



CB&I  
312 Directors Drive  
Knoxville, TN 37923  
Tel: +1 865 690 3211  
Fax: +1 865 690 3626  
Steven.Downey@CBIfederalservices.com

July 31, 2013

U.S. Army Engineer District, Nashville  
ATTN: CELRN-EC-E (Ms. Paula Coleman)  
110 Ninth Avenue South, Room 682  
U.S. Court House Annex  
Nashville, Tennessee 37203

**Subject:                    *Submittal of the Final Powerhouse No. 2 Ash Pits Baseline Human Health Risk Assessment and Screening-Level Ecological Risk Assessment Addenda for Coal Yard No. 2 Former Plum Brook Ordnance Works, Sandusky, Ohio Contract No. W912QR-08-D-0013: Shaw Project Number 132457***

Dear Ms. Coleman:

In accordance with the requirements of Delivery Order No. DX02 of Contract No. W912QR-08-D-0013 awarded to Shaw Environmental & Infrastructure, Inc., a CB&I company, we are pleased to submit the Final Addenda to the Powerhouse No. 2 Ash Pits (AP2) Baseline Human Health Risk Assessment and Screening-Level Ecological Risk Assessment for Coal Yard No. 2 at the Former Plum Brook Ordnance Works (PBOW) located in Sandusky, Ohio. This report was prepared consistent with other PBOW risk assessment reports, U.S. Environmental Protection Agency guidance, and the AP2 risk assessment work plan.

Enclosed for your records are four copies of this report. Copies have also been sent to those on the distribution list as indicated for their records. As requested, the document was sent to the Center of Expertise (CX) and the Restoration Advisory Board Co-Chair in electronic format only.

Should you have any questions or require additional information regarding this submittal, please do not hesitate to contact me at (865) 694-7496.

Sincerely,

Steven. T. Downey, PE, PMP  
Project Manager

Please Reply To: Steven T. Downey  
Phone: 865 694 7496  
E-Mail Address: [Steven.Downey@CBIfederalservices.com](mailto:Steven.Downey@CBIfederalservices.com)

**Control Copy Distribution List**

<u>Name</u>	<u>Control Copy</u>
U.S. Army Engineer District, Nashville ATTN: CELRN-EC-E (Ms. Paula Coleman) 110 Ninth Avenue South, Room 682 Annex Nashville, TN 37203	1-4
U.S. Army Engineer District, Huntington ATTN: CELRH-PM-PP-P (Mr. Rick Meadows) 502 Eighth Street Huntington, West Virginia 25701-2070	5-7 (CD provided)
Mr. Paul Jayko Site Coordinator Division of Emergency and Remedial Response (DERR) Ohio Environmental Protection Agency 347 North Dunbridge Road Bowling Green, Ohio 43402-0466	8, 9
Mr. Brian Tucker Ohio Environmental Protection Agency Division of Emergency and Remedial Response (DERR) Central Office Lazarus Government Center 50 W. Town Street, Suite 700 Columbus, OH 43216-1049	10
Mr. Robert Lallier Environmental Coordinator NASA - Plum Brook Station 6100 Columbus Avenue Sandusky, Ohio 44870	11
U.S. Army Corps of Engineers ( <b>electronic only</b> ) HTRW Center of Expertise ATTN: CEHNC-CX-EG (Vern StJohn) 1616 Capitol Avenue Omaha, Nebraska 68144-3869	(CD provided)
Mr. John Blakeman ( <b>electronic only</b> ) PBOW RAB Co-chairman 2412 Scheid Road Huron, Ohio 44839	(CD provided)
Mr. Jeffrey G. Leach US Army Public Health Command ATTN: MCHB-IP-REH, BLDG E1675 Aberdeen Proving Grounds, MD 21010-5403	12



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## Shaw Environmental & Infrastructure, Inc.

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Former Plum Brook Ordnance Works, Sandusky, Ohio

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Editor	<u>Donald Groseclose</u>	<u></u>	<u>7-31-13</u>
Peer Review	<u>Tom Siard</u>	<u></u>	<u>7-31-13</u>
Technical Review	<u>Michael Gunderson</u>	<u></u>	<u>7-31-13</u>
Quality Assurance Mgr	<u>Ken Martinez</u>	<u></u>	<u>7-31-13</u>
Project Manager	<u>Steven Downey</u>	<u></u>	<u>7-31-13</u>

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**Final  
Powerhouse No. 2 Ash Pits  
Screening-Level Ecological Risk Assessment Addendum  
for Coal Yard No. 2  
FUDS Project No. G05OH001822**

**Former Plum Brook Ordnance Works,  
Sandusky, Ohio**

**Prepared for:**

**U.S. Army Corps of Engineers  
P.O. Box 1070  
Nashville, Tennessee 37202-1070**

**Prepared by:**

**Shaw Environmental & Infrastructure, Inc.  
(A CB&I Company)  
312 Directors Drive  
Knoxville, Tennessee 37923**

**Shaw Project Number 132457**

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## **List of Acronyms**

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AP2	Powerhouse No. 2 Ash Pits
bgs	below ground surface
BSC	background screening concentration
COPEC	chemical of potential ecological concern
D&M	Dames and Moore, Inc.
EPA	U.S. Environmental Protection Agency
ESV	ecological screening value
IT	IT Corporation
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
NASA	National Aeronautics and Space Administration
NWI	National Wetlands Inventory
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
PBOW	Plum Brook Ordnance Works
PCB	polychlorinated biphenyl
Shaw	Shaw Environmental & Infrastructure, Inc.
SLERA	screening-level ecological risk assessment
TNT	trinitrotoluene
TNTA	TNT Area A
TNTB	TNT Area B
TNTC	TNT Area C
UCL	upper confidence limit
USACE	U.S. Army Corps of Engineers

## ***Executive Summary***

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A screening-level ecological risk assessment (SLERA) was performed to provide an estimate of current and future ecological hazard associated with potential hazardous substance releases within the Powerhouse No. 2 Coal Yard (Coal Yard No.2) site at Plum Brook Ordnance Works (PBOW) in Sandusky, Ohio. Coal Yard No.2 is associated with Powerhouse No. 2 Ash Pits (AP2) at PBOW, and this SLERA is an addendum to the AP2 SLERA. Because of the small size of the site, the site is not spatially relevant to any significant degree for most ecological receptors. The site-specific SLERA was performed to satisfy administrative requirements, including Defense Environmental Restoration Program-Formerly Used Defense Sites regulations. The results of the SLERA contribute to the overall characterization of the site and serve as part of the baseline used to develop, evaluate, and select appropriate remedial alternatives, if necessary. The objective of the SLERA is to present information for risk managers regarding the potential for adverse impacts to occur to ecological receptors as a result of site-related releases. Although the term “ecological risk assessment” is commonly used in guidance documents and available technical literature, it should be noted that ecological “risk” is not calculated in the SLERA, as no statistical probabilities of toxicological effects are generated in the SLERA. The assessment addresses the potential for adverse effects to the vegetation, wildlife, aquatic life, and endangered and threatened species.

The maximum detected concentrations of chemicals in soil were compared with risk-based screening ecotoxicity values during an initial screening step. Chemicals that exceeded the screening values or for which no screening values were available and that did not meet additional screening criteria (e.g., comparison with background data, nutrient status, frequency of detection, etc.) were retained as chemicals of potential ecological concern (COPEC) and assessed further. The background screening protocol used for Coal Yard No. 2 is based on PBOW Project Delivery Team agreements and differs somewhat from the current Ohio Environmental Protection Agency guidance. Use of this PBOW Project Delivery Team method for the development of background screening concentrations and as part of the COPEC screening process ensures consistency between all of the PBOW Formerly Used Defense Sites project sites. Only one chemical, cadmium, was identified as a COPEC. Because it was detected at low concentrations only marginally above its conservative screening value, and because it is not a known or suspected contaminant based on site history, cadmium was not recommended for further investigation. Therefore, the SLERA for the Coal Yard No. 2 concluded after the COPEC selection stage.

Based on the findings of the SLERA, the potential for adverse effects to populations of ecological receptors exposed to chemicals in soil at the Coal Yard No. 2 is expected to be negligible.

## **1.0 Introduction**

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This screening-level ecological risk assessment (SLERA) Addendum evaluates the potential for adverse effects posed to ecological receptors from potential releases at the Powerhouse No. 2 Coal Yard (Coal Yard No. 2) at the former Plum Brook Ordnance Works (PBOW). Coal Yard No.2 is associated with Powerhouse No. 2 Ash Pits (AP2) at PBOW, and this SLERA is an addendum to the AP2 SLERA (Shaw Environmental & Infrastructure [Shaw] [a CB&I company], 2010). The approaches used to evaluate the potential for ecological risk are described in the Powerhouse No. 2 Ash Pit SLERA work plan (Shaw, 2009). This SLERA is consistent with the ecological risk assessment process described in U.S. Environmental Protection Agency (EPA) guidance (e.g., EPA [1997]), with Ohio Environmental Protection Agency (OEPA) Division of Emergency and Remedial Response guidance (OEPA, 2008), and with the procedures established in previous ecological risk assessments performed at PBOW (e.g., IT Corporation [IT], 2001; Shaw, 2010), with some adjustments to accommodate current practices in the field of ecological risk assessment.

This work is being conducted by Shaw for the U.S. Army Corps of Engineers (USACE) under the Defense Environmental Restoration Program-Formerly Used Defense Sites and managed by the USACE Huntington District, with technical oversight provided by the USACE Nashville District.

### **1.1 Facility Description and Location**

PBOW is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland (Figure 1-1). Although located primarily in Perkins and Oxford Townships, the eastern edge of the facility extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by Patten Tract Road, and on the east by U.S. Highway 250. The areas surrounding PBOW are mostly agricultural and residential. The facility is currently surrounded by a chain-link fence, and the perimeter is regularly patrolled. Access by authorized personnel is limited to established checkpoints. Public access is restricted. Hunting is allowed by permit on portions of PBOW during the annual deer hunting season.

### **1.2 Facility History and Background**

The PBOW facility was constructed on property comprising 9,009 acres in early 1941 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene, and pentolite (USACE, 1995). Production of explosives at PBOW began in December 1941 and continued until 1945. It

is estimated that more than 1 billion pounds of nitroaromatic explosives were manufactured during the 4-year operating period. The three explosive manufacturing areas were designated TNT Area A (TNTA), TNT Area B (TNTB), and TNT Area C (TNTC). Twelve process lines were used in the manufacture of TNT, including four lines at TNTA, three lines at TNTB, and five lines at TNTC.

After plant operations ceased, the manufacturing process lines were decontaminated by the War Department in late 1945. During decontamination, all structures, equipment, and manufacturing debris were either removed and salvaged or removed and burned. After decontamination, 3,230 acres of the property was initially transferred to the Ordnance Department, then to the War Assets Administration after it was certified by the U.S. Army to be decontaminated. In 1949, PBOW was transferred to the General Services Administration. This transfer did not include the 2,800 acres comprising the Plum Brook Depot area, also known as the Magazine Area. The Department of the Army reacquired the 3,230 acres in 1954 and performed remedial efforts from the mid-1950s until 1963. In 1955, the Army completed further decontamination of manufacturing process lines. This effort included removal of contaminated surface and subsurface soil around the building and wooden and ceramic waste disposal lines containing TNT. Thousands of pounds of TNT were discovered in catch basins; this TNT was removed and burned at the burning grounds.

Two property use agreements were entered into by the Army and the National Advisory Committee of Aeronautics, the predecessor of the National Aeronautics and Space Administration (NASA), in 1956 and 1958, respectively. Accountability and custody for the entire portion of the former PBOW property (6,030 acres) that had been under the accountability and custody of the Department of the Army were transferred to NASA on March 15, 1963. NASA performed further decontamination efforts during 1964. The NASA decontamination process included removing contaminated surface soil above the drain tiles, flumes, etc.; destruction of all buildings by fire; and removal of all soil, debris, sumps, and above-grade portions of concrete foundations. Portions of the concrete foundations located below grade were left buried, and some that had been previously slightly above grade were likewise buried. All materials, including the soil in those areas, were flashed. The area was then rough-graded. The decontamination process was also to have included the burning of nitroaromatic-filled flumes that were excavated (Dames and Moore, Inc. [D&M], 1997).

NASA has operated and maintained the former PBOW property since 1963, and the facility is currently the NASA Glenn Research Center, Plum Brook Station. NASA operates the property as a space research facility in support of their John Glenn Research Center at Lewis Field,

Cleveland, Ohio. Most of the aerospace testing facilities built in the 1960s at the facility are currently on standby or inactive status. On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. The Perkins Township Board of Education acquired 46 acres of the excess acreage and uses this area as a bus transportation area. The General Services Administration retains ownership of the remaining excess acreage and currently has a use agreement with the Ohio National Guard for 604 acres of this land. The details of land transactions are listed in the site management plan (USACE, 1995).

### **1.3 Powerhouse No. 2 Coal Yard Description and History**

Three power stations, Powerhouse No. 1, Powerhouse No. 2, and Powerhouse No. 3, were constructed and utilized to support the acid, 2,4,6-TNT, dinitrotoluene, and pentolite manufacturing processes. Each power station consisted of a main powerhouse, a coal storage area (coal yard), and two aboveground fuel storage tanks. The fuel storage tanks were surrounded by a berm to contain any potential spills or leaks. Each powerhouse building consisted of a boiler house, compressor room, electrical room, filter room, and locker room. Each building also contained two to four large coal-burning boilers, a turboelectric generator, a feed water treatment system, and several steam-driven or electric air compressors. The generated steam was used for space heating, driving compressors, and generating electrical power. As mentioned previously, the coal yards were used as storage areas providing coal to be used in the powerhouse's boilers. The coal was brought into the yards via train. Figure 1-2 shows the location of the three coal yards on PBOW property.

Coal Yard No. 2 is located immediately to the northeast of Powerhouse No. 2. The former coal yard is estimated to have been approximately 200 feet wide by 290 feet in length, or approximately 1.3 acres. The area is currently covered with grass and brush along with some hydrophilic vegetation indicative of wetlands. Demolition of the former Powerhouse No. 2 building by NASA in 2010 resulted in some disturbance of surface soil and vegetation, primarily in areas outside of the footprint of the former coal yard. Minor amounts of coal were observed on the ground surface in isolated areas during previous site walks. No permanent or semipermanent water bodies are present at this site; therefore, soil is the only medium evaluated in the SLERA.

### **1.4 Scope and Objectives**

The objective of this SLERA is to provide an estimate of the potential for adverse ecological effects associated with contamination resulting from former PBOW activities at Coal Yard No. 2. The results of the SLERA will contribute to the overall characterization of the site and may be used to determine the need for additional investigations or to develop, evaluate, and select appropriate remedial alternatives. Guidance documents used to perform the SLERA include the

general guidelines of the *Tri-Service Procedural Guidelines for Ecological Risk Assessments* (Wentsel, et al., 1996), as well as the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1997), *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Guidance Bulletin No. 1* (EPA, 1996), and *Guidance for Conducting Ecological Risk Assessments* (OEPA, 2008). The SLERA fits into Steps 1 and 2 of the ecological risk assessment guidance for Superfund process (EPA, 1997), and Level I through a maximum of Level III evaluation using the OEPA (2008) process.

The goal of the SLERA is to evaluate the potential for adverse ecological effects to ecological receptors from site-related contaminants at Coal Yard No. 2. This objective is met by characterizing the ecological communities in the vicinity of the site, determining the particular contaminants present, identifying pathways for receptor exposure, and estimating the potential for adverse effects to identified receptors. The SLERA addresses the potential for adverse effects to the vegetation, wildlife, aquatic life (e.g., sediment-dwelling organisms), threatened and endangered species, and wetlands or other sensitive habitats associated with the site.

The SLERA evaluates the chemicals of potential ecological concern (COPEC), the ecosystems and receptors at risk, the ecotoxicity of the contaminants known or suspected to be present, and observed or anticipated ecological effects. This evaluation is conducted in two steps: (1) a screening assessment step, which is described in Chapter 2.0 as part of the problem formulation, and (2) a predictive assessment step. Ecological endpoints to be addressed in both steps are identified. The results and conclusions of the screening assessment determine whether a predictive assessment is needed. The criteria by which the need for a predictive assessment is measured are formalized as null hypotheses to be accepted (in which case a predictive assessment is not needed) or rejected (in which case a predictive assessment is needed). The predictive assessment includes the exposure characterization, ecological effects characterization, and risk characterization. Because of the lack of contamination detected at the site, the SLERA process was terminated after the initial screening assessment step during the problem formulation stage, and the predictive assessment was not performed.

## **2.0 Problem Formulation**

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The screening assessment null hypotheses are stated as follows:

- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of viable habitat for potential ecological receptors.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential ecological receptors.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential exposure pathways.
- Potential for adverse ecological effects to ecological entities at the site is minimal or nonexistent due to the lack of potential chemical stressors.

If one or more of these null hypotheses are accepted, a predictive assessment is not triggered. All four null hypotheses must be rejected for a predictive assessment to be triggered. The first three null hypotheses are tested with the results of the ecological site description, the pre-assessment reconnaissance, the documentation of potential receptors of special concern and critical habitats, and the determination of significant ecological threats (Section 2.1). The fourth null hypothesis is tested with the results of COPEC selection (Section 2.2).

If a predictive assessment is triggered, terrestrial ecological conceptual site models are developed, as appropriate, and additional problem formulation tasks are performed.

### **2.1 Ecological Site Description**

This ecological site description includes a general discussion of site background and the area of concern, surface water resources (if any), wetlands, and vegetative communities; a species inventory; and a discussion of threatened and endangered species. Ecological characterization of the study area was based on a compilation of existing ecological information and site reconnaissance activities.

Because Coal Yard No. 2 is in such close proximity to the Powerhouse No. 2 Ash Pits, a formal ecological reconnaissance was not performed for Coal Yard No. 2. Rather, the habitat description, sensitive ecological resources, and faunal assemblages (including potential threatened and endangered species) described in the Powerhouse No. 2 Ash Pits SLERA (Shaw, 2010) were determined to also be relevant for the Coal Yard No. 2 site. Also, a trained ecologist specifically visited Coal Yard No. 2 in June and September of 2011 to make general

observations of site conditions. Photographs taken during these visits are presented on Figure 2-1.

**General Site Background.** PBOW, approximately 6,400 acres in size, is located within the Eastern Lake Plains physiographic region of the Eastern Huron/Erie Lake Plain Ecoregion (Lafferty, 1979; Omernik, 1986). This region is generally characterized as containing flat plains as the predominant land surface form and as having a dominant natural vegetation of elm and ash in undisturbed areas. Approximately two-thirds of Erie County was once covered by a glacial lake that produced features such as beach ridges and wave-cut cliffs. Much of the region is poorly drained due to the flat topography and low stream gradients. Many of the wetlands adjacent to Lake Erie in this region have been preserved by various federal, state, and private organizations (Peterjohn and Rice, 1991), thereby providing important wetland habitat for wildlife.

Across PBOW, the land slopes gently to the north-northeast towards Lake Erie. Elevations range from 675 feet above mean sea level at the southwest edge of the site to 625 feet above mean sea level in the northern portion of the property at Bogart Road, resulting in an average slope of approximately 0.3 percent. The Lake Plains region itself is over 69 percent cropland, 2.7 percent pasture land, and 10.5 percent forest (Ohio Department of Natural Resources [ODNR], 1985). However, since the U.S. Army acquired the site in 1941 and removed the land from agricultural production, undeveloped portions of the former PBOW have become second-generation forest and open fields. This has resulted in PBOW becoming an island of forest and open fields within a sea of agricultural and residential land in north-central Ohio.

As noted in Section 1.3, Coal Yard No. 2 is located immediately adjacent to (northeast) of Powerhouse No. 2. Figure 1-2 shows the specific site location. Descriptions and information regarding the local geography, topography, surface drainage, regional and local geology and hydrogeology characteristics, and precipitation influence effects on local water levels have been prepared and included in the final Powerhouse No. 2 Ash Pits Site Characterization Report (Shaw, 2012). Descriptions of the ecological resources in the vicinity of the Coal Yard No. 2, including common flora and fauna species in the area, discussion of threatened or endangered species, and habitat descriptions of the locality, are included in the Powerhouse No. 2 Ash Pits SLERA (Shaw, 2010).

During a recent field visit performed on September 1, 2011, the majority of the Coal Yard No. 2 area was noted as having recently been filled and graded. Small pieces of coal were observed in the soil. The northern border of the coal yard consists of an early successional forest. As noted

during the initial site staking before any grading or backfilling had taken place, the former Coal Yard No. 2 area was low lying with minimal relief and contained standing water. This water eventually percolated into the soil or evaporated prior to soil sampling. The presence of standing water and minimal relief suggests that limited site runoff occurs.

According to the National Wetland Inventory (NWI) maps for the area (U.S. Fish and Wildlife Service, 2013), there are no designated wetlands at the Coal Yard No. 2 site. It should be noted that the accuracy of NWI maps is limited, especially in relatively flat landscapes such as PBOW, because minor depressions often contain isolated wetlands not easily identified through aerial photograph interpretation (the process used by the U.S. Fish and Wildlife Service in preparing NWI maps). NASA is currently performing a wetland delineation study at PBOW. This delineation effort was not complete at the time of this SLERA's submittal. The delineation effort will better identify locations and extent of sensitive wetland habitat throughout the installation.

## **2.2 Selection of Chemicals of Potential Ecological Concern**

A list of the Coal Yard No. 2 soil samples used for the SLERA is presented in Table 2-1. Sample locations are presented on Figure 2-2. From the chemical results of samples in Table 2-1, a COPEC selection process was performed to develop a subset of chemicals detected at the site that are potentially site-related. Selected COPECs are also present at sufficient frequencies, concentrations, and spatial areas to pose a potential risk to ecological receptors. Examples of screening criteria that were used include the following: analytical detection limit, frequency of detection less than 5 percent, comparability with background, status as a nutrient, and comparison with risk-based screening ecotoxicity values. The COPEC selection process is described in more detail in Section 2.2.3.

### **2.2.1 Data Organization**

Chemical analytical data were reviewed and evaluated for quality, usefulness, and uncertainty. Data identified as being of acceptable quality for use in the SLERA were summarized in a manner that presents the pertinent information to be applied in the SLERA. Any data rejected during the data evaluation as a result of the data evaluation ("R"-qualified data) were identified along with the rejection rationale. All data used in the SLERA were validated.

For ecological impacts, soil from 0 to 6 feet below ground surface (bgs) was used. The 0 to 6 feet depth interval was selected for three primary reasons: (1) to maintain consistency with other PBOW ecological risk assessments (e.g., IT [2001]), (2) to include potential exposure to ecological receptors that may be exposed to deeper soil, and (3) to increase the size of the total

soil database by including samples collected from up to 6 feet bgs. The data used for the SLERA are presented in Appendix A.

Polychlorinated biphenyls (PCB) were scheduled to be collected from sample location CY2-SB01 for the 0.5 to 1 foot and 3 to 5 feet depth ranges, but a paperwork error resulted in a failure to analyze for PCBs in these depth intervals for this sample location. Although field split samples are typically not used for risk assessment purposes, the field split sample for this location did analyze for PCBs. Therefore, the data for field split sample CY0017 were used to represent the 0.5 to 1 foot bgs depth at CY2-SB01.

Chemicals not detected at least once in soil were not included in the risk assessment. Available background data were determined for soil. Potential sources of background information include data from previous and current investigations as well as monitoring wells in areas unaffected by site activities.

The analytical data included qualifiers from the analytical laboratory quality control or from the data validation process that reflect the level of confidence in the data. Some of the data qualifiers reported in the data evaluated for this SLERA and their meanings are as follows (EPA, 1989):

- U - Chemical was analyzed for but not detected; the associated value is the sample quantitation limit.
- J - Value is estimated, concentration reported above the method detection limit and below the contract-required quantitation limit.
- R - Quality control indicates that the data are unusable (chemical may or may not be present).
- B - Concentration of chemical in the sample is not sufficiently higher than concentration in the blank. If the concentration in the sample is less than 5 times the blank concentration or less than 10 times the concentration of a common laboratory contaminant, the result is given a B-qualifier and is not used in the risk assessment. Common laboratory contaminants include acetone, 2-butanone, methylene chloride, toluene, and phthalate esters (EPA, 1989).

"J"-qualified data are used in the risk assessment; "R"- and "B"-qualified data are not. The handling of "U"-qualified data (nondetects) is described in the following sections.

## **2.2.2 Descriptive Statistical Calculations**

Because of the uncertainty associated with characterizing contamination in environmental media, both the mean and the 95 percent upper confidence limit of the mean (UCL) are usually estimated for COPECs. As described in Section 2.2.4, 95 percent UCLs were not calculated for Coal Yard No. 2. The means of detected chemicals are presented in Table 2-2, however, and these values were calculated using the method detection limit as a surrogate concentration for nondetect results.

Analytical data from field duplicates were joined with parent sample results to yield one result for use in the generation of mean concentrations, as follows:

- The average of field duplicate and parent sample was used if both were positive detections or if both were nondetects.
- The detected value was used if one sample was a positive detection and the other was a nondetect.

## **2.2.3 COPEC Selection Criteria**

The criteria used to identify COPECs in the SLERA are described in the following sections.

### **2.2.3.1 Comparison to Ecological Screening Values**

Maximum detected concentrations (MDC) of chemicals detected in soil were compared with ecological screening values (ESV) for ecological endpoints following recommendations received from OEPA and as discussed in EPA *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Bulletin No. 1* (EPA, 1996). Chemicals that exceed the ESVs, or for which no ESVs are available, were retained as COPECs if other COPEC selection criteria were also met. The following ESVs, or ESV hierarchy (as noted), were used for the ecological evaluation:

- **Soil.** Soil screening values were selected using the following hierarchy: (1) EPA ecological soil screening levels (EPA, 2008), (2) *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, et al., 1997a), (3) EPA Region 5 ecological screening levels (EPA, 2003), (4) *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process* (Efroymson, et al., 1997b), and (5) *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants* (Efroymson, et al., 1997c). It should be noted that effects on heterotrophic processes may not be relevant to ecological receptors of concern at the site.

The development of the ESVs used for the former PBOW SLERAs is presented in Appendix B.

### **2.2.3.2 Frequency of Detection**

Chemicals that are detected infrequently may be artifacts in the data that may not reflect site-related activity or disposal practices. These chemicals are not evaluated further in the risk assessment. Generally, chemicals that are detected only at low concentrations in 5 percent or less of the samples from a given medium (if at least 20 samples are analyzed) are dropped from further consideration, unless their presence is expected based on historical information about the site. Because fewer than 20 soil samples were collected for Coal Yard No. 2 soil, this screening criterion was not used in the SLERA.

### **2.2.3.3 Background Evaluation**

Chemical concentrations were compared to site-specific background concentrations (see next paragraph for details) as an indication of whether a chemical is present from site-related activity or as natural background. This comparison is generally valid for inorganic chemicals but not for organic chemicals, because inorganic chemicals are naturally occurring and most organic chemicals related to potential releases are not. Statistical techniques are used as tools to aid the exercise of professional judgment in resolving site-related issues for metals, because metals are naturally present in most environmental media. The statistical techniques generally involve comparing the site data with background data.

The first statistical technique used for the background screen is the comparison of the MDC of the site data set to the PBOW background screening concentration (BSC). BSCs are considered representative concentrations of naturally occurring inorganic constituents; therefore, a comparison between the BSC and concentrations detected on site provides an indication of whether exposure to on-site media exceeds ambient levels. The background screening protocol used for Coal Yard No. 2 is based on PBOW Project Delivery Team agreements (PBOW Project Delivery Team, 2000) and differs somewhat from the current OEPA (2009) guidance. Use of this PBOW team method, which has been used for all PBOW risk assessments to date, ensures consistency between all of the PBOW investigative sites. The background data set and derivation of soil BSCs for all PBOW soil investigations are described in IT (1998). The background soil samples were collected from near the property boundary, away from any potential source areas. BSCs were calculated for use at PBOW based on concentrations found in these background soil samples. Each BSC is either the MDC of the concentrations found in these background soil samples or the calculated 95th percent upper tolerance limit of the background data set, whichever value is lower (PBOW Project Delivery Team, 2000). The upper tolerance limit is the concentration, with a probability of 0.95 (or a confidence of 95 percent), that would cover 95 percent of background population if a larger number of samples were collected. Chemicals with

MDCs less than their respective BSCs are consistent with background concentrations and are eliminated from further consideration. Use of this method for the development of BSCs and as part of the COPEC screening process ensures consistency between all of the PBOW Formerly Used Defense Sites project sites.

If the MDC of a chemical exceeds the BSC, the chemical is retained as a COPEC, or a more detailed statistical analysis may be performed to determine if the background data and the site data are drawn from the same population. The Wilcoxon Rank Sum test can be used for this purpose; however, that test was not used in the Coal Yard No. 2 SLERA because the one metal that was selected as a COPEC had insufficient background data to perform it.

Chemicals that fail the background evaluation are assumed to be site-related and are not eliminated at this point of the screening process.

#### **2.2.3.4 Essential Nutrients**

Evaluating essential nutrients is a special form of risk-based screening applied to certain ubiquitous elements that are generally considered to be required nutrients. Essential nutrients such as calcium, iron, magnesium, potassium, and sodium are usually eliminated as COPECs because they are generally considered to be innocuous in environmental media. Other essential nutrients, including chloride, iodine, and phosphorus, may be eliminated as COPECs, provided that their presence in a particular medium is shown to be unlikely to cause adverse effects to biological health.

#### **2.2.4 Summary of COPEC Selection**

The results of the COPEC screening for soil are presented in Table 2-2. The table presents the following information:

- Chemical name
- Frequency of detection
- Range of detected concentrations
- Range of detection limits
- Arithmetic mean (average) of site concentrations
- Distribution type
- Appropriate ESV
- BSC
- COPEC selection conclusion: NO (with rationale for exclusion) or YES (selected).

Ninety-five percent UCLs are also typically presented for COPECs, but computing a UCL was not considered necessary for the one chemical identified as a COPEC. Footnotes in the table provide the rationale for selecting or rejecting a chemical as a COPEC.

Cadmium was the only chemical identified as a COPEC in soil (Table 2-2). Cadmium was detected in four out of eight samples at concentrations ranging from 0.24 to 0.81 milligrams per kilogram (mg/kg). Concentrations from two samples (CY0028 = 0.72 mg/kg, and CY0018 = 0.81 mg/kg) exceed the ESV of 0.36 mg/kg. No BSC is available for cadmium because it was nondetect in all 25 soil background samples (IT, 1998). However, the reporting limits in the background data set (range = 0.57 to 1.2 mg/kg) exceeded the detected concentrations at Coal Yard No. 2. Therefore, although possibly associated with remnant pieces of coal at the site, the detected concentrations of cadmium could also be naturally occurring. Further, the ESV of 0.36 mg/kg is based on an ecological soil screening level that is protective of a shrew receptor (EPA, 2008). Because of the very small area affected, the low concentrations detected, and the natural population dynamics for small mammals that can rapidly compensate for localized impacts, it is highly unlikely that adverse population-level effects to shrews or other small mammals are occurring at this site. Therefore, cadmium is not recommended for further evaluation.

As discussed in Chapter 2.0, the SLERA null hypotheses state that potential for adverse ecological effects is minimal or nonexistent due to the lack of viable habitat, potential ecological receptors, potential exposure pathways, and/or potential chemical stressors. Because no COPECs are recommended for further evaluation at Coal Yard No. 2, a predictive assessment is not triggered, and no further action for the protection of ecological receptors is considered necessary.

### **3.0 Risk Summary and Conclusions**

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Chemicals detected in soil were screened against conservative benchmark values and other criteria to identify COPECs at Coal Yard No. 2. Because of the small size of the site, the site is not spatially relevant to any significant degree for most ecological receptors. The site-specific SLERA was performed to satisfy administrative requirements, including Formerly Used Defense Sites regulations (USACE, 2004).

Cadmium was the only chemical in soil that was identified as a COPEC. However, because cadmium was detected in two samples at concentrations that marginally exceeded its ESV, and because of the very limited spatial size of the site as well as the area where the slightly elevated cadmium was detected, it was judged that the presence of cadmium is either naturally occurring, inconsequential from an ecological standpoint, or both. Therefore, no further investigation of cadmium is considered necessary for the purposes of environmental protection, and the potential for ecological hazard associated with cadmium exposure is considered negligible.

## 4.0 References

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Dames and Moore, Inc. (D&M), 1997, *TNT Areas Site Investigation, Final Report, Plum Brook Ordnance Works/NASA, Sandusky, Ohio*, April.

Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, 1997a, *Preliminary Remediation Goals for Ecological Endpoints*, Oak Ridge National Laboratory. Report No. ES/ER/TM-162/R2.

Efroymson, R.A., G.W. Suter II, and M.E. Will, 1997b, *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process, 1997 Revision*, Oak Ridge National Laboratory. Report No. ES/ER/TM-126/R2.

Efroymson, R.A., G.W. Suter II, Wooten, A.C., and M.E. Will, 1997c, *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants, 1997 Revision*, Oak Ridge National Laboratory. Report No. ES/ER/TM-85/R3.

IT Corporation (IT), 2001, *Baseline Human Health Risk Assessment and Ecological Risk Assessment Work Plans, TNT Areas A and C, Former Plum Brook Ordnance Works, Sandusky, Ohio*, April.

IT Corporation (IT), 1998, *Site Investigation of Acid Areas, Plum Brook Ordnance Works, Sandusky, Ohio*.

Lafferty, M.B., 1979, *Ohio's Natural Heritage*, The Ohio Academy of Sciences, Columbus, Ohio.

Ohio Department of Natural Resources (ODNR), 1985, *Ohio Resources Inventory*, Joint Publication of ODNR, Division of Soil and Water Conservation and USDA Soil Conservation Service, Columbus, Ohio, 28 pp.

Ohio Environmental Protection Agency (OEPA), 2009, *Use of Background for Remedial Response Sites*, Technical Decision Compendium, Division of Environmental Response and Revitalization, August 21.

Ohio Environmental Protection Agency (OEPA) 2008, *Ecological Risk Assessment Guidance Document*, Division of Emergency and Remedial Response, Columbus, OH, April.

Omernik, J.M., 1986, *Ecoregions of the United States*, Corvallis Environmental Research Laboratory, EPA.

Peterjohn, B.G., and D.L. Rice, 1991, *The Ohio Breeding Bird Atlas*, The Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Columbus, Ohio.

Plum Brook Ordnance Works Project Delivery Team, 2000, *Meeting with USACE and OEPA, Quarterly Background Groundwater Investigation*, meeting minutes, NASA Plum Brook Station, Sandusky, Ohio, May 10.

Shaw Environmental, Inc. (Shaw), 2012, *Powerhouse No. 2 Ash Pits Site Characterization Report Addendum for Coal Yard No. 2, Plum Brook Ordnance Works, Sandusky, Ohio*, September.

Shaw Environmental, Inc. (Shaw), 2010, *Final Screening-Level Ecological Risk Assessment, Power House 2 Ash Pits, Plum Brook Ordnance Works, Sandusky, Ohio*, September.

Shaw Environmental, Inc. (Shaw), 2009, *Work Plans, Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment for Power House 2 Ash Pits, Final, Plum Brook Ordnance Works, Sandusky, Ohio*, February.

U.S. Army Corps of Engineers (USACE), 2004, *Formerly Used Defense Site Program Policy*, Washington, D.C., ER-200-3-1, May.

U.S. Army Corps of Engineers (USACE), 1995, *Site Management Plan, Plum Brook Ordnance Works, Sandusky, Ohio, Part B, Areas of Concern*, September.

U.S. Environmental Protection Agency (EPA), 2008, *Guidance for Developing Ecological Soil Screening Levels*, Office of Solid Waste and Emergency Response, Directive 92857.7-55, Washington, D.C., SSL values on line at: <http://epa.gov/ecotox/ecossl/index.html>.

U.S. Environmental Protection Agency (EPA), 2003, *U.S. EPA Region 5 RCRA Ecological Screening Levels (ESL)*, Website version last updated August 22, 2003: <http://www.epa.gov/reg5rcra/ca/edql.htm>.

U.S. Environmental Protection Agency (EPA), 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*, EPA/540-R-97-006.

U.S. Environmental Protection Agency (EPA), 1996, *Region 5 Biological Technical Assistance Group (BTAG) Ecological Risk Assessment Bulletin No. 1*, Chicago, Illinois.

U.S. Environmental Protection Agency (EPA), 1989, *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)*, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/002.

U.S. Fish and Wildlife Service, 2013, Wetlands Mapper, <http://www.fws.gov/wetlands/Data/Mapper.html>.

Wentsel, R.S., T.W. LaPoint, M. Simini, R.T. Checkai, D. Ludwig, and L.W. Brewer, 1996, *Tri-Service Procedural Guidelines for Ecological Risk Assessments*, U.S. Army Edgewood Research, Development, and Engineering Center, Aberdeen Proving Ground, Maryland.

## **TABLES**

**Table 2-1**

**Summary of Surface Soil Samples Evaluated in the Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

<b>Sample Location</b>	<b>Sample Number</b>	<b>Sample Purpose</b>	<b>Sample Date</b>	<b>Depth of Sample (ft bgs)</b>	<b>Analysis</b>
CY2-SB01	CY0015	REG	10/27/2011	0.5 - 1	Explosives, Gen Chem, Metals, SVOC
CY2-SB01	CY0016	FD	10/27/2011	0.5 - 1	Explosives, Gen Chem, Metals, SVOC
CY2-SB01	CY0017	FS <sup>a</sup>	10/27/2011	0.5 - 1	Explosives, Gen Chem, Metals, PCB, SVOC
CY2-SB01	CY0018	REG	10/27/2011	3 - 5	Explosives, Gen Chem, Metals, SVOC
CY2-SB02	CY0020	REG	10/27/2011	0.5 - 1	Explosives, Gen Chem, Metals, PCB, SVOC
CY2-SB02	CY0021	REG	10/27/2011	3 - 5	Explosives, Gen Chem, Metals, PCB, SVOC
CY2-SB03	CY0025	REG	10/26/2011	0.5 - 1	Explosives, Gen Chem, Metals, PCB, SVOC
CY2-SB03	CY0026	REG	10/26/2011	3 - 5	Explosives, Gen Chem, Metals, PCB, SVOC
CY2-SB04	CY0028	REG	10/26/2011	0 - 1	Explosives, Gen Chem, Metals, PCB, SVOC
CY2-SB04	CY0029	REG	10/26/2011	3 - 5	Explosives, Gen Chem, Metals, PCB, SVOC

<sup>a</sup> The PCB data for this field split sample were used for location CY2-SB01 because PCBs were inadvertently not analyzed for in the original or field duplicate samples for the 0.5 to 1 foot depth range.

ft bgs - Feet below ground surface.

FD - Field duplicate.

FS - Field split.

PCB - Polychlorinated biphenyls.

REG - Regular sample.

SVOC - Semivolatile organic compound.

Table 2-2

**Statistical Summary and COPEC Selection of Chemicals Detected in Soil (0 to 6 Feet Below Ground Surface)  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg				Method	Detection Limit	Mean (mg/kg)	BSC <sup>a</sup> (mg/kg)	ESV <sup>b</sup> (mg/kg)	COPEC? <sup>c,d</sup>
			Detected Minimum	Detected VQ	Concentrations Maximum	Detected VQ						
<b>Inorganics</b>												
Aluminum	8 / 8	100	5.14E+03		1.13E+04	J	9.10E-01	5.40E+00	7.65E+03	1.55E+04	pH Dependent	N (b)
Antimony	1 / 8	13	2.50E-01	J	2.50E-01	J	4.60E-02	2.50E-01	2.13E-01	9.30E+00	0.27	N (a)
Arsenic	8 / 8	100	2.10E+00		1.35E+01		4.50E-02	2.50E-01	9.00E+00	3.65E+01	18	N (a)
Barium	8 / 8	100	3.52E+01		7.09E+01		1.90E-01	1.00E+00	5.82E+01	8.26E+02	330	N (a)
Beryllium	8 / 8	100	2.70E-01		7.70E-01	J	4.60E-03	2.50E-02	4.55E-01	1.00E+00	21	N (a)
Cadmium	4 / 8	50	2.40E-01	J	8.10E-01		4.60E-03	2.50E-02	2.67E-01	NA	0.36	Y
Calcium	8 / 8	100	1.27E+03		5.25E+04		2.30E+00	1.30E+01	2.29E+04	5.23E+04	Nutrient	N (c)
Chromium	8 / 8	100	9.80E+00		2.20E+01		4.60E-02	2.50E-01	1.46E+01	2.90E+01	26	N (a)
Cobalt	8 / 8	100	3.50E+00		1.51E+01		4.60E-02	2.50E-01	8.26E+00	1.16E+02	13	N (b)
Copper	8 / 8	100	1.12E+01		2.64E+01		4.60E-02	2.50E-01	2.10E+01	5.62E+01	28	N (a)
Iron	8 / 8	100	1.64E+04		3.43E+04		1.10E+00	5.80E+00	2.20E+04	2.34E+05	pH Dependent	N (b)
Lead	8 / 8	100	7.40E+00		1.53E+01		3.80E-02	1.10E-01	1.11E+01	4.86E+01	11	N (b)
Magnesium	8 / 8	100	1.81E+03		1.63E+04		2.30E+00	1.30E+01	8.92E+03	1.04E+04	Nutrient	N (c)
Manganese	8 / 8	100	8.11E+01		8.16E+02		4.60E-02	2.50E-01	3.70E+02	3.51E+03	220	N (b)
Mercury	8 / 8	100	1.10E-02	J	4.50E-02	J	6.20E-03	7.70E-03	3.05E-02	8.50E-02	0.00051	N (b)
Nickel	8 / 8	100	1.07E+01		4.00E+01		4.60E-02	2.50E-01	2.38E+01	5.51E+01	38	N (b)
Potassium	8 / 8	100	4.72E+02		1.21E+03		2.30E+00	1.30E+01	8.14E+02	3.39E+03	Nutrient	N (c)
Selenium	4 / 8	50	4.30E-01	J	1.70E+00	J	2.10E-01	4.65E+00	1.27E+00	2.00E+00	0.52	N (b)
Silver	3 / 8	38	5.30E-02	J	8.80E-02	J	4.50E-02	2.50E-01	1.66E-01	1.11E+01	4.2	N (a)
Sodium	3 / 8	38	5.26E+01	J	1.24E+02	J	3.90E+01	2.20E+02	1.53E+02	NA	Nutrient	N (c)
Thallium	1 / 8	13	3.90E-01	J	3.90E-01	J	1.50E-01	7.60E+00	5.08E+00	1.30E+00	1	N (a)
Vanadium	8 / 8	100	1.15E+01		3.24E+01		4.60E-02	2.50E-01	2.18E+01	4.09E+01	7.8	N (b)
Zinc	8 / 8	100	2.42E+01		6.78E+01		4.60E-02	2.50E-01	5.17E+01	3.22E+02	46	N (b)
<b>Semivolatile Organic Compounds</b>												
Bis(2-ethylhexyl)phthalate	1 / 8	13	3.21E-01	J	3.21E-01	J	7.70E-02	8.60E-02	1.11E-01		0.925	N (a)
Fluoranthene	2 / 8	25	3.10E-02	J	6.47E-02	J	1.90E-02	2.20E-02	2.73E-02		1.1	N (a)
Methylnaphthalene, 2-	1 / 8	13	4.29E-02	J	4.29E-02	J	1.90E-02	2.20E-02	2.32E-02		3.24	N (a)
Naphthalene	1 / 8	13	3.21E-02	J	3.21E-02	J	3.10E-02	3.40E-02	3.25E-02		29	N (a)
Phenanthrene	1 / 8	13	2.92E-02	J	2.92E-02	J	1.90E-02	2.20E-02	2.15E-02		29	N (a)
Pyrene	1 / 8	13	6.34E-02	J	6.34E-02	J	1.90E-02	2.20E-02	2.57E-02		1.1	N (a)

BSC - Background screening concentration.

COPEC - Chemical of potential ecological concern.

ESV - Ecological screening value.

J - The compound/analyte was positively identified; the reported result is the estimated concentration of the compound/analyte detected in the sample analyzed.

mg/kg - Milligrams per kilogram.

NA - Not available.

VQ - Validation qualifier.

<sup>a</sup> IT Corporation (IT), 1998, *Site Investigation of Acid Areas*, Plum Brook Ordnance Works, Sandusky, Ohio, August.

<sup>b</sup> ESVs and their sources are in Appendix A.

<sup>c</sup> N = Chemical is not chosen as a COPEC:

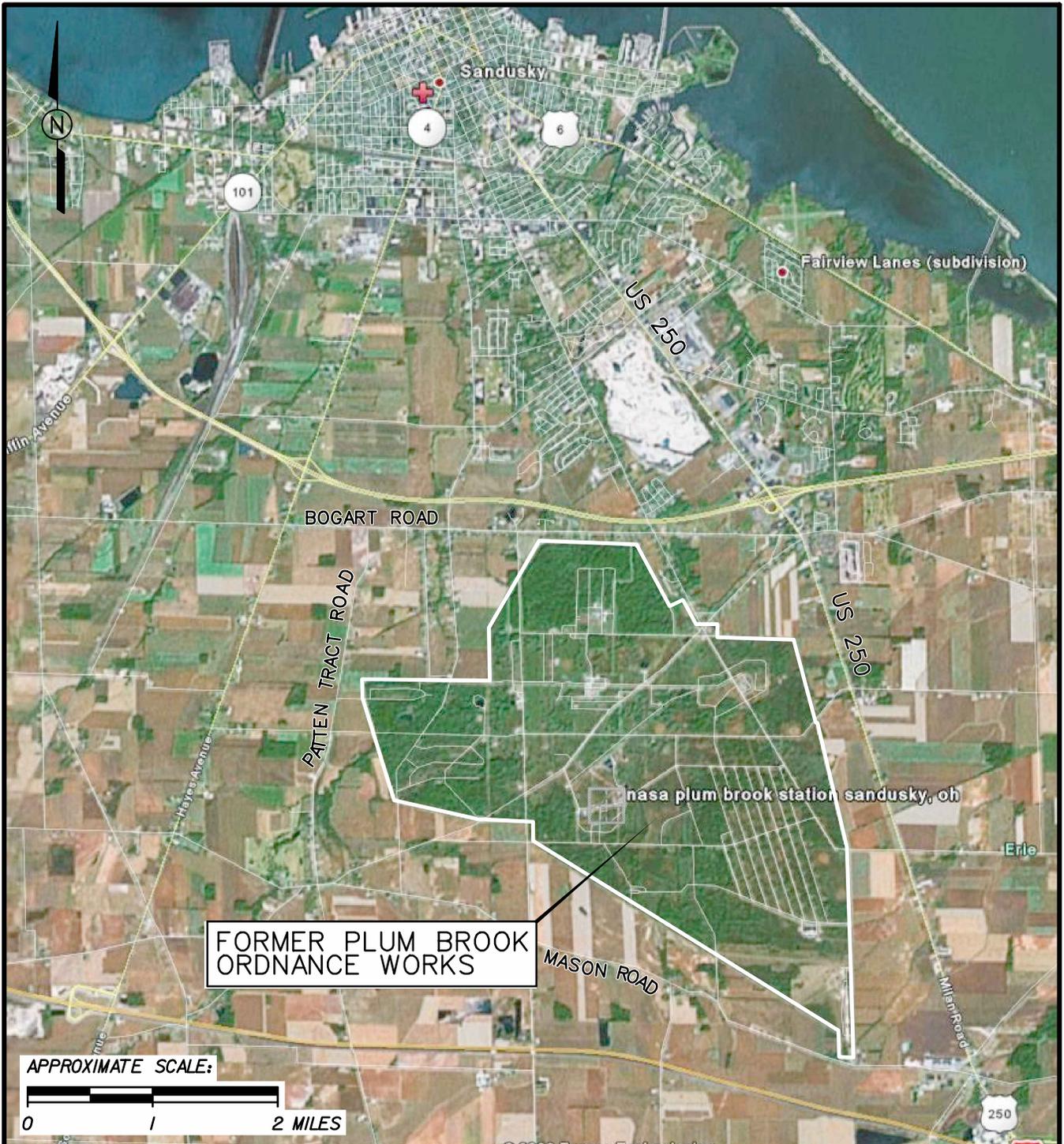
(a) = maximum detected concentration is less than the ESV.

(b) = maximum detected concentration is less than the BSC.

(c) = essential nutrient.

<sup>d</sup> Y = Chemical is chosen as COPEC.

## FIGURES



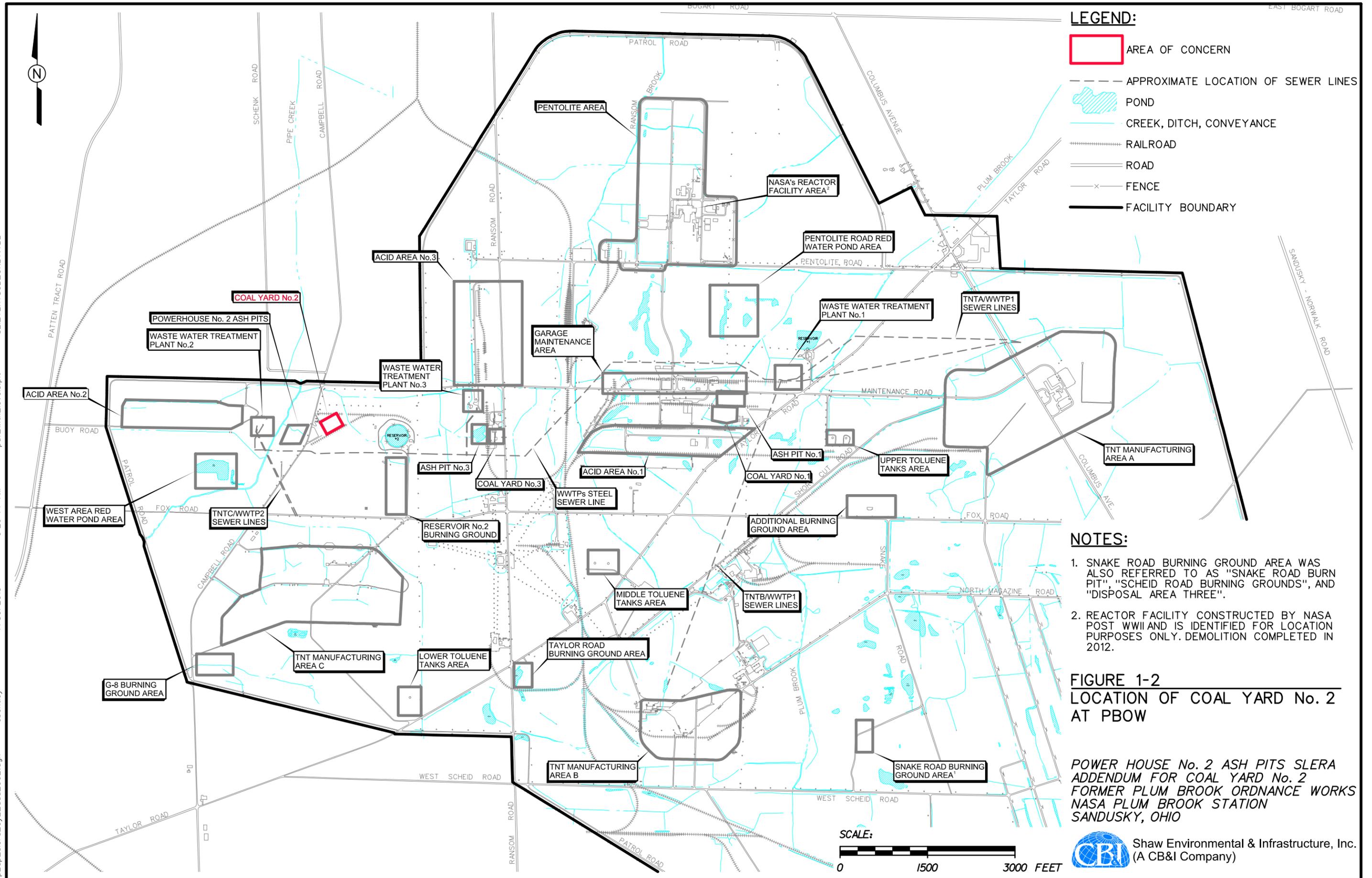
**FIGURE 1-1**  
**PBOW VICINITY MAP**

*POWER HOUSE No. 2 ASH PITS SLERA  
ADDENDUM FOR COAL YARD No. 2  
FORMER PLUM BROOK ORDNANCE WORKS  
NASA PLUM BROOK STATION  
SANDUSKY, OHIO*



Shaw Environmental & Infrastructure, Inc.  
(A CB&I Company)

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**Figure 2-1**

**Photo Log of Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**



Photo 1. Grassy area adjacent to former building pad at Coal Yard No. 2.



Photo 2. Vegetation at a low-lying area at Coal Yard No. 2.

**Figure 2-1**

**Photo Log of Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**



Photo 3. Bare ground at the coal yard following removal of pad.

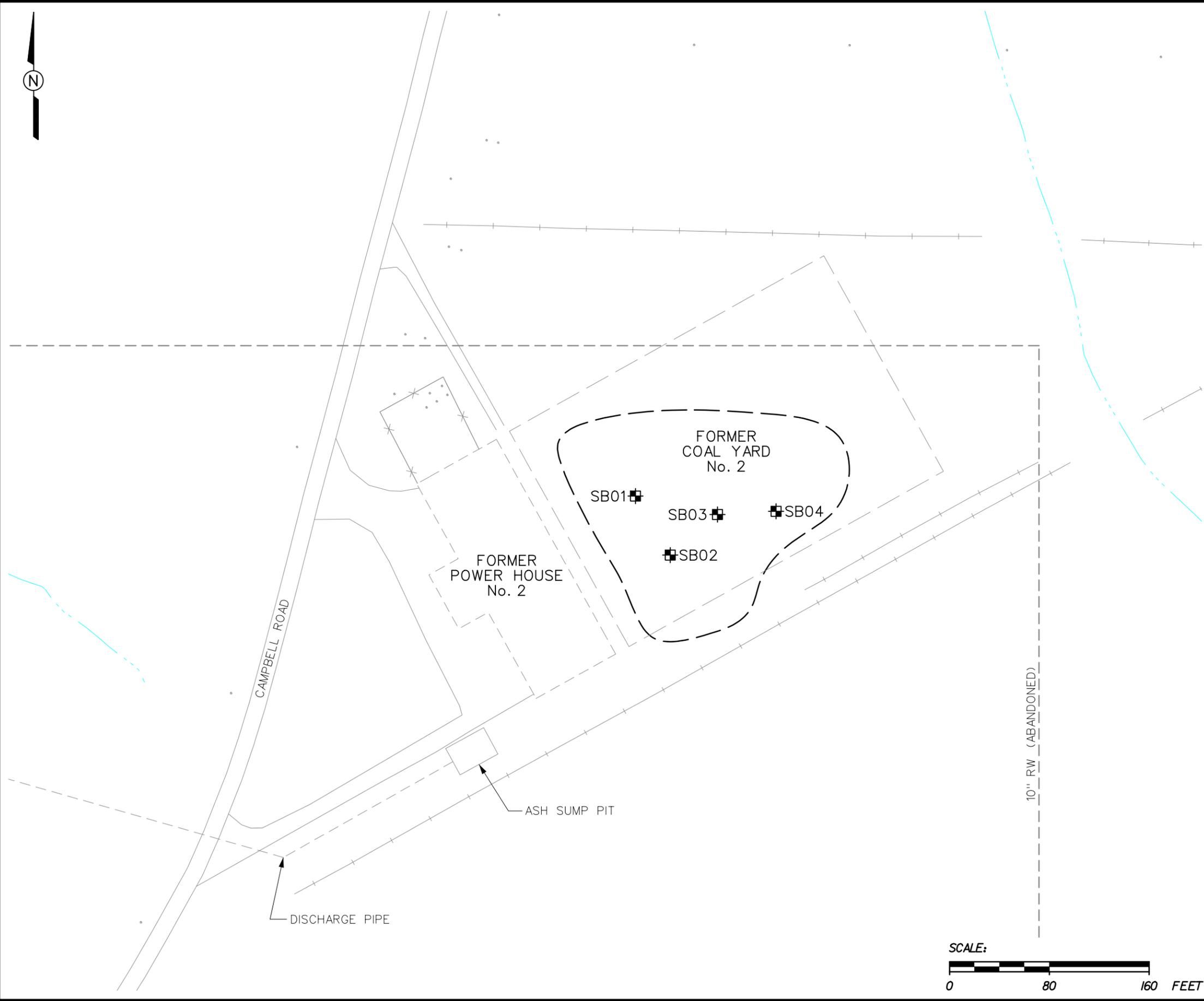


Photo 4. Small piece of coal on the bare ground following removal of pad.

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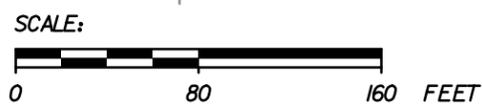


- LEGEND:**
- SOIL BORING
  - UTILITY POLE
  - CREEK, DITCH, CONVEYANCE
  - ABANDONED RAILROAD
  - ROAD
  - APPROXIMATE LOCATION OF FORMER STRUCTURES
  - RAW WATER LINE (RW)
  - APPROXIMATE HISTORICAL COAL STORAGE PERIMETER BASED ON AERIAL PHOTO
  - APPROXIMATE COAL STORAGE PERIMETER BASED ON OCTOBER 2011 FIELD FINDINGS AND EXISTING COAL THICKNESS



**FIGURE 2-2**  
**SAMPLE LOCATIONS AT COAL**  
**YARD No. 2**

*POWER HOUSE No. 2 ASH PITS SLERA  
ADDENDUM FOR COAL YARD No. 2  
FORMER PLUM BROOK ORDNANCE WORKS  
NASA PLUM BROOK STATION  
SANDUSKY, OHIO*



## **APPENDIX A**

### **SOIL DATA USED IN THE SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT**

Table A-1

Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 9)

Location Code		CY2-SB01					CY2-SB01					CY2-SB01					CY2-SB01				
Sample Number		CY0015					CY0016					CY0017					CY0018				
Sample Date		10/27/2011					10/27/2011					10/27/2011					10/27/2011				
Depth		.5 - 1 Ft					.5 - 1 Ft					.5 - 1 Ft					3 - 5 Ft				
Sample Purpose		REG					FD					FS					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
<b>Explosives</b>																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.02	U	U	0.15	0.15	0.061	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.099	U	U	0.15	0.15	0.061	U	U
Dinitrobenzene, 1,3-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.05	U	U	0.15	0.15	0.061	U	U
Dinitrotoluene, 2,4-	mg/kg	0.17	0.17	0.081	U	U	0.18	0.18	0.089	U	U	0.099	0.25	0.02	U	U	0.15	0.15	0.073	U	U
Dinitrotoluene, 2,6-	mg/kg	0.17	0.17	0.073	U	U	0.18	0.18	0.08	U	U	0.099	0.25	0.03	U	U	0.15	0.15	0.066	U	U
HMX	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.03	U	U	0.15	0.15	0.061	U	U
Nitrobenzene	mg/kg	0.17	0.17	0.078	U	U	0.18	0.18	0.085	U	U	0.099	0.25	0.05	U	U	0.15	0.15	0.07	U	U
Nitrotoluene, 2-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.079	U	U	0.15	0.15	0.061	U	U
Nitrotoluene, 3-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.069	U	U	0.15	0.15	0.061	U	U
Nitrotoluene, 4-	mg/kg	0.17	0.17	0.085	U	U	0.18	0.18	0.093	U	U	0.099	0.25	0.079	U	U	0.15	0.15	0.077	U	U
RDX	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.04	U	U	0.15	0.15	0.061	U	U
Tetryl	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.05	U	U	0.15	0.15	0.061	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.02	U	U	0.15	0.15	0.061	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.17	0.17	0.067	U	U	0.18	0.18	0.073	U	U	0.099	0.25	0.02	U	U	0.15	0.15	0.061	U	U
<b>GEN CHEMISTRY</b>																					
% Solids	Percent	84.9	0				83.6	0									80.8	0			
<b>Metals</b>																					
Aluminum	mg/kg	8000	8.1	0.97		J	14500	48	5.7		J	14000	35	8.2			5150	11	1.3		
Antimony	mg/kg	4	4	0.2	U	U	4.8	4.8	0.24	U	U	3.5	3.5	0.9	U	UJ	2.1	2.1	0.11	U	U
Arsenic	mg/kg	10	2	0.2			10	2.4	0.24			12	2.3	0.43			5.8	0.53	0.053		
Barium	mg/kg	49.2	8.1	0.16		J	86.6	48	0.96		J	85	23	0.44			35.2	11	0.21		
Beryllium	mg/kg	0.67	1	0.02	B	J	0.87	1.2	0.024	B	J	0.48	0.58	0.059	J	J	0.36	0.53	0.011	B	J
Cadmium	mg/kg	0.81	0.81	0.02	U	U	0.96	0.96	0.024	U	U	0.063	0.58	0.034	J	J	0.81	0.21	0.0053		
Calcium	mg/kg	3260	1000	10		J	9300	1200	12		J	4700	580	57		J	52500	530	5.3		
Chromium	mg/kg	16.7	2	0.2			19.1	2.4	0.24			19	1.2	0.26			9.8	1.1	0.11		
Cobalt	mg/kg	11.4	10	0.2			10.6	12	0.24	B	J	8.7	1.2	0.13			5.5	2.7	0.053		
Copper	mg/kg	24.6	5	0.2			24.2	6	0.24			24	2.9	0.52			18.8	2.7	0.11		
Iron	mg/kg	28700	61	4.6			27700	72	5.5			31000	58	13	B		17100	32	2.5		
Lead	mg/kg	13.4	0.81	0.04			13	0.96	0.048			14	1.2	0.27			12.8	2.1	0.11		
Magnesium	mg/kg	3000	1000	10			4370	1200	12			4300	580	11	B		15300	530	5.3		
Manganese	mg/kg	249	3	0.2			199	3.6	0.24			200	1.7	0.33		J	454	3.2	0.21		
Mercury	mg/kg	0.038	0.097	0.0069	B	J	0.052	0.096	0.0068	B	J	0.054	0.11	0.016	J B	B	0.019	0.1	0.0073	B	J
Nickel	mg/kg	26.6	8.1	0.2			30	9.6	0.24			25	4.7	0.38			16.1	2.1	0.053		
Potassium	mg/kg	599	2000	10	B	J	815	2400	12	B	J	850	580	31			1020	1100	5.3	B	J
Selenium	mg/kg	1	4	0.4	B	J	4.8	4.8	0.48	U	U	2.3	2.3	0.56	U	U	0.43	2.1	0.21	B	J
Silver	mg/kg	2	2	0.2	U	U	2.4	2.4	0.24	U	U	0.58	0.58	0.17	U	U	0.053	0.53	0.053	B	J
Sodium	mg/kg	2000	2000	170	U	U	2400	2400	200	U	U	580	580	99	U	U	124	1100	91	B	J
Thallium	mg/kg	20	20	6.1	U	U	9.6	9.6	7.2	U	U	3.5	3.5	0.89	U	U	1.1	1.1	0.16	U	U
Vanadium	mg/kg	26.4	10	0.2			28	12	0.24			27	1.2	0.14			11.5	2.7	0.053		
Zinc	mg/kg	64.3	4	0.2			71.3	4.8	0.24			70	5.8	1.7			46	2.1	0.11		

Table A-1

**Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

(Page 2 of 9)

Location Code		CY2-SB01					CY2-SB01					CY2-SB01					CY2-SB01				
Sample Number		CY0015					CY0016					CY0017					CY0018				
Sample Date		10/27/2011					10/27/2011					10/27/2011					10/27/2011				
Depth		.5 - 1 Ft					.5 - 1 Ft					.5 - 1 Ft					3 - 5 Ft				
Sample Purpose		REG					FD					FS					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
<b>PEST/PCB</b>																					
Aroclor 1016	mg/kg											0.079	0.079	0.026	U	U					
Aroclor 1221	mg/kg											0.061	0.061	0.02	U	U					
Aroclor 1232	mg/kg											0.055	0.055	0.017	U	U					
Aroclor 1242	mg/kg											0.049	0.049	0.016	U	U					
Aroclor 1248	mg/kg											0.067	0.067	0.021	U	U					
Aroclor 1254	mg/kg											0.067	0.067	0.021	U	U					
Aroclor 1260	mg/kg											0.067	0.067	0.021	U	U					
<b>Semivolatiles</b>																					
3-Methylphenol and 4-Methylphe	mg/kg	0.2	0.2	0.028	U	U	0.2	0.2	0.029	U	U	0.49	0.49	0.025	U	U	0.2	0.2	0.029	U	U
Acenaphthene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.0082	0.0082	0.0041	U	U	0.2	0.2	0.02	U	U
Acenaphthylene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.013	0.0082	0.0041			0.2	0.2	0.02	U	U
Acetophenone	mg/kg											0.047	0.12	0.011	J	J					
Anthracene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.02	0.0082	0.0041			0.2	0.2	0.02	U	U
Atrazine	mg/kg											0.25	0.25	0.011	U	U					
Benzaldehyde	mg/kg											0.12	0.12	0.015	U	U					
Benzo(a)anthracene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.043	0.0082	0.0041			0.2	0.2	0.02	U	U
Benzo(a)pyrene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.039	0.0082	0.0041			0.2	0.2	0.02	U	U
Benzo(b)fluoranthene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.039	0.0082	0.0041			0.2	0.2	0.02	U	U
Benzo(ghi)perylene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.024	0.0082	0.0041			0.2	0.2	0.02	U	U
Benzo(k)fluoranthene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.018	0.0082	0.0041			0.2	0.2	0.02	U	U
Benzoic acid	mg/kg	0.98	0.98	0.35	U	U	1	1	0.35	U	U						1	1	0.36	U	U
Benzyl alcohol	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U						0.2	0.2	0.041	U	U
Bibenzene	mg/kg											0.034	0.061	0.033	J	J					
Bis(2-chloroethoxy)methane	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.12	0.12	0.027	U	U	0.2	0.2	0.02	U	U
Bis(2-chloroethyl)ether	mg/kg	0.2	0.2	0.02	U	UJ	0.2	0.2	0.02	U	UJ	0.12	0.12	0.0025	U	U	0.2	0.2	0.02	U	UJ
Bis(2-chloroisopropyl)ether	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.12	0.12	0.012	U	U	0.2	0.2	0.02	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.39	0.39	0.079	U	U	0.4	0.4	0.08	U	U	0.061	0.061	0.023	U	U	0.321	0.41	0.081	J	J
Bromophenyl phenyl ether, 4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.016	U	U	0.2	0.2	0.02	U	U
Butyl benzyl phthalate	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.061	0.061	0.012	U	U	0.2	0.2	0.041	U	U
Caprolactam	mg/kg											0.41	0.41	0.045	U	U					
Carbazole	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.02	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.18	0.18	0.026	U	U	0.2	0.2	0.02	U	U
Chloroaniline, 4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.18	0.18	0.021	U	U	0.2	0.2	0.02	U	U
Chloronaphthalene, 2-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.061	0.061	0.0041	U	U	0.2	0.2	0.041	U	U
Chlorophenol, 2-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.02	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.016	U	U	0.2	0.2	0.02	U	U
Chrysene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.055	0.0082	0.0014			0.2	0.2	0.02	U	U
Dibenz(a,h)anthracene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.0082	0.0082	0.0041	U	U	0.2	0.2	0.02	U	U
Dibenzofuran	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.14	0.061	0.0041			0.2	0.2	0.02	U	U
Dichlorobenzene, 1,2-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U						0.2	0.2	0.041	U	U
Dichlorobenzene, 1,3-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U						0.2	0.2	0.041	U	U
Dichlorobenzene, 1,4-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U						0.2	0.2	0.041	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.39	0.39	0.039	U	U	0.4	0.4	0.04	U	U	0.12	0.12	0.022	U	U	0.41	0.41	0.041	U	U

Table A-1

Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio

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Location Code Sample Number Sample Date Depth Sample Purpose		CY2-SB01 CY0015 10/27/2011 .5 - 1 Ft REG					CY2-SB01 CY0016 10/27/2011 .5 - 1 Ft FD					CY2-SB01 CY0017 10/27/2011 .5 - 1 Ft FS					CY2-SB01 CY0018 10/27/2011 3 - 5 Ft REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorophenol, 2,4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.18	0.18	0.025	U	U	0.2	0.2	0.02	U	U
Diethyl phthalate	mg/kg	0.39	0.39	0.079	U	U	0.4	0.4	0.08	U	U	0.061	0.061	0.02	U	U	0.41	0.41	0.081	U	U
Dimethyl phthalate	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.061	0.061	0.021	U	U	0.2	0.2	0.041	U	U
Dimethylphenol, 2,4-	mg/kg	0.2	0.2	0.025	U	U	0.2	0.2	0.025	U	U	0.18	0.18	0.025	U	U	0.2	0.2	0.026	U	U
Di-n-butyl phthalate	mg/kg	0.39	0.39	0.079	U	U	0.4	0.4	0.08	U	U	0.061	0.061	0.018	U	U	0.41	0.41	0.081	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.39	0.39	0.079	U	U	0.4	0.4	0.08	U	U	0.18	0.18	0.098	U	U	0.41	0.41	0.081	U	U
Dinitrophenol, 2,4-	mg/kg	0.98	0.98	0.39	U	U	1	1	0.4	U	U	0.41	0.41	0.098	U	U	1	1	0.41	U	U
Dinitrotoluene, 2,4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.25	0.25	0.033	U	U	0.2	0.2	0.02	U	U
Dinitrotoluene, 2,6-	mg/kg	0.2	0.2	0.023	U	U	0.2	0.2	0.024	U	U	0.25	0.25	0.026	U	U	0.2	0.2	0.024	U	U
Di-n-octyl phthalate	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.041	U	U
Fluoranthene	mg/kg	0.2	0.2	0.02	U	U	0.0293	0.2	0.02	J	J	0.051	0.0082	0.0041			0.2	0.2	0.02	U	U
Fluorene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.018	0.0082	0.0041			0.2	0.2	0.02	U	U
Hexachlorobenzene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.0082	0.0082	0.0026	U	U	0.2	0.2	0.02	U	U
Hexachlorobutadiene	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.041	U	U
Hexachlorocyclopentadiene	mg/kg	0.2	0.2	0.087	U	UJ	0.2	0.2	0.088	U	UJ	0.41	0.41	0.033	U	U	0.2	0.2	0.089	U	UJ
Hexachloroethane	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.061	0.061	0.011	U	U	0.2	0.2	0.041	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.017	0.0082	0.0041			0.2	0.2	0.02	U	U
Isophorone	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.016	U	U	0.2	0.2	0.02	U	U
Methylnaphthalene, 2-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.65	0.0082	0.0041			0.2	0.2	0.02	U	U
Methylphenol, 2-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.25	0.25	0.098	U	U	0.2	0.2	0.02	U	U
Naphthalene	mg/kg	0.2	0.2	0.032	U	U	0.2	0.2	0.032	U	U	0.4	0.0082	0.0041			0.2	0.2	0.032	U	U
Nitroaniline, 2-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.25	0.25	0.011	U	U	0.2	0.2	0.041	U	U
Nitroaniline, 3-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.25	0.25	0.02	U	U	0.2	0.2	0.041	U	U
Nitroaniline, 4-	mg/kg	0.2	0.2	0.039	U	U	0.2	0.2	0.04	U	U	0.25	0.25	0.032	U	U	0.2	0.2	0.041	U	U
Nitrobenzene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.12	0.12	0.0027	U	U	0.2	0.2	0.02	U	U
Nitrophenol, 2-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.02	U	U
Nitrophenol, 4-	mg/kg	0.98	0.98	0.16	U	U	1	1	0.16	U	U	0.41	0.41	0.098	U	U	1	1	0.16	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.02	U	U
n-Nitrosodiphenylamine	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.026	U	U	0.2	0.2	0.02	U	U
Pentachlorophenol	mg/kg	0.98	0.98	0.24	U	U	1	1	0.24	U	U	0.18	0.18	0.098	U	U	1	1	0.24	U	U
Phenanthrene	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.22	0.0082	0.0041			0.2	0.2	0.02	U	U
Phenol	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.061	0.061	0.033	U	U	0.2	0.2	0.02	U	U
Pyrene	mg/kg	0.2	0.2	0.02	U	U	0.0268	0.2	0.02	J	J	0.054	0.0082	0.0041			0.2	0.2	0.02	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U						0.2	0.2	0.02	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.18	0.18	0.031	U	U	0.2	0.2	0.02	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.2	0.2	0.02	U	U	0.2	0.2	0.02	U	U	0.18	0.18	0.098	U	U	0.2	0.2	0.02	U	U

Table A-1

Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio

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Location Code		CY2-SB02					CY2-SB02					CY2-SB03					CY2-SB03				
Sample Number		CY0020					CY0021					CY0025					CY0026				
Sample Date		10/27/2011					10/27/2011					10/26/2011					10/26/2011				
Depth		.5 - 1 Ft					3 - 5 Ft					.5 - 1 Ft					3 - 5 Ft				
Sample Purpose		REG					REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
<b>Explosives</b>																					
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Dinitrobenzene, 1,3-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Dinitrotoluene, 2,4-	mg/kg	0.15	0.15	0.073	U	U	0.15	0.15	0.074	U	U	0.19	0.19	0.09	U	U	0.15	0.15	0.074	U	U
Dinitrotoluene, 2,6-	mg/kg	0.15	0.15	0.065	U	U	0.15	0.15	0.067	U	U	0.19	0.19	0.081	U	U	0.15	0.15	0.066	U	U
HMX	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Nitrobenzene	mg/kg	0.15	0.15	0.07	U	U	0.15	0.15	0.071	U	U	0.19	0.19	0.086	U	U	0.15	0.15	0.071	U	U
Nitrotoluene, 2-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Nitrotoluene, 3-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Nitrotoluene, 4-	mg/kg	0.15	0.15	0.076	U	U	0.15	0.15	0.077	U	U	0.19	0.19	0.094	U	U	0.15	0.15	0.077	U	U
RDX	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Tetryl	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.15	0.15	0.06	U	U	0.15	0.15	0.061	U	U	0.19	0.19	0.074	U	U	0.15	0.15	0.061	U	U
<b>GEN CHEMISTRY</b>																					
% Solids	Percent	86	0				77	0				83.5	0				77.3	0			
<b>Metals</b>																					
Aluminum	mg/kg	7330	7.6	0.91			8500	45	5.4			9880	10	1.2			7300	9.9	1.2		
Antimony	mg/kg	3.8	3.8	0.19	U	U	4.5	4.5	0.22	U	U	5.1	5.1	0.25	U	U	4.9	4.9	0.25	U	U
Arsenic	mg/kg	13.5	1.9	0.19			2.1	0.45	0.045			12.2	2.5	0.25			10.8	2.5	0.25		
Barium	mg/kg	57.3	38	0.76			67.6	45	0.9			68	51	1			63.8	20	0.4		
Beryllium	mg/kg	0.36	0.94	0.019	B	J	0.49	1.1	0.022	B	J	0.48	1.3	0.025	B	J	0.49	0.49	0.0099		
Cadmium	mg/kg	0.76	0.76	0.019	U	U	0.9	0.9	0.022	U	U	1	1	0.025	U	U	0.28	0.99	0.025	B	J
Calcium	mg/kg	1270	940	9.4			34600	1100	11			1740	1300	13			43200	490	4.9		
Chromium	mg/kg	14.9	1.9	0.19			12.9	2.2	0.22			22	2.5	0.25			16.7	2.5	0.25		
Cobalt	mg/kg	4.7	9.4	0.19	B	J	9.6	11	0.22	B	J	6.8	13	0.25	B	J	15.1	12	0.25		
Copper	mg/kg	22.5	4.7	0.19			20.6	5.6	0.22			23.5	6.3	0.25			26.4	6.2	0.25		
Iron	mg/kg	23800	57	4.3			17100	67	5.2			34300	76	5.8			18800	30	2.3		
Lead	mg/kg	11	0.76	0.038			11	0.9	0.045			9.6	1	0.051			15.3	2	0.099		
Magnesium	mg/kg	1810	940	9.4			14600	1100	11			3100	1300	13			14100	490	4.9		
Manganese	mg/kg	81.1	2.8	0.19			492	3.4	0.22			121	3.8	0.25			816	3.7	0.25		
Mercury	mg/kg	0.043	0.094	0.0067	B	J	0.04	0.1	0.0074	B	J	0.035	0.097	0.0069	B	J	0.011	0.11	0.0077	B	J
Nickel	mg/kg	19.2	7.6	0.19			26.8	9	0.22			23.5	10	0.25			40	9.9	0.25		
Potassium	mg/kg	567	1900	9.4	B	J	990	2200	11	B	J	698	2500	13	B	J	1210	990	4.9		
Selenium	mg/kg	0.91	3.8	0.38	B	J	4.5	4.5	0.45	U	U	1.1	5.1	0.51	B	J	4.9	4.9	0.49	U	U
Silver	mg/kg	1.9	1.9	0.19	U	U	0.063	0.45	0.045	B	J	2.5	2.5	0.25	U	U	2.5	2.5	0.25	U	U
Sodium	mg/kg	1900	1900	160	U	U	2200	2200	190	U	U	2500	2500	220	U	U	114	990	84	B	J
Thallium	mg/kg	15	15	5.7	U	U	9	9	6.7	U	U	20	20	7.6	U	U	0.39	0.99	0.15	B	J
Vanadium	mg/kg	24.8	9.4	0.19			17.5	11	0.22			32.4	13	0.25			24.9	12	0.25		
Zinc	mg/kg	50.9	3.8	0.19			52.8	4.5	0.22			57.6	5.1	0.25			63.7	4.9	0.25		

Table A-1

**Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

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Parameter	Units	CY2-SB02 CY0020 10/27/2011 .5 - 1 Ft REG					CY2-SB02 CY0021 10/27/2011 3 - 5 Ft REG					CY2-SB03 CY0025 10/26/2011 .5 - 1 Ft REG					CY2-SB03 CY0026 10/26/2011 3 - 5 Ft REG				
		Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
<b>PEST/PCB</b>																					
Aroclor 1016	mg/kg	0.019	0.019	0.0078	U	U	0.022	0.022	0.0086	U	U	0.02	0.02	0.008	U	U	0.021	0.021	0.0086	U	U
Aroclor 1221	mg/kg	0.019	0.019	0.0097	U	U	0.022	0.022	0.011	U	U	0.02	0.02	0.01	U	U	0.021	0.021	0.011	U	U
Aroclor 1232	mg/kg	0.019	0.019	0.0097	U	U	0.022	0.022	0.011	U	U	0.02	0.02	0.01	U	U	0.021	0.021	0.011	U	U
Aroclor 1242	mg/kg	0.019	0.019	0.0078	U	U	0.022	0.022	0.0086	U	U	0.02	0.02	0.008	U	U	0.021	0.021	0.0086	U	U
Aroclor 1248	mg/kg	0.019	0.019	0.0078	U	U	0.022	0.022	0.0086	U	U	0.02	0.02	0.008	U	U	0.021	0.021	0.0086	U	U
Aroclor 1254	mg/kg	0.019	0.019	0.0078	U	U	0.022	0.022	0.0086	U	U	0.02	0.02	0.008	U	U	0.021	0.021	0.0086	U	U
Aroclor 1260	mg/kg	0.019	0.019	0.0078	U	U	0.022	0.022	0.0086	U	U	0.02	0.02	0.008	U	U	0.021	0.021	0.0086	U	U
<b>Semivolatiles</b>																					
3-Methylphenol and 4-Methylphe	mg/kg	0.19	0.19	0.028	U	U	0.22	0.22	0.031	U	U	0.2	0.2	0.029	U	U	0.21	0.21	0.031	U	U
Acenaphthene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Acenaphthylene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Acetophenone	mg/kg																				
Anthracene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Atrazine	mg/kg																				
Benzaldehyde	mg/kg																				
Benzo(a)anthracene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(a)pyrene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(b)fluoranthene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(ghi)perylene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(k)fluoranthene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzoic acid	mg/kg	0.96	0.96	0.34	U	U	1.1	1.1	0.38	U	U	0.99	0.99	0.35	U	U	1.1	1.1	0.37	U	U
Benzyl alcohol	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Bibenzene	mg/kg																				
Bis(2-chloroethoxy)methane	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Bis(2-chloroethyl)ether	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.39	0.39	0.077	U	U	0.43	0.43	0.086	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.085	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Butyl benzyl phthalate	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Caprolactam	mg/kg																				
Carbazole	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chloroaniline, 4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chloronaphthalene, 2-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Chlorophenol, 2-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chrysene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dibenz(a,h)anthracene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dibenzofuran	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dichlorobenzene, 1,2-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dichlorobenzene, 1,3-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dichlorobenzene, 1,4-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.39	0.39	0.039	U	U	0.43	0.43	0.043	U	U	0.4	0.4	0.04	U	U	0.43	0.43	0.043	U	U

Table A-1

**Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

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Parameter	Units	CY2-SB02 CY0020 10/27/2011 .5 - 1 Ft REG					CY2-SB02 CY0021 10/27/2011 3 - 5 Ft REG					CY2-SB03 CY0025 10/26/2011 .5 - 1 Ft REG					CY2-SB03 CY0026 10/26/2011 3 - 5 Ft REG				
		Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorophenol, 2,4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Diethyl phthalate	mg/kg	0.39	0.39	0.077	U	U	0.43	0.43	0.086	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.085	U	U
Dimethyl phthalate	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dimethylphenol, 2,4-	mg/kg	0.19	0.19	0.024	U	U	0.22	0.22	0.027	U	U	0.2	0.2	0.025	U	U	0.21	0.21	0.027	U	U
Di-n-butyl phthalate	mg/kg	0.39	0.39	0.077	U	U	0.43	0.43	0.086	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.085	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.39	0.39	0.077	U	U	0.43	0.43	0.086	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.085	U	U
Dinitrophenol, 2,4-	mg/kg	0.96	0.96	0.39	U	U	1.1	1.1	0.43	U	U	0.99	0.99	0.4	U	U	1.1	1.1	0.43	U	U
Dinitrotoluene, 2,4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dinitrotoluene, 2,6-	mg/kg	0.19	0.19	0.023	U	U	0.22	0.22	0.025	U	U	0.2	0.2	0.023	U	U	0.21	0.21	0.025	U	U
Di-n-octyl phthalate	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Fluoranthene	mg/kg	0.031	0.19	0.019	J	J	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Fluorene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Hexachlorobenzene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Hexachlorobutadiene	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Hexachlorocyclopentadiene	mg/kg	0.19	0.19	0.085	U	UJ	0.22	0.22	0.095	U	UJ	0.2	0.2	0.087	U	UJ	0.21	0.21	0.094	U	UJ
Hexachloroethane	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Isophorone	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Methylnaphthalene, 2-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Methylphenol, 2-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Naphthalene	mg/kg	0.19	0.19	0.031	U	U	0.22	0.22	0.034	U	U	0.2	0.2	0.032	U	U	0.21	0.21	0.034	U	U
Nitroaniline, 2-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Nitroaniline, 3-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Nitroaniline, 4-	mg/kg	0.19	0.19	0.039	U	U	0.22	0.22	0.043	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Nitrobenzene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Nitrophenol, 2-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Nitrophenol, 4-	mg/kg	0.96	0.96	0.15	U	U	1.1	1.1	0.17	U	U	0.99	0.99	0.16	U	U	1.1	1.1	0.17	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
n-Nitrosodiphenylamine	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Pentachlorophenol	mg/kg	0.96	0.96	0.23	U	U	1.1	1.1	0.26	U	U	0.99	0.99	0.24	U	U	1.1	1.1	0.26	U	U
Phenanthrene	mg/kg	0.0292	0.19	0.019	J	J	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Phenol	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Pyrene	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.19	0.19	0.019	U	U	0.22	0.22	0.022	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U

Table A-1

**Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

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Location Code		CY2-SB04					CY2-SB04				
Sample Number		CY0028					CY0029				
Sample Date		10/26/2011					10/26/2011				
Depth		0 - 1 Ft					3 - 5 Ft				
Sample Purpose		REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
<b>Explosives</b>											
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Dinitrobenzene, 1,3-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Dinitrotoluene, 2,4-	mg/kg	0.16	0.16	0.08	U	U	0.18	0.18	0.089	U	U
Dinitrotoluene, 2,6-	mg/kg	0.16	0.16	0.072	U	U	0.18	0.18	0.08	U	U
HMX	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Nitrobenzene	mg/kg	0.16	0.16	0.077	U	U	0.18	0.18	0.085	U	U
Nitrotoluene, 2-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Nitrotoluene, 3-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Nitrotoluene, 4-	mg/kg	0.16	0.16	0.083	U	U	0.18	0.18	0.093	U	U
RDX	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Tetryl	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.16	0.16	0.066	U	U	0.18	0.18	0.073	U	U
<b>GEN CHEMISTRY</b>											
% Solids	Percent	84.8	0				81.9	0			
<b>Metals</b>											
Aluminum	mg/kg	6650	9.3	1.1			5140	8.5	1		
Antimony	mg/kg	0.25	0.93	0.046	B	J	4.3	4.3	0.21	U	U
Arsenic	mg/kg	6.1	0.46	0.046			11.5	2.1	0.21		
Barium	mg/kg	35.2	9.3	0.19			70.9	43	0.85		
Beryllium	mg/kg	0.27	0.23	0.0046			0.42	1.1	0.021	B	J
Cadmium	mg/kg	0.72	0.19	0.0046			0.24	0.85	0.021	B	J
Calcium	mg/kg	3380	230	2.3			39900	1100	11		
Chromium	mg/kg	10.4	0.46	0.046			11.8	2.1	0.21		
Cobalt	mg/kg	3.5	2.3	0.046			9.9	11	0.21	B	J
Copper	mg/kg	11.2	1.2	0.046			20.9	5.3	0.21		
Iron	mg/kg	16400	14	1.1			20200	64	4.9		
Lead	mg/kg	7.4	0.93	0.046			8.3	0.85	0.043		
Magnesium	mg/kg	2430	230	2.3			16300	1100	11		
Manganese	mg/kg	103	0.7	0.046			672	3.2	0.21		
Mercury	mg/kg	0.034	0.087	0.0062	B	J	0.017	0.09	0.0064	B	J
Nickel	mg/kg	10.7	1.9	0.046			25.7	8.5	0.21		
Potassium	mg/kg	472	460	2.3			848	2100	11	B	J
Selenium	mg/kg	9.3	9.3	4.65	U	U	4.3	4.3	0.43	U	U
Silver	mg/kg	0.088	0.46	0.046	B	J	2.1	2.1	0.21	U	U
Sodium	mg/kg	52.6	460	39	B	J	2100	2100	180	U	U
Thallium	mg/kg	9.2	9.2	7	U	U	8.6	8.6	6.4	U	U
Vanadium	mg/kg	16.1	2.3	0.046			20	11	0.21		
Zinc	mg/kg	24.2	0.93	0.046			50.8	4.3	0.21		

Table A-1

**Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

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Location Code		CY2-SB04					CY2-SB04				
Sample Number		CY0028					CY0029				
Sample Date		10/26/2011					10/26/2011				
Depth		0 - 1 Ft					3 - 5 Ft				
Sample Purpose		REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
<b>PEST/PCB</b>											
Aroclor 1016	mg/kg	0.02	0.02	0.0079	U	U	0.02	0.02	0.0082	U	U
Aroclor 1221	mg/kg	0.02	0.02	0.0099	U	U	0.02	0.02	0.01	U	U
Aroclor 1232	mg/kg	0.02	0.02	0.0099	U	U	0.02	0.02	0.01	U	U
Aroclor 1242	mg/kg	0.02	0.02	0.0079	U	U	0.02	0.02	0.0082	U	U
Aroclor 1248	mg/kg	0.02	0.02	0.0079	U	U	0.02	0.02	0.0082	U	U
Aroclor 1254	mg/kg	0.02	0.02	0.0079	U	U	0.02	0.02	0.0082	U	U
Aroclor 1260	mg/kg	0.02	0.02	0.0079	U	U	0.02	0.02	0.0082	U	U
<b>Semivolatiles</b>											
3-Methylphenol and 4-Methylphe	mg/kg	0.19	0.19	0.028	U	U	0.21	0.21	0.03	U	U
Acenaphthene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Acenaphthylene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Acetophenone	mg/kg										
Anthracene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Atrazine	mg/kg										
Benzaldehyde	mg/kg										
Benzo(a)anthracene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Benzo(a)pyrene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Benzo(b)fluoranthene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Benzo(ghi)perylene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Benzo(k)fluoranthene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Benzoic acid	mg/kg	0.97	0.97	0.34	U	U	1	1	0.36	U	U
Benzyl alcohol	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Bibenzene	mg/kg										
Bis(2-chloroethoxy)methane	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Bis(2-chloroethyl)ether	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.39	0.39	0.078	U	U	0.41	0.41	0.082	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Butyl benzyl phthalate	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Caprolactam	mg/kg										
Carbazole	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Chloroaniline, 4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Chloronaphthalene, 2-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Chlorophenol, 2-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Chrysene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Dibenz(a,h)anthracene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Dibenzofuran	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Dichlorobenzene, 1,2-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Dichlorobenzene, 1,3-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Dichlorobenzene, 1,4-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.39	0.39	0.039	U	U	0.41	0.41	0.041	U	U

Table A-1

Soil Data Used in the Screening-Level Ecological Risk Assessment  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio

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Location Code		CY2-SB04					CY2-SB04				
Sample Number		CY0028					CY0029				
Sample Date		10/26/2011					10/26/2011				
Depth		0 - 1 Ft					3 - 5 Ft				
Sample Purpose		REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Dichlorophenol, 2,4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Diethyl phthalate	mg/kg	0.39	0.39	0.078	U	U	0.41	0.41	0.082	U	U
Dimethyl phthalate	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Dimethylphenol, 2,4-	mg/kg	0.19	0.19	0.025	U	U	0.21	0.21	0.026	U	U
Di-n-butyl phthalate	mg/kg	0.39	0.39	0.078	U	U	0.41	0.41	0.082	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.39	0.39	0.078	U	U	0.41	0.41	0.082	U	U
Dinitrophenol, 2,4-	mg/kg	0.97	0.97	0.39	U	U	1	1	0.41	U	U
Dinitrotoluene, 2,4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Dinitrotoluene, 2,6-	mg/kg	0.19	0.19	0.023	U	U	0.21	0.21	0.024	U	U
Di-n-octyl phthalate	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Fluoranthene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Fluorene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Hexachlorobenzene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Hexachlorobutadiene	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Hexachlorocyclopentadiene	mg/kg	0.19	0.19	0.086	U	U	0.21	0.21	0.09	U	UJ
Hexachloroethane	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Isophorone	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Methylnaphthalene, 2-	mg/kg	0.0429	0.19	0.019	J	J	0.21	0.21	0.021	U	U
Methylphenol, 2-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Naphthalene	mg/kg	0.0321	0.19	0.031	J	J	0.21	0.21	0.033	U	U
Nitroaniline, 2-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Nitroaniline, 3-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Nitroaniline, 4-	mg/kg	0.19	0.19	0.039	U	U	0.21	0.21	0.041	U	U
Nitrobenzene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Nitrophenol, 2-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Nitrophenol, 4-	mg/kg	0.97	0.97	0.16	U	U	1	1	0.16	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
n-Nitrosodiphenylamine	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Pentachlorophenol	mg/kg	0.97	0.97	0.23	U	U	1	1	0.25	U	U
Phenanthrene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Phenol	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Pyrene	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.19	0.19	0.019	U	U	0.21	0.21	0.021	U	U

FD - Field duplicate.  
FS - Field split.  
LQ - Laboratory qualifier.  
MDL - Method detection limit.  
mg/kg - Milligrams per kilogram.

REG - Regular sample.  
RL - Reporting limit.  
VQ - Validation qualifier.  
Gray cells had no data.

**APPENDIX B**

**ECOLOGICAL SCREENING VALUES FOR SOIL**

Table B-1

**Ecological Screening Values for Soil  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

(Page 1 of 4)

Chemical	CAS No.	EPA Eco-SSLs <sup>a</sup> (mg/kg)	Eco Endpoints PRGs <sup>b</sup> (mg/kg)	EPA Region V ESL <sup>c</sup> (mg/kg)	Tox. Benchmark <sup>d</sup> (earthworm only) (mg/kg)	Tox Benchmarks <sup>e</sup> Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
<b>Inorganic Analytes</b>							
Aluminum	7429-90-5	pH Dependent	NSV	NSV	NSV	50	pH Dependent
Antimony	7440-36-0	0.27	5	0.142	NSV	5	0.27
Arsenic	7440-38-2	18	9.9	5.7	60	10	18
Barium	7440-39-3	330	283	1.04	NSV	500	330
Beryllium	7440-41-7	21	10	1.06	NSV	10	21
Cadmium	7440-43-9	0.36	4	0.00222	20	4	0.36
Calcium	7440-70-2	NSV	NSV	NSV	NSV	NSV	Nutrient
Chromium	7440-47-3	26	0.4	0.4	0.4	1	26
Chromium, hexavalent	18540-29-9	81	NSV	NSV	NSV	NSV	81
Cobalt	7440-48-4	13	20	0.14	NSV	20	13
Copper	7440-50-8	28	60	5.4	50	100	28
Iron	7439-89-6	pH Dependent	NSV	NSV	NSV	NSV	pH Dependent
Lead	7439-92-1	11	40.5	0.0537	500	50	11
Magnesium	7439-95-4	NSV	NSV	NSV	NSV	NSV	Nutrient
Manganese	7439-96-5	220	NSV	NSV	NSV	500	220
Mercury	7439-97-6	NSV	0.00051	0.1	0.1	0.3	0.00051
Nickel	7440-02-0	38	30	13.6	200	30	38
Potassium	7440-09-7	NSV	NSV	NSV	NSV	NSV	Nutrient
Selenium	7782-49-2	0.52	0.21	0.0276	70	1	0.52
Silver	7440-22-4	4.2	2	4.04	NSV	2	4.2
Sodium	7440-23-5	NSV	NSV	NSV	NSV	NSV	Nutrient
Thallium	7440-28-0	NSV	1	0.0569	NSV	1	1
Vanadium	7440-62-2	7.8	2	1.59	NSV	2	7.8
Zinc	7440-66-6	46	8.5	6.62	200	50	46
<b>Cyanide</b>							
Cyanide, Total	57-12-5	NSV	NSV	1.33	NSV	NSV	1.33
<b>Polychlorinated Biphenyls</b>							
Aroclor 1016	12674-11-2	NSV	0.371 <sup>f</sup>	0.000332 <sup>f</sup>	NSV	40 <sup>f</sup>	0.371
Aroclor 1221	11104-28-2	NSV	0.371 <sup>f</sup>	0.000332 <sup>f</sup>	NSV	40 <sup>f</sup>	0.371
Aroclor 1232	11141-16-5	NSV	0.371 <sup>f</sup>	0.000332 <sup>f</sup>	NSV	40 <sup>f</sup>	0.371
Aroclor 1242	53469-21-9	NSV	0.371 <sup>f</sup>	0.000332 <sup>f</sup>	NSV	40 <sup>f</sup>	0.371
Aroclor 1254	11097-69-1	NSV	0.371 <sup>f</sup>	0.000332 <sup>f</sup>	NSV	40 <sup>f</sup>	0.371
Aroclor 1260	11096-82-5	NSV	0.371 <sup>f</sup>	0.000332 <sup>f</sup>	NSV	40 <sup>f</sup>	0.371

**Table B-1**  
**Ecological Screening Values for Soil**  
**Coal Yard No. 2**  
**Former Plum Brook Ordnance Works, Sandusky, Ohio**

(Page 2 of 4)

Chemical	CAS No.	EPA Eco-SSLs <sup>a</sup> (mg/kg)	Eco Endpoints PRGs <sup>b</sup> (mg/kg)	EPA Region V ESL <sup>c</sup> (mg/kg)	Tox. Benchmark <sup>d</sup> (earthworm only) (mg/kg)	Tox Benchmarks <sup>e</sup> Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
<b>Organochlorine Pesticides</b>							
4,4'-DDE	72-55-9	0.021 <sup>g</sup>	NSV	0.596	NSV	NSV	0.021
4,4'-DDT	50-29-3	0.021 <sup>g</sup>	NSV	0.0035	NSV	NSV	0.021
Methoxychlor	72-43-5	NSV	NSV	0.0199	NSV	NSV	0.0199
<b>Nitroaromatics</b>							
Amino-2,6-dinitrotoluene, 4-	19406-51-0	NSV	NSV	0.0328 <sup>i</sup>	NSV	NSV	0.0328
Amino-4,6-dinitrotoluene, 2-	35572-78-2	NSV	NSV	0.0328 <sup>i</sup>	NSV	NSV	0.0328
Dinitrobenzene, 1,3-	99-65-0	NSV	NSV	0.655	NSV	NSV	0.655
Dinitrotoluene, 2,4-	121-14-2	NSV	NSV	1.28	NSV	NSV	1.28
Dinitrotoluene, 2,6-	606-20-2	NSV	NSV	0.0328	NSV	NSV	0.0328
RDX	121-82-4	NSV	NSV	NSV	NSV	NSV	NSV
Tetryl	479-45-8	NSV	NSV	NSV	NSV	NSV	NSV
Trinitrobenzene, 1,3,5-	99-35-4	NSV	NSV	0.376	NSV	NSV	0.376
Trinitrotoluene, 2,4,6-	118-96-7	NSV	NSV	NSV	NSV	NSV	NSV
<b>Semivolatile Organic Compounds</b>							
Acenaphthene	83-32-9	29	20	682	NSV	20	29
Acenaphthylene	208-96-8	29	NSV	682	NSV	NSV	29
Anthracene	120-12-7	29	NSV	1480	NSV	NSV	29
Benzo(a)anthracene	56-55-3	1.1	NSV	5.21	NSV	NSV	1.1
Benzo(a)pyrene	50-32-8	1.1	NSV	1.52	NSV	NSV	1.1
Benzo(b)fluoranthene	205-99-2	1.1	NSV	59.8	NSV	NSV	1.1
Benzo(ghi)perylene	191-24-2	1.1	NSV	119	NSV	NSV	1.1
Benzo(k)fluoranthene	207-08-9	1.1	NSV	148	NSV	NSV	1.1
Benzoic acid	65-85-0	NSV	NSV	NSV	NSV	NSV	NSV
bis(2-Ethylhexyl)phthalate	117-81-7	NSV	NSV	0.925	NSV	NSV	0.925
Carbazole	86-74-8	NSV	NSV	NSV	NSV	NSV	NSV
Chrysene	218-01-9	1.1	NSV	4.73	NSV	NSV	1.1
Dibenz(a,h)anthracene	53-73-3	1.1	NSV	18.4	NSV	NSV	1.1
Dibenzofuran	132-64-9	NSV	NSV	NSV	NSV	NSV	NSV
Di-n-butyl phthalate	84-74-2	NSV	200	0.15	NSV	200	200

Table B-1

**Ecological Screening Values for Soil  
Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio**

(Page 3 of 4)

Chemical	CAS No.	EPA Eco-SSLs <sup>a</sup> (mg/kg)	Eco Endpoints PRGs <sup>b</sup> (mg/kg)	EPA Region V ESL <sup>c</sup> (mg/kg)	Tox. Benchmark <sup>d</sup> (earthworm only) (mg/kg)	Tox Benchmarks <sup>e</sup> Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Fluoranthene	206-44-0	1.1	NSV	122	NSV	NSV	1.1
Fluorene	86-73-7	1.1	NSV	122	30	NSV	1.1
Indeno(1,2,3-cd)pyrene	193-39-5	1.1	NSV	109	NSV	NSV	1.1
Methylnaphthalene, 2-	91-57-6	29	NSV	3.24	NSV	NSV	3.24
Naphthalene	91-20-3	29	NSV	0.0994	NSV	NSV	29
Nitroaniline, 3-	99-09-2	NSV	NSV	3.16	NSV	NSV	3.16
Phenanthrene	85-01-8	29	NSV	45.7	NSV	NSV	29
Pyrene	129-00-0	1.1	NSV	78.5	NSV	NSV	1.1
<b>Volatile Organic Compounds</b>							
Acetone	67-64-1	NSV	NSV	2.5	NSV	NSV	2.5
Benzene	71-43-2	NSV	NSV	0.255	NSV	NSV	0.255
Bromomethane	74-83-9	NSV	NSV	0.235	NSV	NSV	0.235
Butanone, 2-	78-93-3	NSV	NSV	89.6	NSV	NSV	89.6
Carbon disulfide	75-15-0	NSV	NSV	0.0941	NSV	NSV	0.0941
Dichloroethane, 1,1-	75-34-3	NSV	NSV	20.1	NSV	NSV	20.1
Dichloroethene, 1,1-	75-35-4	NSV	NSV	8.28	NSV	NSV	8.28
Dichloroethene, cis-1,2-	156-59-2	NSV	NSV	0.784 <sup>h</sup>	NSV	NSV	0.784
Methylene chloride	75-09-2	NSV	NSV	4.05	NSV	NSV	4.05
Toluene	108-88-3	NSV	200	5.45	NSV	200	200
Trichloroethane, 1,1,1-	79-00-5	NSV	NSV	29.8	NSV	NSV	29.8
Trichloroethene	79-01-6	NSV	NSV	12.4	NSV	NSV	12.4
Trimethylbenzene, 1,2,4-	95-63-6	NSV	NSV	NSV	NSV	NSV	NSV
Xylene, Total	1330-20-7	NSV	NSV	10	NSV	NSV	10

**Table B-1**  
**Ecological Screening Values for Soil**  
**Coal Yard No. 2**  
**Former Plum Brook Ordnance Works, Sandusky, Ohio**

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EPA - U.S. Environmental Protection Agency.  
Eco-SSL - Ecological soil screening level.  
ESL - Ecological screening level.  
ESV - Ecological screening value.  
NSV - No screening value available.  
mg/kg - Milligrams per kilogram.

Priority for Selection of ESVs:

- 1) EPA Eco-SSL
- 2) PRG for Eco Endpoints, (Efroymson, et.al, 1997a)
- 3) EPA Region 5 Ecological Screening Levels
- 4) Efroymson, 1997b
- 5) Efroymson, 1997c

<sup>a</sup> EPA, 2008, Ecological Soil Screening Level (SSL) guidance. On-line at: <http://www.epa.gov/ecotox/ecossl/index.html>

<sup>b</sup> Efroymson, 1997a, *Preliminary Remediation Goals for Ecological Endpoints*. [www.esd.ornl.gov/programs/ecorisk/documents/tm162r2.pdf](http://www.esd.ornl.gov/programs/ecorisk/documents/tm162r2.pdf) .

<sup>c</sup> Screening value based on: EPA , 2003, *Region 5 Ecological Screening Level (ESL)*, Website version last updated August 22, 2003: <http://www.epa.gov/Region5/rcraca/edql.htm>.

<sup>d</sup> Efroymson, R.A., M.E. Will, G.W. Suter, 1997b, Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision, ES/ER/TM-126/R2 (microbial screening values are not included). <http://www.esd.ornl.gov/programs/ecorisk/documents/tm126r21.pdf>.

<sup>e</sup> Efroymson, R.A., M.E. Will, G.W. Suter, 1997c, Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision, ES/ER/TM-85/R3. <http://www.esd.ornl.gov/programs/ecorisk/documents/tm85r3.pdf>

<sup>f</sup> Based on the screening value for total PCBs.

<sup>g</sup> Based on the screening value for DDT and metabolites.

<sup>h</sup> Based on the screening value for dichloroethylene [trans-1,2].

<sup>i</sup> Based on the screening value for 2,6-dinitrotoluene.

## **RESPONSE TO COMMENTS**

**Responses to Ohio Environmental Protection Agency Comments on the  
Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment  
for Powerhouse No. 2 Ash Pits Addendum for Coal Yard No. 2  
Former Plum Brook Ordnance Works, Sandusky, Ohio,  
Dated April 11, 2013**

*Comments by Janusz Byczkowski, Risk Assessor, Ohio Environmental Protection Agency, received May 17, 2013.*

*BHHRA Comments*

**Comment 1:**      **Section ES-1, Line 6.** The BHHRA document states:  
“...consistent with methodologies described in the U.S. Environmental Protection Agency’s primary risk assessment guidance documents, the site-specific work plan, and discussions and agreements between the Ohio Environmental Protection Agency, the U.S. Army Corps of Engineers Nashville...”

The issue of determining background and the “agreement” was already discussed in previous reviews. Please note that no legally binding agreement has been made between OEPA and ACE or Shaw Environmental Inc., regarding risk assessment methodology at the NASA Plum Brook Site. Please delete reference to “agreements” with Ohio Environmental Protection Agency.

**Response 1:**      The words “and agreements” will be removed from the indicated text.

*BHHRA and SLERA Comments*

**Comment 2:**      **BHHRA Table 2-4 and SLERA Table 2-2.** From comparison of maximum detected concentrations of cadmium in soil in BHHRA Table 2-4 versus SLERA Table 2-2 (8.90E-01 vs. 8.10E-01 mg/kg, respectively) it is not clear which numerical value is correct.

Please verify and correct maximum detected concentration of cadmium in soil.

**Response 2:**      The BHHRA and SLERA use different soil datasets to select COPCs/COPECs. The cadmium MDC for the BHHRA in Table 2-4 of 0.89 mg/kg was detected in sample CY0019, which was collected from the 8 to 10 feet below ground surface (bgs) interval. Soil at this depth is not included in the SLERA, which only evaluates soil up to 6 feet bgs. Thus, the MDCs in the BHHRA and SLERA are different for chemicals such as cadmium that have higher concentrations in soil samples collected from a depth greater than 6 feet bgs.