0054	< 0.0052	< 0.005	< 0.0049	< 0.0057	< 0.0055

Table A-2

Quarry 3 Subsurface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-9(3-4 Feet)	SB-9(5-6 Feet)	SB-10(3-4 Feet)	SB-10(5-6 Feet)	SB-10(13-14 Feet)	SB-12(3-4 Feet)	SB-13(3-4 Feet)
Date Collected	7/29/2003	7/29/2003	7/31/2003	7/31/2003	7/31/2003	7/30/2003	7/30/2003
Depth	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	13-14 Feet	3-4 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
1,2-Dichlorobenzene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
1,3-Dichlorobenzene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
1,4-Dichlorobenzene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2,4,5-Trichlorophenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2,4,6-Trichlorophenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2,4-Dichlorophenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2,4-Dimethylphenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2,4-Dinitrophenol	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6	< 1.5	< 1.5
2,4-Dinitrotoluene	< 0.074	< 0.076	< 0.074	< 0.077	< 0.079	< 0.074	< 0.077
2,6-Dinitrotoluene	< 0.074	< 0.076	< 0.074	< 0.077	< 0.079	< 0.074	< 0.077
2-Chloronaphthalene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2-Chlorophenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2-Methylnaphthalene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2-Methylphenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
2-Nitroaniline	< 0.74	< 0.76	< 0.74	< 0.77	< 0.79	< 0.74	< 0.77
2-Nitrophenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
3,3'-Dichlorobenzidine	< 0.74	< 0.76	< 0.74	< 0.77	< 0.79	< 0.74	< 0.77
3-Nitroaniline	< 0.74	< 0.76	< 0.74	< 0.77	< 0.79	< 0.74	< 0.77
4,6-Dinitro-2-methylphenol	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6	< 1.5	< 1.5
4-Bromophenyl-phenylether	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
4-Chloro-3-methylphenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
4-Chloroaniline	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
4-Chlorophenyl-phenylether	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
4-Methylphenol	< 0.37	< 0.38	< 0.37	< 0.39	0.033 J	< 0.37	< 0.38
4-Nitroaniline	< 0.74	< 0.76	< 0.74	< 0.77	< 0.79	< 0.74	< 0.77
4-Nitrophenol	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6	< 1.5	< 1.5
Acenaphthene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Acenaphthylene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Anthracene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Benzo(a)anthracene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Benzo(a)pyrene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Benzo(b)fluoranthene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Benzo(g,h,i)perylene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Benzo(k)fluoranthene	< 0.037	0.0079 J	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
bis(2-Chloroethoxy)methane	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
bis(2-Chloroethyl)ether	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
bis(2-chloroisopropyl)ether	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location Date Collected Depth Sample Type Area Soil Type Constituent	SB-9(3-4 Feet) 7/29/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-9(5-6 Feet) 7/29/2003 5-6 Feet Investigation Quarry 3 Subsurface	SB-10(3-4 Feet) 7/31/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-10(5-6 Feet) 7/31/2003 5-6 Feet Investigation Quarry 3 Subsurface	SB-10(13-14 Feet) 7/31/2003 13-14 Feet Investigation Quarry 3 Subsurface	SB-12(3-4 Feet) 7/30/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-13(3-4 Feet) 7/30/2003 3-4 Feet Investigation Quarry 3 Subsurface
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.37	< 0.38	< 0.37	< 0.39	0.2 J	< 0.37	< 0.38
Butylbenzylphthalate	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Carbazole	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Chrysene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Dibenz(a,h)anthracene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Dibenzofuran	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Diethylphthalate	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Dimethylphthalate	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Di-n-butylphthalate	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Di-n-octylphthalate	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Fluoranthene	< 0.37	0.0089 J	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Fluorene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Hexachlorobenzene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Hexachlorobutadiene	< 0.074	< 0.076	< 0.074	< 0.077	< 0.079	< 0.074	< 0.077
Hexachlorocyclopentadiene	NA	NA	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Hexachloroethane	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Indeno(1,2,3-cd)pyrene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
Isophorone	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Naphthalene	< 0.00292	< 0.00292	< 0.00292	< 0.00292	< 0.00292	< 0.00292	< 0.00292
Nitrobenzene	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
N-Nitroso-di-n-propylamine	< 0.037	< 0.038	< 0.037	< 0.039	< 0.039	< 0.037	< 0.038
N-Nitrosodiphenylamine	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Pentachlorophenol	< 1.5	< 1.5	< 1.5	< 1.5	< 1.6	< 1.5	< 1.5
Phenanthrene	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Phenol	< 0.37	< 0.38	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Pyrene	< 0.37	0.0085 J	< 0.37	< 0.39	< 0.39	< 0.37	< 0.38
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-9(3-4 Feet)	SB-9(5-6 Feet)	SB-10(3-4 Feet)	SB-10(5-6 Feet)	SB-10(13-14 Feet)	SB-12(3-4 Feet)	SB-13(3-4 Feet)
Date Collected	7/29/2003	7/29/2003	7/31/2003	7/31/2003	7/31/2003	7/30/2003	7/30/2003
Depth	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	13-14 Feet	3-4 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	1720	1770	3000	3170	5130	2890 J	5180 J
Antimony	< 0.79	< 0.89	< 1.3	< 1.2	< 4.2	1.2 J	< 1.2
Arsenic	2	1.5	5.8	5.9	6.8	1.6 J	< 0.67
Barium	197	64.3	147	76.8	136 J	59.7	12.7 J
Beryllium	1.8 J	1.9 J	2.6	2.9	5.2	3	1.4
Cadmium	< 0.081	< 0.092	< 0.13	< 0.13	< 0.43	0.35 J	< 0.084
Calcium	81.2 J	110 J	2500	4200	34700	3920 J	180 J
Chromium	10.9	10.4	7.7 J	5.5 J	5.3 J	12.8 J	23 J
Cobalt	18.6	12	55.2 J	96.3 J	203 J	43.4	4.2 J
Copper	65.3	53.7	74.7 J	76.5 J	280 J	35.6	64.3
Iron	37200	28300	84900	82100	74400	39800	51100
Lead	29.1	28	24.1 J	31.1 J	253 J	92.5 J	69.4 J
Magnesium	73.2 J	78.7 J	1170 J	1900	19100	2090 J	60.2 J
Manganese	787	370	1720 J	1220 J	6760 J	918	109
Mercury	0.06	0.03 J	0.07	0.07	0.09	< 0.019	0.06
Nickel	27.1	19.6	62.5 J	79.4 J	133 J	38.2	6.7 J
Potassium	< 21.5	< 24.4	57.6 J	62 J	< 114	113 J	97.9 J
Selenium	< 0.79	< 0.89	< 1.3	< 1.2	< 4.2	< 0.85	< 0.88
Silver	< 0.14	< 0.16	< 0.23	< 0.22	< 0.75	< 0.28	< 0.29
Sodium	< 72.9	< 82.8	< 121	< 114	< 389	< 80.3	< 83.1
Thallium	< 0.89	< 1	< 1.5	< 1.4	< 1.4	< 0.95	< 1.5
Vanadium	12.1	12.6	7.7 J	7 J	10.2 J	13.5	26
Zinc	154	133	399 J	385 J	560 J	418 J	139 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-13(5-6 Feet)	SB-15(3-4 Feet)	SB-15(5-6 Feet)	SB-17(3-4 Feet)	SB-17(5-6 Feet)	SB-17(19-20 Feet)	SB-18(3-4 Feet)
Date Collected	7/30/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	8/1/2003
Depth	5-6 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	19-20 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
1,1,2,2-Tetrachloroethane	< 0.0011	< 0.0015	< 0.0013	< 0.001	< 0.0009	< 0.0012	< 0.001
1,1,2-Trichloroethane	< 0.0034	< 0.0045	< 0.0038	< 0.0029	< 0.0028	< 0.0036	< 0.003
1,1-Dichloroethane	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
1,1-Dichloroethene	< 0.0022	< 0.003	< 0.0025	< 0.0019	< 0.0019	< 0.0024	< 0.002
1,2-Dichloroethane	< 0.0022	< 0.003	< 0.0025	< 0.0019	< 0.0019	< 0.0024	< 0.002
1,2-Dichloropropane	< 0.0011	< 0.0015	< 0.0013	< 0.001	< 0.0009	< 0.0012	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
4-Methyl-2-Pentanone	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Acetone	NA	0.082 J	0.095 J	0.026 J	0.026 J	0.016 J	0.038 J
Benzene	< 0.0011	< 0.0015	0.0014	< 0.001	< 0.0009	< 0.0012	< 0.001
Bromodichloromethane	< 0.0011	< 0.0015	< 0.0013	< 0.001	< 0.0009	< 0.0012	< 0.001
Bromoform	< 0.0045	< 0.0059	< 0.0051	< 0.0038	< 0.0038	< 0.0048	< 0.004
Bromomethane	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Carbon Disulfide	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Carbon Tetrachloride	< 0.0022	< 0.003	< 0.0025	< 0.0019	< 0.0019	< 0.0024	< 0.002
Chlorobenzene	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Chloroethane	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Chloroform	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Chloromethane	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
cis-1,2-Dichloroethene	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
cis-1,3-Dichloropropene	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Dibromochloromethane	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Ethylbenzene	< 0.0045	< 0.0059	< 0.0051	< 0.0038	< 0.0038	< 0.0048	< 0.004
Methylene Chloride	< 0.0034	< 0.0045	< 0.0038	< 0.0029	< 0.0028	< 0.0036	< 0.003
Styrene	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Tetrachloroethene	< 0.0011	< 0.0015	< 0.0013	< 0.001	< 0.0009	< 0.0012	< 0.001
Toluene	< 0.0056	0.0019 J	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
trans-1,2-Dichloroethene	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
trans-1,3-Dichloropropene	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Trichloroethene	< 0.0011	< 0.0015	< 0.0013	< 0.001	< 0.0009	< 0.0012	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005
Xylene (Total)	< 0.0056	< 0.0074	< 0.0063	< 0.0048	< 0.0047	< 0.0059	< 0.005

Table A-2

Quarry 3 Subsurface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-13(5-6 Feet)	SB-15(3-4 Feet)	SB-15(5-6 Feet)	SB-17(3-4 Feet)	SB-17(5-6 Feet)	SB-17(19-20 Feet)	SB-18(3-4 Feet)
Date Collected	7/30/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	8/1/2003
Depth	5-6 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	19-20 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
1,2-Dichlorobenzene	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
1,3-Dichlorobenzene	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
1,4-Dichlorobenzene	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
2,4,5-Trichlorophenol	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
2,4,6-Trichlorophenol	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
2,4-Dichlorophenol	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
2,4-Dimethylphenol	< 0.38	< 0.44	< 0.45	0.92	< 0.39	0.02 J	< 0.38
2,4-Dinitrophenol	< 1.5	< 1.8	< 1.8	< 3.1	< 1.6	< 1.7	< 1.5
2,4-Dinitrotoluene	< 0.076	< 0.089	< 0.089	< 0.16	< 0.078	< 0.084	< 0.076
2,6-Dinitrotoluene	< 0.076	< 0.089	< 0.089	< 0.16	< 0.078	< 0.084	< 0.076
2-Chloronaphthalene	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
2-Chlorophenol	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
2-Methylnaphthalene	< 0.38	< 0.44	< 0.45	0.82	< 0.39	0.05 J	< 0.38
2-Methylphenol	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	0.023 J	< 0.38
2-Nitroaniline	< 0.76	< 0.89	< 0.89	< 1.6	< 0.78	< 0.84	< 0.76
2-Nitrophenol	< 0.38	< 0.44	0.015 J	< 0.78	< 0.39	< 0.42	< 0.38
3,3'-Dichlorobenzidine	< 0.76	< 0.89	< 0.89	< 1.6	< 0.78	< 0.84	< 0.76
3-Nitroaniline	< 0.76	< 0.89	< 0.89	< 1.6	< 0.78	< 0.84	< 0.76
4,6-Dinitro-2-methylphenol	< 1.5	< 1.8	< 1.8	< 3.1	< 1.6	< 1.7	< 1.5
4-Bromophenyl-phenylether	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
4-Chloro-3-methylphenol	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
4-Chloroaniline	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
4-Chlorophenyl-phenylether	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
4-Methylphenol	< 0.38	< 0.44	< 0.45	2.6	0.032 J	0.17 J	0.03 J
4-Nitroaniline	< 0.76	< 0.89	< 0.89	< 1.6	< 0.78	< 0.84	< 0.76
4-Nitrophenol	< 1.5	< 1.8	< 1.8	< 3.1	< 1.6	< 1.7	< 1.5
Acenaphthene	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	0.015 J	< 0.38
Acenaphthylene	0.018 J	< 0.44	< 0.45	8.8	0.085 J	0.18 J	0.21 J
Anthracene	< 0.38	< 0.44	< 0.45	2	0.022 J	0.13 J	0.076 J
Benzo(a)anthracene	< 0.038	< 0.044	< 0.045	2.2 J	0.049 J	0.032 J	0.6 J
Benzo(a)pyrene	< 0.038	< 0.044	0.014 J	1.9	0.1	0.024 J	0.8
Benzo(b)fluoranthene	< 0.038	< 0.044	0.021 J	2.3	0.1	0.02 J	0.68
Benzo(g,h,i)perylene	< 0.38	< 0.44	< 0.45	1.5	0.17 J	0.014 J	0.76
Benzo(k)fluoranthene	< 0.038	< 0.044	0.021 J	2.6 J	0.13 J	0.017 J	0.88 J
bis(2-Chloroethoxy)methane	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
bis(2-Chloroethyl)ether	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
bis(2-chloroisopropyl)ether	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38

Table A-2

Quarry 3 Subsurface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-13(5-6 Feet)	SB-15(3-4 Feet)	SB-15(5-6 Feet)	SB-17(3-4 Feet)	SB-17(5-6 Feet)	SB-17(19-20 Feet)	SB-18(3-4 Feet)
Date Collected	7/30/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	8/1/2003
Depth	5-6 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	19-20 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Butylbenzylphthalate	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Carbazole	< 0.38	< 0.44	< 0.45	11	0.023 J	0.36 J	0.12 J
Chrysene	< 0.38	< 0.44	0.021 J	2.3	0.053 J	0.025 J	0.65
Dibenz(a,h)anthracene	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
Dibenzofuran	< 0.38	< 0.44	< 0.45	1.1	< 0.39	0.092 J	< 0.38
Diethylphthalate	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Dimethylphthalate	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Di-n-butylphthalate	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Di-n-octylphthalate	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Fluoranthene	< 0.38	< 0.44	0.013 J	4.7	0.083 J	0.18 J	0.68
Fluorene	< 0.38	< 0.44	< 0.45	1.4	< 0.39	0.097 J	< 0.38
Hexachlorobenzene	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
Hexachlorobutadiene	< 0.076	< 0.089	< 0.089	< 0.16	< 0.078	< 0.084	< 0.076
Hexachlorocyclopentadiene	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Hexachloroethane	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
Indeno(1,2,3-cd)pyrene	< 0.038	< 0.044	< 0.045	1.8	0.16	0.012 J	0.64
Isophorone	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Naphthalene	< 0.00292	< 0.00292	< 0.00292	0.89	< 0.00292	0.47	0.014 J
Nitrobenzene	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
N-Nitroso-di-n-propylamine	< 0.038	< 0.044	< 0.045	< 0.078	< 0.039	< 0.042	< 0.038
N-Nitrosodiphenylamine	< 0.38	< 0.44	< 0.45	< 0.78	< 0.39	< 0.42	< 0.38
Pentachlorophenol	< 1.5	< 1.8	< 1.8	< 3.1	< 1.6	< 1.7	< 1.5
Phenanthrene	< 0.38	< 0.44	< 0.45	5.2	0.034 J	0.67	0.14 J
Phenol	< 0.38	< 0.44	< 0.45	2.1	< 0.39	0.11 J	< 0.38
Pyrene	< 0.38	< 0.44	0.014 J	2.9	0.067 J	0.12 J	0.62
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-13(5-6 Feet)	SB-15(3-4 Feet)	SB-15(5-6 Feet)	SB-17(3-4 Feet)	SB-17(5-6 Feet)	SB-17(19-20 Feet)	SB-18(3-4 Feet)
Date Collected	7/30/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003	8/1/2003
Depth	5-6 Feet	3-4 Feet	5-6 Feet	3-4 Feet	5-6 Feet	19-20 Feet	3-4 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	4160 J	4180	3360	5270	4160	6820	2710 J
Antimony	< 1.2	< 1.5	< 1.4	< 4.6	< 4.2	< 4.5	< 1.2
Arsenic	< 0.67	2.3 J	2.7 J	42.4	16.8	19.8	4.4 J
Barium	9.6 J	171	126	8.6 J	< 1.4	11.1 J	13.2 J
Beryllium	1.3	4.1	2.9	6.6	5.9	9.1	2.3 J
Cadmium	< 0.083	1.2 J	1.6	< 0.47	< 0.43	< 0.46	< 0.083
Calcium	89.7 J	166 J	320 J	19800	7240	9160	141900 J
Chromium	19.5 J	12.6 J	11.8 J	6 J	5.4 J	5.7 J	3.1 J
Cobalt	7.8 J	62.2	95.6	23.5 J	31.2 J	42.4 J	19.4
Copper	58.7	67.4	48.1	22.1 J	26.6 J	30.9 J	16.5 J
Iron	39300	105500	77300	37200	33500	37800	16700
Lead	45.7 J	50.7 J	50.4 J	24.1 J	18.9 J	30.3 J	28 J
Magnesium	103 J	386 J	328 J	4410 J	2090 J	3130 J	47800 J
Manganese	52.9	2500	3480	262 J	264 J	383 J	393
Mercury	< 0.019	< 0.022	0.07	3.5	0.08	0.06	0.07
Nickel	8.5 J	76.2	59	54 J	51.5 J	81.1 J	31.1
Potassium	< 65.8	116 J	147 J	171 J	127 J	278 J	213 J
Selenium	1.1	< 1.1	< 1	17.4	< 4.2	< 4.5	< 0.87
Silver	< 0.29	< 0.37	< 0.34	< 0.82	< 0.75	< 0.8	< 0.29
Sodium	< 82.6	< 105	< 96.4	< 425	< 385	< 414	< 81.6
Thallium	< 0.98	< 3.1	< 2.9	< 1	< 0.94	< 1	< 0.97
Vanadium	16.5	15.6	13.5	8.4 J	7.9 J	13 J	5.1 J
Zinc	213 J	833 J	565 J	387 J	352 J	464 J	120
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18D(3-4 Feet)	SB-18(5-6 Feet)	SB-18(16-17 Feet)	SB-19(3-4 Feet)	SB-19(5-6 Feet)	SB-19(9-10 Feet)	SB-20(3-4 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	3-4 Feet	5-6 Feet	16-17 Feet	3-4 Feet	5-6 Feet	9-10 Feet	3-4 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
1,1,2,2-Tetrachloroethane	< 0.001	< 0.001	< 0.0009	< 0.001	< 0.001	< 0.0009	< 0.001
1,1,2-Trichloroethane	< 0.003	< 0.0029	< 0.0028	< 0.003	< 0.0029	< 0.0028	< 0.0031
1,1-Dichloroethane	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
1,1-Dichloroethene	< 0.002	< 0.002	< 0.0019	< 0.002	< 0.0019	< 0.0019	< 0.0021
1,2-Dichloroethane	< 0.002	< 0.002	< 0.0019	< 0.002	< 0.0019	< 0.0019	< 0.0021
1,2-Dichloropropane	< 0.001	< 0.001	< 0.0009	< 0.001	< 0.001	< 0.0009	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
4-Methyl-2-Pentanone	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Acetone	0.038 J	0.022 J	0.013 J	0.045 J	0.033 J	0.014 J	0.03 J
Benzene	0.0005 J	0.0016	< 0.0009	< 0.001	< 0.001	< 0.0009	< 0.001
Bromodichloromethane	< 0.001	< 0.001	< 0.0009	< 0.001	< 0.001	< 0.0009	< 0.001
Bromoform	< 0.004	< 0.0039	< 0.0038	< 0.004	< 0.0039	< 0.0038	< 0.0041
Bromomethane	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Carbon Disulfide	< 0.005	< 0.0049	< 0.0047	0.0006 J	< 0.0048	< 0.0047	< 0.0052
Carbon Tetrachloride	< 0.002	< 0.002	< 0.0019	< 0.002	< 0.0019	< 0.0019	< 0.0021
Chlorobenzene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Chloroethane	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Chloroform	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Chloromethane	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
cis-1,2-Dichloroethene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
cis-1,3-Dichloropropene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Dibromochloromethane	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Ethylbenzene	< 0.004	< 0.0039	< 0.0038	< 0.004	< 0.0039	< 0.0038	< 0.0041
Methylene Chloride	< 0.003	< 0.0029	< 0.0028	< 0.003	< 0.0029	< 0.0028	< 0.0031
Styrene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Tetrachloroethene	< 0.001	< 0.001	< 0.0009	< 0.001	< 0.001	< 0.0009	< 0.001
Toluene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
trans-1,2-Dichloroethene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
trans-1,3-Dichloropropene	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Trichloroethene	< 0.001	< 0.001	< 0.0009	< 0.001	< 0.001	< 0.0009	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052
Xylene (Total)	< 0.005	< 0.0049	< 0.0047	< 0.0049	< 0.0048	< 0.0047	< 0.0052

Table A-2

Quarry 3 Subsurface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18D(3-4 Feet)	SB-18(5-6 Feet)	SB-18(16-17 Feet)	SB-19(3-4 Feet)	SB-19(5-6 Feet)	SB-19(9-10 Feet)	SB-20(3-4 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	3-4 Feet	5-6 Feet	16-17 Feet	3-4 Feet	5-6 Feet	9-10 Feet	3-4 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.036	< 0.037	< 0.039	< 0.039	< 0.038	NA	< 0.035
1,2-Dichlorobenzene	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
1,3-Dichlorobenzene	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
1,4-Dichlorobenzene	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
2,4,5-Trichlorophenol	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
2,4,6-Trichlorophenol	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
2,4-Dichlorophenol	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
2,4-Dimethylphenol	0.014 J	< 0.37	0.0091 J	0.015 J	0.067 J	0.03 J	< 0.35
2,4-Dinitrophenol	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	NA	< 1.4
2,4-Dinitrotoluene	< 0.073	< 0.074	< 0.079	< 0.078	< 0.076	NA	< 0.07
2,6-Dinitrotoluene	< 0.073	< 0.074	< 0.079	< 0.078	< 0.076	NA	< 0.07
2-Chloronaphthalene	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
2-Chlorophenol	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
2-Methylnaphthalene	0.022 J	< 0.37	< 0.39	0.04 J	0.054 J	0.024 J	< 0.35
2-Methylphenol	0.051 J	< 0.37	0.025 J	0.029 J	< 0.38	0.046 J	< 0.35
2-Nitroaniline	< 0.73	< 0.74	< 0.79	< 0.78	< 0.76	NA	< 0.7
2-Nitrophenol	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
3,3'-Dichlorobenzidine	< 0.73	< 0.74	< 0.79	< 0.78	< 0.76	NA	< 0.7
3-Nitroaniline	< 0.73	< 0.74	< 0.79	< 0.78	< 0.76	NA	< 0.7
4,6-Dinitro-2-methylphenol	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	NA	< 1.4
4-Bromophenyl-phenylether	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
4-Chloro-3-methylphenol	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
4-Chloroaniline	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
4-Chlorophenyl-phenylether	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
4-Methylphenol	0.23 J	< 0.37	0.11 J	0.12 J	0.32 J	0.28 J	< 0.35
4-Nitroaniline	< 0.73	< 0.74	< 0.79	< 0.78	< 0.76	NA	< 0.7
4-Nitrophenol	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	NA	< 1.4
Acenaphthene	< 0.36	< 0.37	< 0.39	< 0.39	0.02 J	0.022 J	< 0.35
Acenaphthylene	0.24 J	< 0.37	0.08 J	0.11 J	1.2	0.11 J	0.024 J
Anthracene	0.14 J	< 0.37	0.07 J	0.031 J	0.42	0.095 J	< 0.35
Benzo(a)anthracene	0.6 J	< 0.037	0.26 J	0.035 J	1.3 J	0.038 J	0.017 J
Benzo(a)pyrene	0.74	0.0087 J	0.29	0.06	1.8	0.046 J	0.023 J
Benzo(b)fluoranthene	0.77	0.008 J	0.24	0.057	1.5	0.036 J	0.021 J
Benzo(g,h,i)perylene	0.7	0.0079 J	0.25 J	0.19 J	1.7	0.055 J	0.052 J
Benzo(k)fluoranthene	0.68 J	0.0096 J	0.34 J	0.1 J	2 J	0.057 J	0.025 J
bis(2-Chloroethoxy)methane	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
bis(2-Chloroethyl)ether	< 0.036	< 0.037	< 0.039	< 0.039	< 0.038	NA	< 0.035
bis(2-chloroisopropyl)ether	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18D(3-4 Feet)	SB-18(5-6 Feet)	SB-18(16-17 Feet)	SB-19(3-4 Feet)	SB-19(5-6 Feet)	SB-19(9-10 Feet)	SB-20(3-4 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	3-4 Feet	5-6 Feet	16-17 Feet	3-4 Feet	5-6 Feet	9-10 Feet	3-4 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	0.092 J	< 0.35
Butylbenzylphthalate	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Carbazole	0.28 J	< 0.37	0.3 J	0.032 J	0.57	0.23 J	< 0.35
Chrysene	0.65	< 0.37	0.29 J	0.048 J	1.4	0.044 J	0.018 J
Dibenz(a,h)anthracene	0.17	< 0.037	< 0.039	< 0.039	< 0.038	0.01 J	< 0.035
Dibenzofuran	0.024 J	< 0.37	0.022 J	0.018 J	0.049 J	0.098 J	< 0.35
Diethylphthalate	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Dimethylphthalate	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Di-n-butylphthalate	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Di-n-octylphthalate	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Fluoranthene	1.2	0.0082 J	0.59	0.065 J	1.9	0.13 J	0.024 J
Fluorene	0.026 J	< 0.37	0.022 J	< 0.39	0.067 J	0.083 J	< 0.35
Hexachlorobenzene	< 0.036	< 0.037	< 0.039	< 0.039	< 0.038	NA	< 0.035
Hexachlorobutadiene	< 0.073	< 0.074	< 0.079	< 0.078	< 0.076	NA	< 0.07
Hexachlorocyclopentadiene	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Hexachloroethane	< 0.036	< 0.037	< 0.039	< 0.039	< 0.038	NA	< 0.035
Indeno(1,2,3-cd)pyrene	0.6	< 0.037	0.23	0.15	1.6	0.049 J	0.034 J
Isophorone	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Naphthalene	0.38	0.037 J	0.1 J	0.31 J	0.32 J	0.2 J	< 0.00292
Nitrobenzene	< 0.036	< 0.037	< 0.039	< 0.039	< 0.038	NA	< 0.035
N-Nitroso-di-n-propylamine	< 0.036	< 0.037	< 0.039	< 0.039	< 0.038	NA	< 0.035
N-Nitrosodiphenylamine	< 0.36	< 0.37	< 0.39	< 0.39	< 0.38	NA	< 0.35
Pentachlorophenol	< 1.4	< 1.5	< 1.6	< 1.6	< 1.5	NA	< 1.4
Phenanthrene	0.42	< 0.37	0.25 J	0.054 J	0.6	0.44 J	0.013 J
Phenol	< 0.36	< 0.37	< 0.39	0.12 J	< 0.38	0.2 J	< 0.35
Pyrene	1	0.0086 J	0.49	0.048 J	1.6	0.098 J	0.022 J
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-18D(3-4 Feet)	SB-18(5-6 Feet)	SB-18(16-17 Feet)	SB-19(3-4 Feet)	SB-19(5-6 Feet)	SB-19(9-10 Feet)	SB-20(3-4 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	3-4 Feet	5-6 Feet	16-17 Feet	3-4 Feet	5-6 Feet	9-10 Feet	3-4 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	4320 J	5780	4140	3880	3740	5040	973
Antimony	< 1.3	< 1.3	< 1.4	< 1.4	< 1.2	< 1.3	< 1.1
Arsenic	7.3 J	8.4	6.4	14.6	15.6	9.8	6.5
Barium	14.5 J	18.8 J	13.7 J	9.3 J	9.2 J	7.8 J	24.1 J
Beryllium	3.5 J	3.7	4.3	4.9	3.5	3.6	2.1
Cadmium	< 0.087	< 0.089	< 0.095	< 0.093	< 0.083	< 0.086	< 0.077
Calcium	79800 J	115900 J	53900 J	61600 J	98900 J	68300 J	3180
Chromium	4.6 J	3.9 J	5.4 J	5.3 J	4.8 J	4.5 J	10.4
Cobalt	26.9 J	48.5 J	28 J	44.9 J	21.9 J	34.2 J	20.1
Copper	24.8 J	29.4 J	25.5 J	76.9 J	23.2 J	38.9 J	20
Iron	24400	40200	30000	28500	23100	26000	33200
Lead	23.1 J	31.7 J	22 J	23.5 J	17.1 J	45 J	10.4
Magnesium	28300 J	17700 J	18700 J	19800 J	39400 J	23400 J	1600
Manganese	384 J	560 J	449 J	374 J	317 J	683 J	167
Mercury	0.08 J	0.06 J	0.11 J	0.11 J	0.29 J	0.11 J	< 0.018
Nickel	44.2	59.9	50.6	49.4	40.2	48.5	23.4
Potassium	344 J	306 J	121 J	104 J	242 J	102 J	< 60.7
Selenium	< 0.92	< 0.94	< 0.99	24.6	9	< 0.91	2.1
Silver	< 0.31	< 0.31	< 0.33	< 0.33	< 0.29	< 0.3	< 0.27
Sodium	< 86.2	< 88.2	< 93.5	< 92.3	< 82.1	< 85.3	93.7 J
Thallium	< 1	< 1	< 1.1	< 1.1	< 0.98	< 1	< 0.9
Vanadium	7.4 J	6.9 J	9.6 J	7.4 J	6.6 J	9.1 J	7.2 J
Zinc	178	202	161	204	151	145	203
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-20(5-6 Feet)	SB-20(8-9 Feet)	SB-22(3-4 Feet)	SB-22(5-6 Feet)	SB-22(18-19 Feet)	SB-23(3-4 Feet)	SB-23(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	5-6 Feet	8-9 Feet	3-4 Feet	5-6 Feet	18-19 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1;1,1-Trichloroethane	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
1,1,2,2-Tetrachloroethane	< 0.001	< 0.0009	< 0.0011	< 0.001	< 0.0011	< 0.001	< 0.001
1,1,2-Trichloroethane	< 0.0029	< 0.0027	< 0.0033	< 0.0029	< 0.0032	< 0.0032	< 0.003
1,1-Dichloroethane	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
1,1-Dichloroethene	< 0.0019	< 0.0018	< 0.0022	< 0.0019	< 0.0021	< 0.0021	< 0.002
1,2-Dichloroethane	< 0.0019	< 0.0018	< 0.0022	< 0.0019	< 0.0021	< 0.0021	< 0.002
1,2-Dichloropropane	< 0.001	< 0.0009	< 0.0011	< 0.001	< 0.0011	< 0.001	< 0.001
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
4-Methyl-2-Pentanone	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Acetone	0.059 J	0.047 J	0.062 J	0.054 J	NA	NA	0.072 J
Benzene	< 0.001	< 0.0009	< 0.0011	< 0.001	< 0.0011	< 0.001	0.001 J
Bromodichloromethane	< 0.001	< 0.0009	< 0.0011	< 0.001	< 0.0011	< 0.001	< 0.001
Bromoform	< 0.0038	< 0.0036	< 0.0044	< 0.0039	< 0.0042	< 0.0042	< 0.004
Bromomethane	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Carbon Disulfide	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Carbon Tetrachloride	< 0.0019	< 0.0018	< 0.0022	< 0.0019	< 0.0021	< 0.0021	< 0.002
Chlorobenzene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Chloroethane	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Chloroform	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Chloromethane	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
cis-1,2-Dichloroethene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
cis-1,3-Dichloropropene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Dibromochloromethane	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Ethylbenzene	< 0.0038	< 0.0036	< 0.0044	< 0.0039	< 0.0042	< 0.0042	< 0.004
Methylene Chloride	< 0.0029	< 0.0027	< 0.0033	< 0.0029	< 0.0032	< 0.0032	< 0.003
Styrene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Tetrachloroethene	< 0.001	< 0.0009	< 0.0011	< 0.001	< 0.0011	< 0.001	< 0.001
Toluene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
trans-1,2-Dichloroethene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
trans-1,3-Dichloropropene	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Trichloroethene	< 0.001	< 0.0009	< 0.0011	< 0.001	< 0.0011	< 0.001	< 0.001
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005
Xylene (Total)	< 0.0048	< 0.0046	< 0.0054	< 0.0049	< 0.0053	< 0.0053	< 0.005

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-20(5-6 Feet)	SB-20(8-9 Feet)	SB-22(3-4 Feet)	SB-22(5-6 Feet)	SB-22(18-19 Feet)	SB-23(3-4 Feet)	SB-23(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	5-6 Feet	8-9 Feet	3-4 Feet	5-6 Feet	18-19 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.036	< 0.075	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
1,2-Dichlorobenzene	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
1,3-Dichlorobenzene	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
1,4-Dichlorobenzene	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2,4,5-Trichlorophenol	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2,4,6-Trichlorophenol	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2,4-Dichlorophenol	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2,4-Dimethylphenol	< 0.36	0.065 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2,4-Dinitrophenol	< 1.4	< 3	< 1.6	< 1.6	< 1.6	< 1.5	< 1.6
2,4-Dinitrotoluene	< 0.073	< 0.15	< 0.078	< 0.079	< 0.082	< 0.077	< 0.079
2,6-Dinitrotoluene	< 0.073	< 0.15	< 0.078	< 0.079	< 0.082	< 0.077	< 0.079
2-Chloronaphthalene	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2-Chlorophenol	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2-Methylnaphthalene	< 0.36	0.057 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2-Methylphenol	< 0.36	0.064 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
2-Nitroaniline	< 0.73	< 1.5	< 0.78	< 0.79	< 0.82	< 0.77	< 0.79
2-Nitrophenol	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
3,3'-Dichlorobenzidine	< 0.73	< 1.5	< 0.78	< 0.79	< 0.82	< 0.77	< 0.79
3-Nitroaniline	< 0.73	< 1.5	< 0.78	< 0.79	< 0.82	< 0.77	< 0.79
4,6-Dinitro-2-methylphenol	< 1.4	< 3	< 1.6	< 1.6	< 1.6	< 1.5	< 1.6
4-Bromophenyl-phenylether	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
4-Chloro-3-methylphenol	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
4-Chloroaniline	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
4-Chlorophenyl-phenylether	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
4-Methylphenol	0.016 J	0.21 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
4-Nitroaniline	< 0.73	< 1.5	< 0.78	< 0.79	< 0.82	< 0.77	< 0.79
4-Nitrophenol	< 1.4	< 3	< 1.6	< 1.6	< 1.6	< 1.5	< 1.6
Acenaphthene	< 0.36	0.11 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Acenaphthylene	< 0.36	2.7	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Anthracene	< 0.36	2.2	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Benzo(a)anthracene	< 0.036	10	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Benzo(a)pyrene	< 0.036	12	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Benzo(b)fluoranthene	< 0.036	13	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Benzo(g,h,i)perylene	< 0.36	7.6	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Benzo(k)fluoranthene	< 0.036	7.4	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
bis(2-Chloroethoxy)methane	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
bis(2-Chloroethyl)ether	< 0.036	< 0.075	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
bis(2-chloroisopropyl)ether	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-20(5-6 Feet)	SB-20(8-9 Feet)	SB-22(3-4 Feet)	SB-22(5-6 Feet)	SB-22(18-19 Feet)	SB-23(3-4 Feet)	SB-23(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	5-6 Feet	8-9 Feet	3-4 Feet	5-6 Feet	18-19 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Butylbenzylphthalate	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Carbazole	< 0.36	1.3	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Chrysene	< 0.36	10	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Dibenz(a,h)anthracene	< 0.036	2.2	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Dibenzofuran	< 0.36	0.21 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Diethylphthalate	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Dimethylphthalate	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Di-n-butylphthalate	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Di-n-octylphthalate	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Fluoranthene	< 0.36	15	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Fluorene	< 0.36	0.4 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Hexachlorobenzene	< 0.036	< 0.075	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Hexachlorobutadiene	< 0.073	< 0.15	< 0.078	< 0.079	< 0.082	< 0.077	< 0.079
Hexachlorocyclopentadiene	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Hexachloroethane	< 0.036	< 0.075	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Indeno(1,2,3-cd)pyrene	< 0.036	7	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
Isophorone	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Naphthalene	0.021 J	0.2 J	< 0.00292	0.011 J	< 0.00292	< 0.00292	< 0.00292
Nitrobenzene	< 0.036	< 0.075	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
N-Nitroso-di-n-propylamine	< 0.036	< 0.075	< 0.039	< 0.04	< 0.041	< 0.039	< 0.039
N-Nitrosodiphenylamine	< 0.36	< 0.75	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Pentachlorophenol	0.013 J	< 3	< 1.6	< 1.6	< 1.6	< 1.5	< 1.6
Phenanthrene	< 0.36	5.9	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Phenol	0.037 J	0.18 J	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Pyrene	< 0.36	14	< 0.39	< 0.4	< 0.41	< 0.39	< 0.39
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-20(5-6 Feet)	SB-20(8-9 Feet)	SB-22(3-4 Feet)	SB-22(5-6 Feet)	SB-22(18-19 Feet)	SB-23(3-4 Feet)	SB-23(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003	8/1/2003
Depth	5-6 Feet	8-9 Feet	3-4 Feet	5-6 Feet	18-19 Feet	3-4 Feet	5-6 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	957	1160	3670	3860	1840	1820	4320
Antimony	< 1.1	< 1.8	< 2	< 1.9	< 1.3	< 13.4	< 3.4
Arsenic	1	2.6	6.6	5	2.3	< 7.4	6.8
Barium	49.9	44.6 J	28.2 J	32.8 J	10.1 J	< 3.9	117
Beryllium	2.5	4.3	6.6	4.8	2.3	1.7 J	5.3 J
Cadmium	< 0.079	< 0.12	0.31 J	< 0.13	< 0.09	< 0.93	< 0.24
Calcium	1820	8830	18700	3070	618 J	< 98.5	3760 J
Chromium	11	15.5	10	9.3	11.3	23.1	13.1
Cobalt	20.5	23	40.5	31	7.2 J	143	69.9 J
Copper	22.9	28.3	38.4	37.5	70.8	156	71
Iron	27200	45400	63900	66500	32400	227100	80900
Lead	8.1	11.6	33.1	32.9	17.3	45.7	127 J
Magnesium	604 J	2960	7340	898 J	154 J	< 96.4	2120 J
Manganese	340	257	969	701	106	574	1800
Mercury	< 0.018	0.1	0.06	< 0.017	< 0.021	< 0.017	0.04 J
Nickel	27.2	36.5	74.8	63.6	18.5	53.1 J	85.1 J
Potassium	< 62.5	< 97.1	< 111	< 102	< 70.7	< 731	< 186
Selenium	1.5	2.4	2	2.6	2.1	10.2 J	3.7
Silver	< 0.28	< 0.43	< 0.49	< 0.45	< 0.31	< 3.2	< 0.83
Sodium	< 78.3	< 122	< 140	< 128	< 88.7	< 917	< 233
Thallium	< 0.93	< 1.4	< 1.7	< 1.5	< 1.1	< 10.9	< 2.8
Vanadium	8.2 J	10.3 J	10.5 J	11.1 J	12.7	13.1 J	12.4 J
Zinc	178	262	334	294	114	1090	365 J
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-23D(5-6 Feet)	SB-23(14-15 Feet)	SB-24(3-4 Feet)	SB-24(5-6 Feet)	SB-24(14-15 Feet)	SB-25(3-4 Feet)	SB-25(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
1,1,2,2-Tetrachloroethane	< 0.001	< 0.0012	< 0.0011	< 0.0011	< 0.0011	< 0.001	< 0.0011
1,1,2-Trichloroethane	< 0.003	< 0.0036	< 0.0032	< 0.0033	< 0.0032	< 0.003	< 0.0032
1,1-Dichloroethane	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
1,1-Dichloroethene	< 0.002	< 0.0024	< 0.0021	< 0.0022	< 0.0021	< 0.002	< 0.0021
1,2-Dichloroethane	< 0.002	< 0.0024	< 0.0021	< 0.0022	< 0.0021	< 0.002	< 0.0021
1,2-Dichloropropane	< 0.001	< 0.0012	< 0.0011	< 0.0011	< 0.0011	< 0.001	< 0.0011
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
4-Methyl-2-Pentanone	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Acetone	0.088 J	0.1 J	0.058 J	0.071 J	0.076 J	0.17 J	0.081 J
Benzene	0.0011	< 0.0012	< 0.0011	< 0.0011	< 0.0011	< 0.001	< 0.0011
Bromodichloromethane	< 0.001	< 0.0012	< 0.0011	< 0.0011	< 0.0011	< 0.001	< 0.0011
Bromoform	< 0.004	< 0.0048	< 0.0042	< 0.0044	< 0.0043	< 0.0039	< 0.0043
Bromomethane	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Carbon Disulfide	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Carbon Tetrachloride	< 0.002	< 0.0024	< 0.0021	< 0.0022	< 0.0021	< 0.002	< 0.0021
Chlorobenzene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Chloroethane	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Chloroform	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Chloromethane	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
cis-1,2-Dichloroethene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
cis-1,3-Dichloropropene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Dibromochloromethane	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Ethylbenzene	< 0.004	< 0.0048	< 0.0042	< 0.0044	< 0.0043	< 0.0039	< 0.0043
Methylene Chloride	< 0.003	< 0.0036	< 0.0032	< 0.0033	< 0.0032	< 0.003	< 0.0032
Styrene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Tetrachloroethene	< 0.001	< 0.0012	< 0.0011	< 0.0011	< 0.0011	< 0.001	< 0.0011
Toluene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
trans-1,2-Dichloroethene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
trans-1,3-Dichloropropene	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Trichloroethene	< 0.001	< 0.0012	< 0.0011	< 0.0011	< 0.0011	< 0.001	< 0.0011
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054
Xylene (Total)	< 0.0051	< 0.006	< 0.0053	< 0.0055	< 0.0053	< 0.0049	< 0.0054

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-23D(5-6 Feet)	SB-23(14-15 Feet)	SB-24(3-4 Feet)	SB-24(5-6 Feet)	SB-24(14-15 Feet)	SB-25(3-4 Feet)	SB-25(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
1,2-Dichlorobenzene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
1,3-Dichlorobenzene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
1,4-Dichlorobenzene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
2,4,5-Trichlorophenol	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
2,4,6-Trichlorophenol	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
2,4-Dichlorophenol	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
2,4-Dimethylphenol	< 0.39	< 0.42	< 0.39	0.058 J	< 0.42	< 0.39	< 0.38
2,4-Dinitrophenol	< 1.6	< 1.7	< 1.6	< 1.7	< 1.7	< 1.6	< 1.5
2,4-Dinitrotoluene	< 0.078	< 0.083	< 0.078	< 0.083	< 0.085	< 0.078	< 0.075
2,6-Dinitrotoluene	< 0.078	< 0.083	< 0.078	< 0.083	< 0.085	< 0.078	< 0.075
2-Chloronaphthalene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
2-Chlorophenol	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
2-Methylnaphthalene	< 0.39	< 0.42	< 0.39	0.0087 J	< 0.42	< 0.39	< 0.38
2-Methylphenol	< 0.39	< 0.42	< 0.39	0.055 J	< 0.42	< 0.39	< 0.38
2-Nitroaniline	< 0.78	< 0.83	< 0.78	< 0.83	< 0.85	< 0.78	< 0.75
2-Nitrophenol	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
3,3'-Dichlorobenzidine	< 0.78	< 0.83	< 0.78	< 0.83	< 0.85	< 0.78	< 0.75
3-Nitroaniline	< 0.78	< 0.83	< 0.78	< 0.83	< 0.85	< 0.78	< 0.75
4,6-Dinitro-2-methylphenol	< 1.6	< 1.7	< 1.6	< 1.7	< 1.7	< 1.6	< 1.5
4-Bromophenyl-phenylether	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
4-Chloro-3-methylphenol	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
4-Chloroaniline	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
4-Chlorophenyl-phenylether	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
4-Methylphenol	< 0.39	< 0.42	< 0.39	0.21 J	< 0.42	< 0.39	< 0.38
4-Nitroaniline	< 0.78	< 0.83	< 0.78	< 0.83	< 0.85	< 0.78	< 0.75
4-Nitrophenol	< 1.6	< 1.7	< 1.6	< 1.7	< 1.7	< 1.6	< 1.5
Acenaphthene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Acenaphthylene	< 0.39	< 0.42	< 0.39	0.33 J	< 0.42	< 0.39	< 0.38
Anthracene	< 0.39	< 0.42	< 0.39	0.079 J	< 0.42	< 0.39	< 0.38
Benzo(a)anthracene	< 0.039	< 0.042	0.018 J	0.039 J	< 0.042	< 0.039	< 0.038
Benzo(a)pyrene	< 0.039	< 0.042	< 0.039	0.047 J	< 0.042	< 0.039	< 0.038
Benzo(b)fluoranthene	< 0.039	< 0.042	0.02 J	0.05 J	< 0.042	< 0.039	< 0.038
Benzo(g,h,i)perylene	< 0.39	< 0.42	< 0.39	0.069 J	< 0.42	< 0.39	< 0.38
Benzo(k)fluoranthene	< 0.039	< 0.042	< 0.039	0.054 J	< 0.042	< 0.039	< 0.038
bis(2-Chloroethoxy)methane	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
bis(2-Chloroethyl)ether	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
bis(2-chloroisopropyl)ether	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-23D(5-6 Feet)	SB-23(14-15 Feet)	SB-24(3-4 Feet)	SB-24(5-6 Feet)	SB-24(14-15 Feet)	SB-25(3-4 Feet)	SB-25(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Butylbenzylphthalate	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Carbazole	< 0.39	< 0.42	< 0.39	0.041 J	< 0.42	< 0.39	< 0.38
Chrysene	< 0.39	< 0.42	< 0.39	0.063 J	< 0.42	< 0.39	< 0.38
Dibenz(a,h)anthracene	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
Dibenzofuran	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Diethylphthalate	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Dimethylphthalate	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Di-n-butylphthalate	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Di-n-octylphthalate	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Fluoranthene	< 0.39	< 0.42	0.034 J	0.056 J	< 0.42	< 0.39	< 0.38
Fluorene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Hexachlorobenzene	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
Hexachlorobutadiene	< 0.078	< 0.083	< 0.078	< 0.083	< 0.085	< 0.078	< 0.075
Hexachlorocyclopentadiene	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Hexachloroethane	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
Indeno(1,2,3-cd)pyrene	< 0.039	< 0.042	< 0.039	0.074 J	< 0.042	< 0.039	< 0.038
Isophorone	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Naphthalene	< 0.00292	< 0.00292	< 0.00292	0.051 J	< 0.00292	< 0.00292	< 0.00292
Nitrobenzene	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
N-Nitroso-di-n-propylamine	< 0.039	< 0.042	< 0.039	< 0.042	< 0.042	< 0.039	< 0.038
N-Nitrosodiphenylamine	< 0.39	< 0.42	< 0.39	< 0.42	< 0.42	< 0.39	< 0.38
Pentachlorophenol	< 1.6	< 1.7	< 1.6	< 1.7	< 1.7	< 1.6	< 1.5
Phenanthrene	< 0.39	< 0.42	0.0086 J	0.024 J	< 0.42	< 0.39	< 0.38
Phenol	< 0.39	< 0.42	< 0.39	0.22 J	< 0.42	< 0.39	< 0.38
Pyrene	< 0.39	< 0.42	0.021 J	0.033 J	< 0.42	< 0.39	< 0.38
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-23D(5-6 Feet)	SB-23(14-15 Feet)	SB-24(3-4 Feet)	SB-24(5-6 Feet)	SB-24(14-15 Feet)	SB-25(3-4 Feet)	SB-25(5-6 Feet)
Date Collected	8/1/2003	8/1/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet	14-15 Feet	3-4 Feet	5-6 Feet
Sample Type	Duplicate	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	3550	3530	2010	1910	3170	4860	1520
Antimony	< 3.4	< 3.6	< 1.4	< 0.88	< 1.5	< 1.4	< 0.88
Arsenic	7.4	5	< 1.2	3.9	6.1	7.7	3.5
Barium	93.1 J	70.3 J	54.4 J	22.9 J	153 J	73.8 J	71.1 J
Beryllium	10.1 J	8	1.5 J	1.5 J	4.1 J	2.9 J	2 J
Cadmium	< 0.24	< 0.25	< 0.14	< 0.091	< 0.15	< 0.14	< 0.09
Calcium	9800 J	2060 J	4070	< 16.9	399 J	229 J	< 16.8
Chromium	11.3	13.2	13.8	11	9.7	9.9	8.2
Cobalt	106 J	79.5	16.4 J	19.7	58.4	79.5	24.2
Copper	77.4	54.2	52.7	38.5	50.2	73.2	52
Iron	85500	85800	57400 J	34900 J	91900 J	58900 J	34200 J
Lead	78.5 J	35.6	40.5	27.7	45.7	41.9	25.9
Magnesium	5400 J	827 J	101 J	121 J	480 J	272 J	96.7 J
Manganese	1840	1250	491	322	2370	884	393
Mercury	0.11 J	0.04	< 0.02	0.06	0.03 J	0.07	0.02 J
Nickel	137 J	94.6	14.1	16.5	72.4	68.1	25.8
Potassium	< 185	< 197	88 J	40.1 J	87.9 J	95.1 J	42 J
Selenium	3.4	3.2	< 1.4	< 0.88	< 1.5	< 1.4	< 0.88
Silver	< 0.82	< 0.87	< 0.25	< 0.16	< 0.27	< 0.25	< 0.16
Sodium	< 232	583 J	< 127	< 81.8	< 138	< 127	< 81.6
Thallium	< 2.8	< 2.9	< 1.6	< 1	< 1.7	< 1.5	< 0.99
Vanadium	11.8 J	11.6 J	11.9 J	14.1	13.1 J	12.5 J	8.9 J
Zinc	649 J	456	256	163	479	315	132
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-25(19-20 Feet)	SB-26(3-4 Feet)	SB-26(5-6 Feet)	3-26(23-24 Feet Fe	SB-28(3-4 Feet)	SB-28(5-6 Feet)	SB-28(19-20 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	19-20 Feet	3-4 Feet	5-6 Feet	23-24 Feet Feet	3-4 Feet	5-6 Feet	19-20 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
VOCs (mg/Kg)							
1,1,1-Trichloroethane	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
1,1,2,2-Tetrachloroethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0012	< 0.0012	< 0.0013
1,1,2-Trichloroethane	< 0.0031	< 0.0031	< 0.0031	< 0.0032	< 0.0036	< 0.0037	< 0.0039
1,1-Dichloroethane	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
1,1-Dichloroethene	< 0.0021	< 0.0021	< 0.0021	< 0.0021	< 0.0024	< 0.0025	< 0.0026
1,2-Dichloroethane	< 0.0021	< 0.0021	< 0.0021	< 0.0021	< 0.0024	< 0.0025	< 0.0026
1,2-Dichloropropane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0012	< 0.0012	< 0.0013
2-Butanone	NA	NA	NA	NA	NA	NA	NA
2-Chloroethyl Vinyl Ether	NA	NA	NA	NA	NA	NA	NA
2-Hexanone	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
4-Methyl-2-Pentanone	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Acetone	0.06 J	0.1 J	0.15 J	0.053 J	0.063 J	0.092 J	0.038 J
Benzene	0.005	< 0.001	< 0.001	< 0.001	< 0.0012	< 0.0012	< 0.0013
Bromodichloromethane	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0012	< 0.0012	< 0.0013
Bromoform	< 0.0042	< 0.0041	< 0.0041	< 0.0042	< 0.0048	< 0.005	< 0.0052
Bromomethane	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Carbon Disulfide	0.0007 J	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	0.0007 J
Carbon Tetrachloride	< 0.0021	< 0.0021	< 0.0021	< 0.0021	< 0.0024	< 0.0025	< 0.0026
Chlorobenzene	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Chloroethane	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Chloroform	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Chloromethane	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
cis-1,2-Dichloroethene	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
cis-1,3-Dichloropropene	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Dibromochloromethane	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Ethylbenzene	< 0.0042	< 0.0041	< 0.0041	< 0.0042	< 0.0048	< 0.005	< 0.0052
Methylene Chloride	< 0.0031	< 0.0031	< 0.0031	< 0.0032	< 0.0036	< 0.0037	< 0.0039
Styrene	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Tetrachloroethene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0012	< 0.0012	< 0.0013
Toluene	0.0026 J	0.0005 J	< 0.0052	0.0005 J	< 0.0061	< 0.0062	< 0.0065
trans-1,2-Dichloroethene	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
trans-1,3-Dichloropropene	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Trichloroethene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.0012	< 0.0012	< 0.0013
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	< 0.0052	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065
Xylene (Total)	0.011	< 0.0052	< 0.0052	< 0.0053	< 0.0061	< 0.0062	< 0.0065

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location Date Collected Depth Sample Type Area Soil Type Constituent	SB-25(19-20 Feet) 8/4/2003 19-20 Feet Investigation Quarry 3 Subsurface	SB-26(3-4 Feet) 8/4/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-26(5-6 Feet) 8/4/2003 5-6 Feet Investigation Quarry 3 Subsurface	3-26(23-24 Feet Fe 8/4/2003 23-24 Feet Feet Investigation Quarry 3 Subsurface	SB-28(3-4 Feet) 8/4/2003 3-4 Feet Investigation Quarry 3 Subsurface	SB-28(5-6 Feet) 8/4/2003 5-6 Feet Investigation Quarry 3 Subsurface	SB-28(19-20 Feet) 8/4/2003 19-20 Feet Investigation Quarry 3 Subsurface
SVOCs (mg/Kg)							
1,2,4-Trichlorobenzene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
1,2-Dichlorobenzene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
1,3-Dichlorobenzene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
1,4-Dichlorobenzene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2,4,5-Trichlorophenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2,4,6-Trichlorophenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2,4-Dichlorophenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2,4-Dimethylphenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2,4-Dinitrophenol	< 1.7	< 1.6	< 1.6	< 1.5	< 1.6	< 1.8	< 1.9
2,4-Dinitrotoluene	< 0.084	< 0.079	< 0.082	< 0.074	< 0.082	< 0.09	< 0.094
2,6-Dinitrotoluene	< 0.084	< 0.079	< 0.082	< 0.074	< 0.082	< 0.09	< 0.094
2-Chloronaphthalene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2-Chlorophenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2-Methylnaphthalene	0.18 J	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2-Methylphenol	0.01 J	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
2-Nitroaniline	< 0.84	< 0.79	< 0.82	< 0.74	< 0.82	< 0.9	< 0.94
2-Nitrophenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
3,3'-Dichlorobenzidine	< 0.84	< 0.79	< 0.82	< 0.74	< 0.82	< 0.9	< 0.94
3-Nitroaniline	< 0.84	< 0.79	< 0.82	< 0.74	< 0.82	< 0.9	< 0.94
4,6-Dinitro-2-methylphenol	< 1.7	< 1.6	< 1.6	< 1.5	< 1.6	< 1.8	< 1.9
4-Bromophenyl-phenylether	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
4-Chloro-3-methylphenol	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
4-Chloroaniline	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
4-Chlorophenyl-phenylether	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
4-Methylphenol	0.08 J	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
4-Nitroaniline	< 0.84	< 0.79	< 0.82	< 0.74	< 0.82	< 0.9	< 0.94
4-Nitrophenol	< 1.7	< 1.6	< 1.6	< 1.5	< 1.6	< 1.8	< 1.9
Acenaphthene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Acenaphthylene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Anthracene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Benzo(a)anthracene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Benzo(a)pyrene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Benzo(b)fluoranthene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Benzo(g,h,i)perylene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Benzo(k)fluoranthene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
bis(2-Chloroethoxy)methane	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
bis(2-Chloroethyl)ether	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
bis(2-chloroisopropyl)ether	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47

Table A-2 **Quarry 3 Subsurface Soil Data (Continued)**
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-25(19-20 Feet)	SB-26(3-4 Feet)	SB-26(5-6 Feet)	3-26(23-24 Feet Fe	SB-28(3-4 Feet)	SB-28(5-6 Feet)	SB-28(19-20 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	19-20 Feet	3-4 Feet	5-6 Feet	23-24 Feet Feet	3-4 Feet	5-6 Feet	19-20 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
SVOCs (mg/Kg)							
bis(2-Ethylhexyl)phthalate	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Butylbenzylphthalate	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Carbazole	0.046 J	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Chrysene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Dibenz(a,h)anthracene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Dibenzofuran	0.031 J	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Diethylphthalate	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Dimethylphthalate	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Di-n-butylphthalate	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Di-n-octylphthalate	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Fluoranthene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Fluorene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Hexachlorobenzene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Hexachlorobutadiene	< 0.084	< 0.079	< 0.082	< 0.074	< 0.082	< 0.09	< 0.094
Hexachlorocyclopentadiene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Hexachloroethane	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Indeno(1,2,3-cd)pyrene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
Isophorone	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Naphthalene	0.43	< 0.00292	< 0.00292	< 0.00292	< 0.00292	< 0.00292	< 0.00292
Nitrobenzene	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
N-Nitroso-di-n-propylamine	< 0.042	< 0.04	< 0.041	< 0.037	< 0.041	< 0.045	< 0.047
N-Nitrosodiphenylamine	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Pentachlorophenol	< 1.7	< 1.6	< 1.6	< 1.5	< 1.6	< 1.8	< 1.9
Phenanthrene	< 0.42	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Phenol	0.051 J	< 0.4	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Pyrene	< 0.42	0.012 J	< 0.41	< 0.37	< 0.41	< 0.45	< 0.47
Pesticides (mg/Kg)							
Aldrin	NA	NA	NA	NA	NA	NA	NA
alpha-BHC	NA	NA	NA	NA	NA	NA	NA
beta-BHC	NA	NA	NA	NA	NA	NA	NA
delta-BHC	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	NA	NA	NA	NA	NA	NA	NA
Chlordane	NA	NA	NA	NA	NA	NA	NA
4,4-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4-DDT	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA
Endosulfan I	NA	NA	NA	NA	NA	NA	NA

Table A-2

Quarry 3 Subsurface Soil Data (Continued)
Crater Resources Superfund Site - Gulph Mills, Pennsylvania

Sample Location	SB-25(19-20 Feet)	SB-26(3-4 Feet)	SB-26(5-6 Feet)	3-26(23-24 Feet Fe	SB-28(3-4 Feet)	SB-28(5-6 Feet)	SB-28(19-20 Feet)
Date Collected	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003	8/4/2003
Depth	19-20 Feet	3-4 Feet	5-6 Feet	23-24 Feet Feet	3-4 Feet	5-6 Feet	19-20 Feet
Sample Type	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation	Investigation
Area	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3	Quarry 3
Soil Type	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Constituent							
Pesticides (mg/Kg)							
Endosulfan II	NA	NA	NA	NA	NA	NA	NA
Endosulfan sulfate	NA	NA	NA	NA	NA	NA	NA
Endrin	NA	NA	NA	NA	NA	NA	NA
Endrin aldehyde	NA	NA	NA	NA	NA	NA	NA
Heptachlor	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	NA	NA	NA	NA	NA	NA	NA
Toxaphene	NA	NA	NA	NA	NA	NA	NA
Inorganics (mg/Kg)							
Aluminum	4210	7950	9770	810	3410	4030	4740
Antimony	< 1.5	< 1.3	< 1.4	< 0.87	< 1.4	< 1.6	< 1.6
Arsenic	10.9	10.2	14.7	< 0.76	3.2	3.9	4.2
Barium	77.3 J	26 J	30.5 J	1.4 J	93.1	143	140
Beryllium	6.4 J	3.2 J	5.4 J	< 0.022	2.7	4.2	4.1
Cadmium	< 0.15	< 0.13	< 0.15	< 0.089	< 0.099	0.65 J	< 0.11
Calcium	430 J	788 J	876 J	< 16.6	157 J	284 J	286 J
Chromium	5.9	13.5	12.3	2.7	10.1 J	10.8 J	14.8 J
Cobalt	244	44.6	62.3	< 0.78	43.3 J	57.6 J	62.7 J
Copper	155	39.3	47.3	< 0.47	39.3 J	44.5 J	59.8 J
Iron	140700 J	46100 J	57000 J	2180 J	59200	99600	78500
Lead	59.3	36.5	33.5	< 0.49	36.7 J	38.3 J	58.5 J
Magnesium	312 J	627 J	1000 J	< 15.6	347 J	516 J	677 J
Manganese	1560	690	762	3 J	1370 J	3030 J	2040 J
Mercury	0.15	0.1	0.09	< 0.019	< 0.021	< 0.023	0.06 J
Nickel	237	57.5	84.8	< 0.87	63.2	84.2	86.4
Potassium	< 40	272 J	283 J	< 23.6	163 J	188 J	530 J
Selenium	1.5 J	< 1.3	< 1.4	< 0.87	< 1	< 1.1	< 1.2
Silver	< 0.26	< 0.23	< 0.26	< 0.16	< 0.34	< 0.38	< 0.39
Sodium	< 136	< 117	< 133	< 80.2	< 97.4	< 107	< 111
Thallium	< 1.7	< 1.4	< 1.6	< 0.98	< 1.2	< 1.3	< 1.3
Vanadium	8.2 J	19.4	19.4	3.9 J	13.1	14.3	18.1
Zinc	991	269	365	< 1.3	550	815	863
Wet Chemistry (mg/Kg)							
Total Cyanide	NA	NA	NA	NA	NA	NA	NA

Notes:
NA - Not Analyzed.
ND - Not Detected.
J - Estimated Value.