



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

October 23, 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 Ash Pit No. 1 Baseline Human Health Risk Assessment and Screening-Level Ecological Risk Assessment Addenda for Coal Yard No. 1 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 Ash Pit No. 1 (AP1) Baseline Human Health Risk Assessment and Screening Level Ecological Risk Assessment for Coal Yard No. 1 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 AP1 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

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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 (electronic only) HTRW Center of Expertise ATTN: CEHNC-CX-EG (Vern StJohn) 1616 Capitol Avenue Omaha, Nebraska 68144-3869	(CD provided)
Mr. John Blakeman (electronic only) 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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Former Plum Brook Ordnance Works, Sandusky, Ohio

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Editor	<u>Donald Groseclose</u>	<u></u>	<u>10-23-13</u>
Peer Review	<u>Tom Siard</u>	<u></u>	<u>10-23-13</u>
Technical Review	<u>Michael Gunderson</u>	<u></u>	<u>10-23-13</u>
Quality Assurance Mgr	<u>Ken Martinez</u>	<u></u>	<u>10-23-13</u>
Project Manager	<u>Steven Downey</u>	<u></u>	<u>10-23-13</u>

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Final

**Ash Pit No. 1
Screening-Level Ecological Risk Assessment Addendum
for Coal Yard No. 1
FUDS Project No. G05OH001821**

**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

API	Ash Pit No. 1
bgs	below ground surface
BSC	background screening concentration
COPEC	chemical of potential ecological concern
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
OEPA	Ohio Environmental Protection Agency
PBOW	Plum Brook Ordnance Works
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

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 Ash Pit No. 1 (AP1) Coal Yard (Coal Yard No. 1) site at Plum Brook Ordnance Works (PBOW) in Sandusky, Ohio. Coal Yard No. 1 is associated with AP1 at PBOW, and this SLERA is an addendum to the AP1 SLERA. 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 small size of the site likely reduces any potential hazard to populations of ecological receptors to negligible levels, even if contamination were found to be present. However, to meet project team goals and agreements, SLERAs are performed at all individual sites at PBOW.

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 the PBOW sites 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.

Cadmium and dibenzofuran were the only two chemicals identified as COPECs following the initial screening step. Cadmium was only detected in three samples at concentrations that marginally exceeded its conservative ecological screening value. The presence of cadmium may be background-related; a concentration gradient indicative of a release was not observed in the data set, and background data for this chemical that would allow a comparison of Coal Yard No. 1 concentrations to naturally occurring concentrations were not available. Dibenzofuran was

detected in a single soil sample at an estimated concentration and was identified as a COPEC due to its lack of a screening value. Because of the low concentrations detected and very limited spatial area potentially affected, neither chemical is expected to be relevant to ecological exposure at the site, and the SLERA for the Coal Yard No. 1 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. 1 is expected to be negligible.

1.0 Introduction

This screening-level ecological risk assessment (SLERA) addendum evaluates the potential for adverse effects posed to ecological receptors from potential releases at the Ash Pit No. 1 (AP1) Coal Yard (Coal Yard No. 1) at the former Plum Brook Ordnance Works (PBOW). Coal Yard No.1 is associated with AP1 at PBOW both spatially and due to shared historical operations; thus, this SLERA is performed as an addendum to the AP1 SLERA, which was submitted as a final report in August 2011 (Shaw Environmental & Infrastructure [Shaw] [a CB&I company], 2011). This addendum evaluates additional soil samples that were collected from the adjacent Coal Yard No. 1 in 2011. The approaches used to evaluate the potential for ecological risk are the same as those described in the AP1 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, 2010a), with some adjustments to accommodate current practices in the field of ecological risk assessment. It is noted that the small size of the site likely reduces any potential hazard to populations of ecological receptors to negligible levels, even if contamination were found to be present. However, to meet project team goals and agreements, SLERAs are performed at all individual sites at PBOW.

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 were initially transferred to the Ordnance Department, then to the War Assets Administration after being 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., 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 Coal Yard No. 1 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 locations of the three coal yards on PBOW property.

Former Coal Yard No. 1 is located immediately to the west of Powerhouse No. 1. The historical former coal yard is estimated to have been approximately 350 feet wide by 210 feet in length (approximately 1.7 acres). Half of the Powerhouse No. 1 building was demolished and the other half was remodeled and is currently being used as a storage/shop building and power supply hub station by NASA. The former coal yard is currently covered with grass and brush vegetation. A thin layer of coal was observed on the ground surface in isolated areas and along the northern perimeter 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. 1. 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. 1. 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

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. 1 is in such close proximity to AP1, a formal ecological reconnaissance was not performed for Coal Yard No. 1. Rather, the habitat description, sensitive ecological resources, and faunal assemblages (including potential threatened and endangered species) described in the AP1 SLERA (Shaw, 2011) were determined to also be relevant for the Coal Yard No. 1 site. Also, a trained ecologist visited Coal Yard No. 1 in September 2011 to make

general observations of site conditions. Photographs taken during this visit 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 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, 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. 1 is located immediately adjacent to Powerhouse No. 1. Figure 1-2 shows the specific site location and general site features. 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 Ash Pit 1 Site Characterization Report (Shaw, 2010b). Descriptions of the ecological resources in the vicinity of the Coal Yard No. 1, including common flora and fauna species in the area, threatened or endangered species, and local habitats, are included in the AP1 SLERA (Shaw, 2011).

The Coal Yard No. 1 area is primarily covered by herbaceous and shrubby vegetation, with early successional forest present near the perimeter of the site (see Photos 1 through 3, Figure 2-1). Small pieces of coal were observed in the soil (see Photo 4, Figure 2-1). The former Coal Yard No. 1 area has minimal relief, and no water bodies are present at the site.

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. 1 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. 1 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 listed 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.

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 (UCL) of the mean are usually estimated for COPECs. As described in Section 2.2.4, 95 percent UCLs were not calculated for Coal Yard No. 1. 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 Sections 2.2.3.1 through 2.2.3.4.

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 Guidance Bulletin No. 1* (EPA, 1996). Chemicals that exceeded 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. 1 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 the PBOW sites is based on PBOW Project Delivery Team (PDT) agreements (PBOW Project Delivery Team, 2000) and differs somewhat from the current OEPA (2009) guidance. Use of this PBOW PDT method for the development of BSCs and as part of the COPEC screening process ensures consistency between all of the PBOW FUDS project 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 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. 1 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 two chemicals identified as COPECs, as further explained in the following paragraphs. Footnotes in the table provide the rationale for selecting or rejecting a chemical as a COPEC.

Cadmium and dibenzofuran were the only two chemicals identified as COPECs in soil (Table 2-2). Cadmium was detected in six out of eight samples at concentrations ranging from 0.15 to 0.8 milligrams per kilogram (mg/kg). Concentrations from three samples (CY0005 = 0.52 mg/kg, CY0013 = 0.57 mg/kg, and CY0012 = 0.8 mg/kg) exceeded 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) approximated the detected concentrations at Coal Yard No. 1. 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 spatial area where cadmium was present at concentrations above the ESV, 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.

Dibenzofuran was detected in only one out of eight soil samples (sample CY0005) at a concentration of 0.103 mg/kg. The result for this sample was “J-flagged” because the detected concentration was below the sample reporting limit of 0.84 mg/kg. Dibenzofuran was selected as a COPEC because it lacked an ESV. Therefore, there is no evidence that dibenzofuran is toxic at the detected concentration. Dibenzofuran is a component of coal tar, which is made into creosote, which is widely used as a wood preservative (HSDB, 2013). Thus, its presence may be related to the former coal yard operations, or may simply be associated with typical infrastructure, materials, and processes at the NASA facility. Regardless, its presence in a single sample at a concentration below reporting limits suggests that this chemical is present neither as the result of a site-related release nor at sufficiently high concentrations to warrant concern for ecological receptors. The fact that the sample where dibenzofuran was detected (CY0005) was collected from the 3 to 5 feet bgs soil sampling interval further reduces concern for ecological exposure, as soil 3 feet below the surface is unlikely to be regularly encountered by most environmental receptors. Therefore, dibenzofuran 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. 1, 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

Chemicals detected in soil were screened against conservative benchmark values and other criteria to identify COPECs at Coal Yard No. 1. 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 and dibenzofuran were the only chemicals in soil that were identified as COPECs. Cadmium was detected in three samples at concentrations that marginally exceeded its ESV, and the area where the slightly elevated cadmium was detected was very limited in spatial size. Cadmium lacked a BSC because it was not detected in the PBOW background samples, but the reporting limits for this metal in the background data set approximate the concentrations that were detected at Coal Yard No.1. Therefore, it was judged that the presence of cadmium is either naturally occurring, inconsequential from an ecological standpoint, or both. Dibenzofuran was retained as a COPEC initially because no ESV was available for it. However, this chemical was detected in only a single sample at an estimated (“J-qualified”) concentration below its reporting limit. Also, the sample where this chemical was detected was obtained from a depth of 3 feet bgs, which is below the surface soil zone where ecological exposure would be expected to be the highest. Because of the low concentrations and limited spatial area where these two chemicals were detected, the potential for adverse effects to local populations to occur as the result of exposure to them was judged to be extremely low. Therefore, no further investigation of cadmium or dibenzofuran is considered necessary for the purposes of environmental protection, and the potential for ecological hazard associated with exposure to these two chemicals is considered negligible.

4.0 References

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TABLES

Table 2-1

**Summary of Soil Samples Evaluated in the Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio**

Sample Location	Sample Number	Sample Purpose	Sample Date	Depth of Sample (ft bgs)	Analysis
Surface Soil					
CY1-SB01	CY0001	REG	12/20/2011	0.5 - 1.5	Explosives, Metals, PCB, SVOC
CY1-SB02	CY0004	REG	12/20/2011	0.3 - 1.3	Explosives, Metals, PCB, SVOC
CY1-SB03	CY0007	REG	12/20/2011	0.5 - 1.5	Explosives, Metals, PCB, SVOC
CY1-SB04	CY0012	REG	12/20/2011	1 - 2	Explosives, Metals, PCB, SVOC
CY1-SB01	CY0002	REG	12/20/2011	3 - 5	Explosives, Metals, PCB, SVOC
CY1-SB02	CY0005	REG	12/20/2011	3 - 5	Explosives, Metals, PCB, SVOC
CY1-SB03	CY0008	REG	12/20/2011	3 - 5	Explosives, Metals, PCB, SVOC
CY1-SB03	CY0009	FD	12/20/2011	3 - 5	Explosives, Metals, PCB, SVOC
CY1-SB04	CY0013	REG	12/20/2011	3 - 5	Explosives, Metals, PCB, SVOC

FD - Field duplicate; averaged with regular sample.

ft bgs - Feet below ground surface.

PCB - Polychlorinated biphenyls.

REG - Regular sample.

SVOC - Semivolatile organic compounds.

Table 2-2

**Statistical Summary and Selection of Chemicals of Potential Ecological Concern in Soil (0 to 6 feet bgs)
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio**

Chemical	Detection Frequency	Percent Detection	Range of Values, mg/kg				Mean mg/kg	BSC ^a mg/kg	ESV ^b (mg/kg)	COPEC? ^{c,d}
			Detected Concentrations		Method Detection Limit					
			Minimum	VQ Maximum	VQ Minimum	Maximum				
Inorganics										
Aluminum	8 / 8	100	2.03E+03	1.23E+04	8.20E-01	2.10E+00	6.80E+03	1.55E+04	pH Dependent	N (b)
Antimony	5 / 8	63	1.20E-01	J 2.30E-01	J 4.10E-02	1.09E-01	1.32E-01	9.30E+00	0.27	N (b)
Arsenic	8 / 8	100	3.10E+00	3.46E+01	4.10E-02	1.09E-01	1.28E+01	3.65E+01	18	N (b)
Barium	8 / 8	100	1.85E+01	8.22E+01	4.10E-02	1.09E-01	4.70E+01	8.26E+02	330	N (b)
Beryllium	8 / 8	100	6.10E-02	J 6.50E-01	4.10E-03	1.09E-02	3.74E-01	1.00E+00	21	N (b)
Cadmium	6 / 8	75	1.50E-01	J 8.00E-01	4.10E-03	1.09E-02	3.22E-01	NA	0.36	Y
Calcium	8 / 8	100	4.47E+02	1.98E+04	J 2.00E+00	5.30E+00	4.63E+03	5.23E+04	Nutrient	N (c)
Chromium	8 / 8	100	3.90E+00	1.90E+01	4.10E-02	1.09E-01	1.14E+01	2.90E+01	26	N (b)
Cobalt	8 / 8	100	7.90E-01	J 1.49E+01	4.10E-02	1.09E-01	6.61E+00	1.16E+02	13	N (b)
Copper	8 / 8	100	3.30E+00	2.58E+01	4.10E-02	1.09E-01	1.40E+01	5.62E+01	28	N (b)
Iron	8 / 8	100	7.84E+03	3.17E+04	1.40E+00	3.65E+00	1.74E+04	2.34E+05	pH Dependent	N (b)
Lead	8 / 8	100	4.80E+00	2.98E+01	4.10E-02	6.80E-02	1.11E+01	4.86E+01	11	N (b)
Magnesium	8 / 8	100	2.74E+02	8.22E+03	J 2.00E+00	5.30E+00	2.46E+03	1.04E+04	Nutrient	N (c)
Manganese	8 / 8	100	2.37E+01	3.46E+02	J 4.10E-02	1.09E-01	1.78E+02	3.51E+03	220	N (b)
Mercury	8 / 8	100	1.30E-02	J 4.90E-02	J 6.60E-03	7.40E-03	2.74E-02	8.50E-02	0.00051	N (b)
Nickel	8 / 8	100	2.30E+00	3.81E+01	4.10E-02	1.09E-01	1.61E+01	5.51E+01	38	N (b)
Potassium	8 / 8	100	2.02E+02	J 1.30E+03	2.00E+00	5.30E+00	6.61E+02	3.39E+03	Nutrient	N (c)
Silver	1 / 8	13	7.40E-02	J 7.40E-02	J 4.10E-02	1.09E-01	6.94E-02	1.11E+01	4.2	N (b)
Sodium	4 / 8	50	8.95E+01	J 1.11E+02	J 3.10E+01	8.00E+01	8.10E+01	NA	Nutrient	N (c)
Thallium	3 / 8	38	2.34E-01	J 6.40E-01	J 4.10E-02	6.80E-02	1.90E-01	1.30E+00	1	N (b)
Vanadium	8 / 8	100	8.00E+00	2.61E+01	4.10E-02	1.09E-01	1.87E+01	4.09E+01	7.8	N (b)
Zinc	8 / 8	100	9.40E+00	1.57E+02	4.10E-02	1.09E-01	4.82E+01	3.22E+02	46	N (b)
Semivolatile Organic Compounds										
Dibenzofuran	1 / 8	13	1.03E-01	J 1.03E-01	J 2.00E-02	8.40E-02	3.13E-02	NSV	Y	
Fluoranthene	2 / 8	25	3.13E-02	J 1.38E-01	J 2.00E-02	8.40E-02	3.67E-02	1.1	N (a)	
Fluorene	1 / 8	13	1.05E-01	J 1.05E-01	J 2.00E-02	8.40E-02	3.15E-02	1.1	N (a)	
Methylnaphthalene, 2-	2 / 8	25	2.64E-02	J 3.34E-02	J 2.00E-02	8.40E-02	3.10E-02	3.24	N (a)	
Naphthalene	1 / 8	13	1.83E-01	J 1.83E-01	J 3.20E-02	1.30E-01	6.40E-02	29	N (a)	
Phenanthrene	1 / 8	13	2.55E-02	J 2.55E-02	J 2.00E-02	8.40E-02	2.92E-02	29	N (a)	
Pyrene	2 / 8	25	3.09E-02	J 1.24E-01	J 2.00E-02	8.40E-02	3.49E-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.

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

^b ESVs and their sources are in Appendix B.

^c 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.

FIGURES

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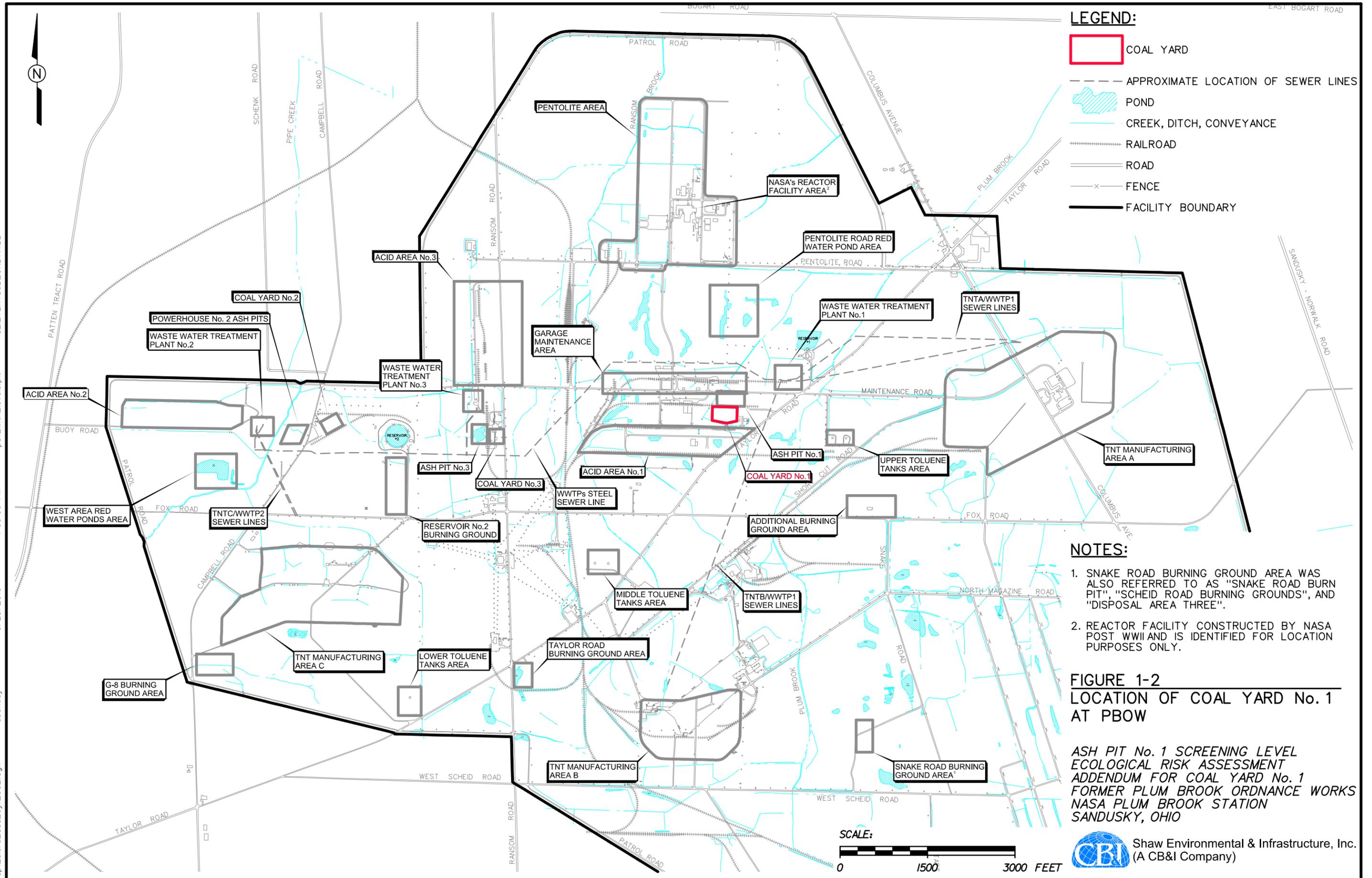
FIGURE 1-1
PBOW VICINITY MAP

ASH PIT No. 1 SCREENING LEVEL
ECOLOGICAL RISK ASSESSMENT
ADDENDUM FOR COAL YARD No. 1
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO



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

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LEGEND:

- COAL YARD
- APPROXIMATE LOCATION OF SEWER LINES
- POND
- CREEK, DITCH, CONVEYANCE
- RAILROAD
- ROAD
- x- FENCE
- FACILITY BOUNDARY

NOTES:

1. SNAKE ROAD BURNING GROUND AREA WAS ALSO REFERRED TO AS "SNAKE ROAD BURN PIT", "SCHEID ROAD BURNING GROUNDS", AND "DISPOSAL AREA THREE".
2. REACTOR FACILITY CONSTRUCTED BY NASA POST WWII AND IS IDENTIFIED FOR LOCATION PURPOSES ONLY.

**FIGURE 1-2
LOCATION OF COAL YARD No. 1
AT PBOW**

*ASH PIT No. 1 SCREENING LEVEL
 ECOLOGICAL RISK ASSESSMENT
 ADDENDUM FOR COAL YARD No. 1
 FORMER PLUM BROOK ORDNANCE WORKS
 NASA PLUM BROOK STATION
 SANDUSKY, OHIO*

Figure 2-1

Photographic Log of Coal Yard No. 1 Former Plum Brook Ordnance Works, Sandusky, Ohio



Photo 1. Grassy habitat at Coal Yard No. 1.



Photo 2. Grass and shrub habitat at Coal Yard No. 1.

Figure 2-1

Photographic Log of Coal Yard No. 1 Former Plum Brook Ordnance Works, Sandusky, Ohio

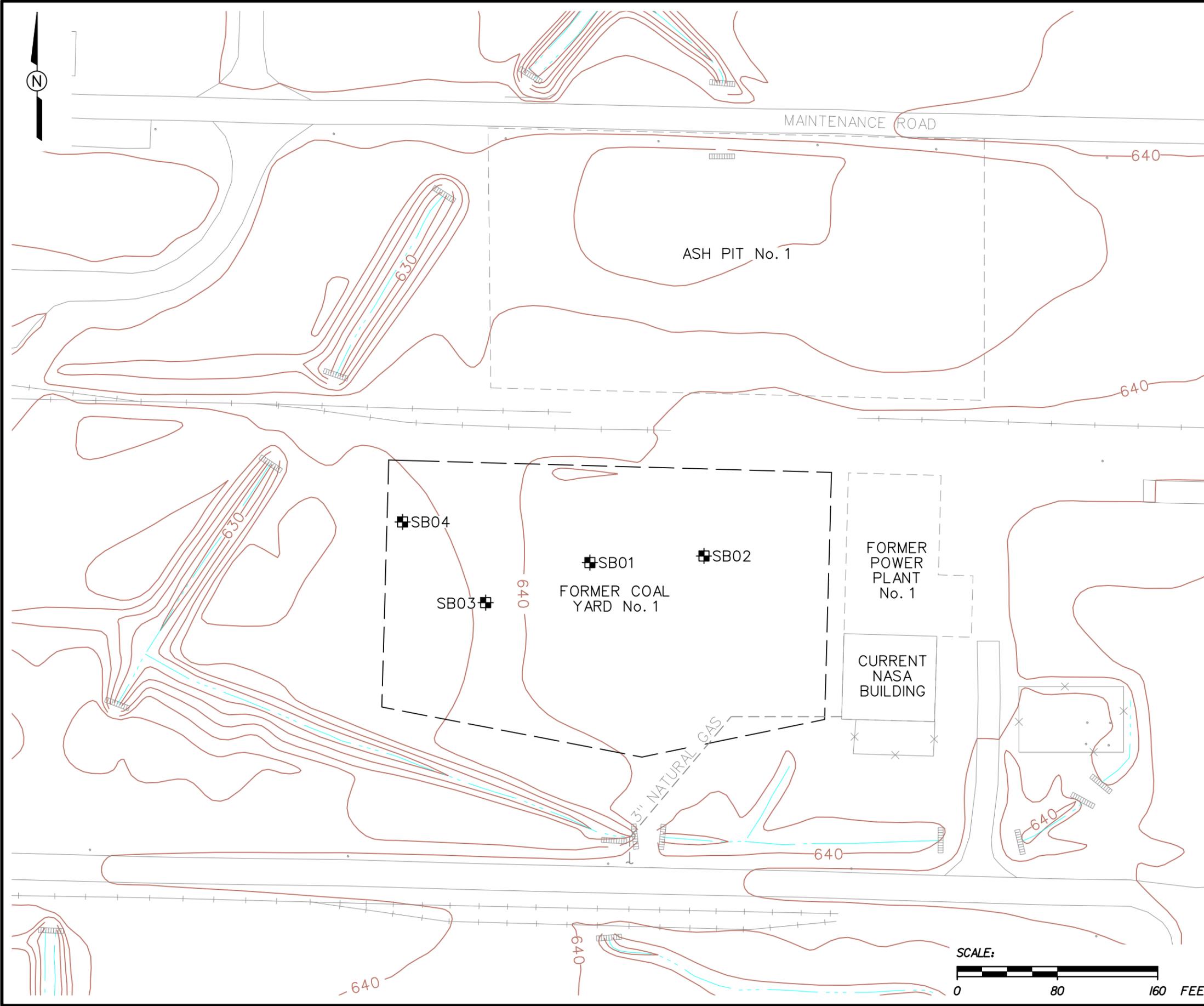


Photo 3. Herbaceous vegetation at Coal Yard No. 1.



Photo 4. Bare ground with small pieces of coal at Coal Yard No. 1.

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- LEGEND:**
- SOIL BORING
 - UTILITY POLE
 - CREEK, DITCH, CONVEYANCE
 - FORMER RAILROAD
 - ROAD
 - - - UNDERGROUND UTILITIES
 - - - APPROXIMATE HISTORICAL COAL STORAGE PERIMETER BASED ON AERIAL PHOTO
 - 640- TOPOGRAPHIC CONTOUR (2 FT. INTEVAL)

FIGURE 2-2
SAMPLE LOCATIONS AT COAL YARD No. 1

ASH PIT No. 1 SCREENING LEVEL
ECOLOGICAL RISK ASSESSMENT
ADDENDUM FOR COAL YARD No. 1
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO



APPENDIX A

SOIL DATA USED IN THE SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT

Appendix A

Soil Data Used in the Screening-Level Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 6)

LOCATION CODE		CY1-SB01					CY1-SB01					CY1-SB02				
SAMPLE_NO		CY0001					CY0002					CY0004				
SAMPLE_DATE		12/20/2011					12/20/2011					12/20/2011				
DEPTH		0.5 - 1.5 Ft					3 - 5 Ft					0.3 - 1.3 Ft				
SAMPLE_PURPOSE		REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Explosives																
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Dinitrobenzene, 1,3-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Dinitrotoluene, 2,4-	mg/kg	0.19	0.19	0.093	U	U	0.15	0.15	0.075	U	U	0.16	0.16	0.079	U	U
Dinitrotoluene, 2,6-	mg/kg	0.19	0.19	0.084	U	U	0.15	0.15	0.067	U	U	0.16	0.16	0.071	U	U
HMX	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Nitrobenzene	mg/kg	0.19	0.19	0.089	U	U	0.15	0.15	0.072	U	U	0.16	0.16	0.076	U	U
Nitrotoluene, 2-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Nitrotoluene, 3-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Nitrotoluene, 4-	mg/kg	0.19	0.19	0.097	U	U	0.15	0.15	0.078	U	U	0.16	0.16	0.082	U	U
RDX	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Tetryl	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.19	0.19	0.077	U	U	0.15	0.15	0.062	U	U	0.16	0.16	0.065	U	U
General Chemistry																
% Solids	Percent	83.3	0				78.7	0				83.1	0			
Total organic carbon	Percent	0.27	0.2	0.2												
Metals																
Aluminum	mg/kg	4660	11	1.1			10100	21	2.1			2030	8.2	0.82		
Antimony	mg/kg	0.12	1.1	0.053	B	J	2.1	2.1	0.1	U	U	0.14	0.82	0.041	B	J
Arsenic	mg/kg	3.1	0.53	0.053			7.9	1	0.1			34.6	0.41	0.041		
Barium	mg/kg	18.5	11	0.053			73.8	21	0.1			23.9	8.2	0.041		
Beryllium	mg/kg	0.24	0.27	0.0053	B	J	0.52	0.52	0.01			0.061	0.2	0.0041	B	J
Cadmium	mg/kg	0.21	0.21	0.0053	U	U	0.15	0.41	0.01	B	J	0.16	0.16	0.0041	U	U
Calcium	mg/kg	727	270	2.7			5470	520	5.2			447	200	2		
Chromium	mg/kg	7.8	0.53	0.053			15.4	1	0.1			3.9	0.41	0.041		
Cobalt	mg/kg	3.1	2.7	0.053			8.3	5.2	0.1			0.79	2	0.041	B	J
Copper	mg/kg	6	1.3	0.053			19.4	2.6	0.1			3.3	1	0.041		
Iron	mg/kg	8320	16	1.8			18800	31	3.5			7840	12	1.4		
Lead	mg/kg	4.8	1.1	0.053			10.7	1	0.052			5.5	0.82	0.041		
Magnesium	mg/kg	614	270	2.7			3710	520	5.2			274	200	2		
Manganese	mg/kg	30.6	0.8	0.053			316	1.5	0.1			23.7	0.61	0.041		
Mercury	mg/kg	0.013	0.092	0.0066	B	J	0.021	0.098	0.0069	B	J	0.022	0.096	0.0068	B	J
Nickel	mg/kg	7.8	2.1	0.053			23.1	4.1	0.1			2.3	1.6	0.041		
Potassium	mg/kg	212	530	2.7	B	J	744	1000	5.2	B	J	202	410	2	B	J
Selenium	mg/kg	1.1	1.1	0.11	U	U	2.1	2.1	0.21	U	U	0.82	0.82	0.082	U	U
Silver	mg/kg	0.53	0.53	0.053	U	U	1	1	0.1	U	U	0.41	0.41	0.041	U	U
Sodium	mg/kg	530	530	40	U	U	1000	1000	77	U	U	111	410	31	B	J
Thallium	mg/kg	0.53	0.53	0.053	U	U	0.52	0.52	0.052	U	U	0.41	0.41	0.041	U	U
Vanadium	mg/kg	15.4	2.7	0.053			25.2	5.2	0.1			8	2	0.041		
Zinc	mg/kg	21.3	1.1	0.053			43.9	2.1	0.1			9.4	0.82	0.041		
PCBs																
Aroclor 1016	mg/kg	0.02	0.02	0.0079	U	U	0.021	0.021	0.0084	U	U	0.02	0.02	0.008	U	U
Aroclor 1221	mg/kg	0.02	0.02	0.0098	U	U	0.021	0.021	0.011	U	U	0.02	0.02	0.01	U	U
Aroclor 1232	mg/kg	0.02	0.02	0.0098	U	U	0.021	0.021	0.011	U	U	0.02	0.02	0.01	U	U
Aroclor 1242	mg/kg	0.02	0.02	0.0079	U	U	0.021	0.021	0.0084	U	U	0.02	0.02	0.008	U	U
Aroclor 1248	mg/kg	0.02	0.02	0.0079	U	U	0.021	0.021	0.0084	U	U	0.02	0.02	0.008	U	U
Aroclor 1254	mg/kg	0.02	0.02	0.0079	U	U	0.021	0.021	0.0084	U	U	0.02	0.02	0.008	U	U
Aroclor 1260	mg/kg	0.02	0.02	0.0079	U	U	0.021	0.021	0.0084	U	U	0.02	0.02	0.008	U	U
Semivolatiles																
3-Methylphenol and 4-Methylphenol	mg/kg	0.2	0.2	0.029	U	U	0.21	0.21	0.031	U	U	0.2	0.2	0.029	U	U
Acenaphthene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Acenaphthylene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Anthracene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Benzo(a)anthracene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Benzo(a)pyrene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Benzo(b)fluoranthene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Benzo(ghi)perylene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Benzo(k)fluoranthene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Benzoic acid	mg/kg	1	1	0.35	U	U	1.1	1.1	0.38	U	U	1	1	0.36	U	U
Benzyl alcohol	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Bis(2-chloroethyl)ether	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.4	0.4	0.08	U	U	0.43	0.43	0.086	U	U	0.41	0.41	0.081	U	U

Appendix A

Soil Data Used in the Screening-Level Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

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LOCATION CODE		CY1-SB01 CY0001 12/20/2011 0.5 - 1.5 Ft					CY1-SB01 CY0002 12/20/2011 3 - 5 Ft					CY1-SB02 CY0004 12/20/2011 0.3 - 1.3 Ft				
SAMPLE_NO	SAMPLE_DATE	REG														
DEPTH	SAMPLE_PURPOSE	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Parameter	Units	REG														
Bromophenyl phenyl ether, 4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Butyl benzyl phthalate	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Carbazole	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Chloroaniline, 4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Chloronaphthalene, 2-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Chlorophenol, 2-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Chrysene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Dibenz(a,h)anthracene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Dibenzofuran	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Dichlorobenzene, 1,2-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Dichlorobenzene, 1,3-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Dichlorobenzene, 1,4-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.4	0.4	0.04	U	U	0.43	0.43	0.043	U	U	0.41	0.41	0.041	U	U
Dichlorophenol, 2,4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Diethyl phthalate	mg/kg	0.4	0.4	0.08	U	U	0.43	0.43	0.086	U	U	0.41	0.41	0.081	U	U
Dimethyl phthalate	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Dimethylphenol, 2,4-	mg/kg	0.2	0.2	0.025	U	U	0.21	0.21	0.027	U	U	0.2	0.2	0.026	U	U
Di-n-butyl phthalate	mg/kg	0.4	0.4	0.08	U	U	0.43	0.43	0.086	U	U	0.41	0.41	0.081	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.4	0.4	0.08	U	U	0.43	0.43	0.086	U	U	0.41	0.41	0.081	U	U
Dinitrophenol, 2,4-	mg/kg	1	1	0.4	U	U	1.1	1.1	0.43	U	U	1	1	0.41	U	U
Dinitrotoluene, 2,4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Dinitrotoluene, 2,6-	mg/kg	0.2	0.2	0.024	U	U	0.21	0.21	0.025	U	U	0.2	0.2	0.024	U	U
Di-n-octyl phthalate	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Fluoranthene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Fluorene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Hexachlorobenzene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Hexachlorobutadiene	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Hexachlorocyclopentadiene	mg/kg	0.2	0.2	0.088	U	U	0.21	0.21	0.094	U	U	0.2	0.2	0.089	U	U
Hexachloroethane	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	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	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Isophorone	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Methylnaphthalene, 2-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Methylphenol, 2-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Naphthalene	mg/kg	0.2	0.2	0.032	U	U	0.21	0.21	0.034	U	U	0.2	0.2	0.032	U	U
Nitroaniline, 2-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Nitroaniline, 3-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Nitroaniline, 4-	mg/kg	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U	0.2	0.2	0.041	U	U
Nitrobenzene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Nitrophenol, 2-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Nitrophenol, 4-	mg/kg	1	1	0.16	U	U	1.1	1.1	0.17	U	U	1	1	0.16	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
n-Nitrosodiphenylamine	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Pentachlorophenol	mg/kg	1	1	0.24	U	U	1.1	1.1	0.26	U	U	1	1	0.24	U	U
Phenanthrene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Phenol	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Pyrene	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U	0.2	0.2	0.02	U	U

Appendix A

Soil Data Used in the Screening-Level Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

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LOCATION CODE		CY1-SB02					CY1-SB03					CY1-SB03				
SAMPLE_NO		CY0005					CY0007					CY0008				
SAMPLE_DATE		12/20/2011					12/20/2011					12/20/2011				
DEPTH		3 - 5 Ft					0.5 - 1.5 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		REG					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Explosives																
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Dinitrobenzene, 1,3-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Dinitrotoluene, 2,4-	mg/kg	0.16	0.16	0.076	U	U	0.17	0.17	0.084	U	U	0.17	0.17	0.083	U	U
Dinitrotoluene, 2,6-	mg/kg	0.16	0.16	0.068	U	U	0.17	0.17	0.076	U	U	0.17	0.17	0.075	U	U
HMX	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Nitrobenzene	mg/kg	0.16	0.16	0.073	U	U	0.17	0.17	0.081	U	U	0.17	0.17	0.08	U	U
Nitrotoluene, 2-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Nitrotoluene, 3-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Nitrotoluene, 4-	mg/kg	0.16	0.16	0.079	U	U	0.17	0.17	0.088	U	U	0.17	0.17	0.087	U	U
RDX	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Tetryl	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.16	0.16	0.063	U	U	0.17	0.17	0.07	U	U	0.17	0.17	0.069	U	U
General Chemistry																
% Solids	Percent	79.7	0				82.9	0				78.2	0			
Total organic carbon	Percent															
Metals																
Aluminum	mg/kg	6020	12	1.2			5020	12	1.2			11400	19	1.9		
Antimony	mg/kg	0.23	1.2	0.062	B	J	1.2	1.2	0.06	U	U	1.9	1.9	0.097	U	U
Arsenic	mg/kg	3.8	0.62	0.062			9	0.6	0.06			12.5	0.97	0.097		
Barium	mg/kg	44	12	0.062			31.6	12	0.06			84.6	19	0.097		
Beryllium	mg/kg	0.5	0.31	0.0062			0.32	0.3	0.006			0.63	0.48	0.0097		
Cadmium	mg/kg	0.52	0.25	0.0062			0.17	0.24	0.006	B	J	0.33	0.39	0.0097	B	J
Calcium	mg/kg	4140	310	3.1			2340	300	3			3110	480	4.8		
Chromium	mg/kg	10.7	0.62	0.062			8.7	0.6	0.06			17.8	0.97	0.097		
Cobalt	mg/kg	9.5	3.1	0.062			3.3	3	0.06			14.1	4.8	0.097		
Copper	mg/kg	18.3	1.6	0.062			7.5	1.5	0.06			24.8	2.4	0.097		
Iron	mg/kg	17300	19	2.1			12700	18	2.1			26000	29	3.3		
Lead	mg/kg	29.8	1.2	0.062			7.2	1.2	0.06			12.8	0.97	0.048		
Magnesium	mg/kg	1180	310	3.1			1090	300	3			3950	480	4.8		
Manganese	mg/kg	188	0.93	0.062			148	0.9	0.06			230	1.5	0.097	B	J
Mercury	mg/kg	0.037	0.1	0.0074	B	J	0.034	0.094	0.0067	B	J	0.02	0.1	0.0073	B	J
Nickel	mg/kg	13.6	2.5	0.062			9.4	2.4	0.06			37.2	3.9	0.097		
Potassium	mg/kg	435	620	3.1	B	J	400	600	3	B	J	1390	970	4.8		
Selenium	mg/kg	1.2	1.2	0.12	U	U	1.2	1.2	0.12	U	U	1.9	1.9	0.19	U	U
Silver	mg/kg	0.62	0.62	0.062	U	U	0.6	0.6	0.06	U	U	0.97	0.97	0.097	U	U
Sodium	mg/kg	620	620	47	U	U	111	600	45	B	J	970	970	73	U	U
Thallium	mg/kg	0.62	0.62	0.062	U	U	0.6	0.6	0.06	U	U	0.41	0.48	0.048	B	J
Vanadium	mg/kg	18.1	3.1	0.062			16.6	3	0.06			23.2	4.8	0.097		
Zinc	mg/kg	157	1.2	0.062			21.1	1.2	0.06			57	1.9	0.097		
PCBs																
Aroclor 1016	mg/kg	0.021	0.021	0.0082	U	U	0.02	0.02	0.0079	U	U	0.021	0.021	0.0085	U	U
Aroclor 1221	mg/kg	0.021	0.021	0.01	U	U	0.02	0.02	0.0099	U	U	0.021	0.021	0.011	U	U
Aroclor 1232	mg/kg	0.021	0.021	0.01	U	U	0.02	0.02	0.0099	U	U	0.021	0.021	0.011	U	U
Aroclor 1242	mg/kg	0.021	0.021	0.0082	U	U	0.02	0.02	0.0079	U	U	0.021	0.021	0.0085	U	U
Aroclor 1248	mg/kg	0.021	0.021	0.0082	U	U	0.02	0.02	0.0079	U	U	0.021	0.021	0.0085	U	U
Aroclor 1254	mg/kg	0.021	0.021	0.0082	U	U	0.02	0.02	0.0079	U	U	0.021	0.021	0.0085	U	U
Aroclor 1260	mg/kg	0.021	0.021	0.0082	U	U	0.02	0.02	0.0079	U	U	0.021	0.021	0.0085	U	U
Semivolatiles																
3-Methylphenol and 4-Methylphenol	mg/kg	0.84	0.84	0.12	U	U	0.2	0.2	0.028	U	U	0.21	0.21	0.031	U	U
Acenaphthene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Acenaphthylene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Anthracene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(a)anthracene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(a)pyrene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(b)fluoranthene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(ghi)perylene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzo(k)fluoranthene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Benzoic acid	mg/kg	4.2	4.2	1.5	U	U	0.99	0.99	0.35	U	U	1.1	1.1	0.38	U	U
Benzyl alcohol	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Bis(2-chloroethyl)ether	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	1.7	1.7	0.34	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.086	U	U

Appendix A

Soil Data Used in the Screening-Level Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

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LOCATION CODE		CY1-SB02 CY0005 12/20/2011 3 - 5 Ft					CY1-SB03 CY0007 12/20/2011 0.5 - 1.5 Ft					CY1-SB03 CY0008 12/20/2011 3 - 5 Ft				
SAMPLE_NO	SAMPLE_DATE	REG														
DEPTH	SAMPLE_PURPOSE	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Parameter	Units	REG														
Bromophenyl phenyl ether, 4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Butyl benzyl phthalate	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Carbazole	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chloroaniline, 4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chloronaphthalene, 2-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Chlorophenol, 2-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Chrysene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dibenz(a,h)anthracene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dibenzofuran	mg/kg	0.103	0.84	0.084	J	J	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dichlorobenzene, 1,2-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dichlorobenzene, 1,3-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dichlorobenzene, 1,4-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dichlorobenzidine, 3,3'-	mg/kg	1.7	1.7	0.17	U	U	0.4	0.4	0.04	U	U	0.43	0.43	0.043	U	U
Dichlorophenol, 2,4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Diethyl phthalate	mg/kg	1.7	1.7	0.34	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.086	U	U
Dimethyl phthalate	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Dimethylphenol, 2,4-	mg/kg	0.84	0.84	0.11	U	U	0.2	0.2	0.025	U	U	0.21	0.21	0.027	U	U
Di-n-butyl phthalate	mg/kg	1.7	1.7	0.34	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.086	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	1.7	1.7	0.34	U	U	0.4	0.4	0.079	U	U	0.43	0.43	0.086	U	U
Dinitrophenol, 2,4-	mg/kg	4.2	4.2	1.7	U	U	0.99	0.99	0.4	U	U	1.1	1.1	0.43	U	U
Dinitrotoluene, 2,4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Dinitrotoluene, 2,6-	mg/kg	0.84	0.84	0.099	U	U	0.2	0.2	0.023	U	U	0.21	0.21	0.025	U	U
Di-n-octyl phthalate	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Fluoranthene	mg/kg	0.138	0.84	0.084	J	J	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Fluorene	mg/kg	0.105	0.84	0.084	J	J	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Hexachlorobenzene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Hexachlorobutadiene	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Hexachlorocyclopentadiene	mg/kg	0.84	0.84	0.37	U	U	0.2	0.2	0.087	U	U	0.21	0.21	0.094	U	U
Hexachloroethane	mg/kg	0.84	0.84	0.17	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	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Isophorone	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Methylnaphthalene, 2-	mg/kg	0.84	0.84	0.084	U	U	0.0264	0.2	0.02	J	J	0.21	0.21	0.021	U	U
Methylphenol, 2-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Naphthalene	mg/kg	0.84	0.84	0.13	U	U	0.2	0.2	0.032	U	U	0.21	0.21	0.034	U	U
Nitroaniline, 2-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Nitroaniline, 3-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Nitroaniline, 4-	mg/kg	0.84	0.84	0.17	U	U	0.2	0.2	0.04	U	U	0.21	0.21	0.043	U	U
Nitrobenzene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Nitrophenol, 2-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Nitrophenol, 4-	mg/kg	4.2	4.2	0.67	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	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
n-Nitrosodiphenylamine	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Pentachlorophenol	mg/kg	4.2	4.2	1	U	U	0.99	0.99	0.24	U	U	1.1	1.1	0.26	U	U
Phenanthrene	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Phenol	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Pyrene	mg/kg	0.124	0.84	0.084	J	J	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.84	0.84	0.084	U	U	0.2	0.2	0.02	U	U	0.21	0.21	0.021	U	U

Appendix A

Soil Data Used in the Screening-Level Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

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LOCATION CODE		CY1-SB03					CY1-SB04					CY1-SB04				
SAMPLE_NO		CY0009					CY0012					CY0013				
SAMPLE_DATE		12/20/2011					12/20/2011					12/20/2011				
DEPTH		3 - 5 Ft					1 - 2 Ft					3 - 5 Ft				
SAMPLE_PURPOSE		FD					REG					REG				
Parameter	Units	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Explosives																
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Dinitrobenzene, 1,3-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Dinitrotoluene, 2,4-	mg/kg	0.2	0.2	0.096	U	U	0.15	0.15	0.071	U	U	0.15	0.15	0.071	U	U
Dinitrotoluene, 2,6-	mg/kg	0.2	0.2	0.086	U	U	0.15	0.15	0.063	U	U	0.15	0.15	0.064	U	U
HMX	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Nitrobenzene	mg/kg	0.2	0.2	0.092	U	U	0.15	0.15	0.068	U	U	0.15	0.15	0.068	U	U
Nitrotoluene, 2-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Nitrotoluene, 3-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Nitrotoluene, 4-	mg/kg	0.2	0.2	0.1	U	U	0.15	0.15	0.073	U	U	0.15	0.15	0.074	U	U
RDX	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Tetryl	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.2	0.2	0.079	U	U	0.15	0.15	0.058	U	U	0.15	0.15	0.059	U	U
General Chemistry																
% Solids	Percent	78.9	0				74	0				76.5	0			
Total organic carbon	Percent															
Metals																
Aluminum	mg/kg	13100	23	2.3			5480	14	1.4			8830	11	1.1		J
Antimony	mg/kg	2.3	2.3	0.12	U	U	0.17	1.4	0.068	B	J	0.13	1.1	0.057	B	J
Arsenic	mg/kg	10.1	1.2	0.12			24.6	0.68	0.068			8.4	0.57	0.057		J
Barium	mg/kg	79.8	23	0.12			46.5	14	0.068			55.1	11	0.057		J
Beryllium	mg/kg	0.67	0.58	0.012			0.26	0.34	0.0068	B	J	0.44	0.29	0.0057		J
Cadmium	mg/kg	0.38	0.47	0.012	B	J	0.8	0.27	0.0068			0.57	0.23	0.0057		J
Calcium	mg/kg	2910	580	5.8			1090	340	3.4			19800	290	2.9		J
Chromium	mg/kg	20.1	1.2	0.12			13	0.68	0.068			13	0.57	0.057		J
Cobalt	mg/kg	15.7	5.8	0.12			3.3	3.4	0.068	B	J	9.7	2.9	0.057		J
Copper	mg/kg	26.7	2.9	0.12			12	1.7	0.068			19.9	1.4	0.057		J
Iron	mg/kg	20700	35	4			31700	20	2.3			19100	17	1.9		J
Lead	mg/kg	10.6	1.2	0.058			7.6	1.4	0.068			11.4	1.1	0.057		J
Magnesium	mg/kg	3710	580	5.8			748	340	3.4			8220	290	2.9		J
Manganese	mg/kg	461	1.7	0.12		J	93.6	1	0.068			279	0.86	0.057		J
Mercury	mg/kg	0.031	0.11	0.0075	B	J	0.049	0.098	0.007	B	J	0.018	0.1	0.0073	B	J
Nickel	mg/kg	39	4.7	0.12			9.8	2.7	0.068			24.7	2.3	0.057		J
Potassium	mg/kg	1210	1200	5.8			716	680	3.4			1280	570	2.9		J
Selenium	mg/kg	2.3	2.3	0.23	U	U	1.4	1.4	0.14	U	U	1.1	1.1	0.11	U	UJ
Silver	mg/kg	1.2	1.2	0.12	U	U	0.074	0.68	0.068	B	J	0.57	0.57	0.057	U	UJ
Sodium	mg/kg	1200	1200	87	U	U	89.5	680	51	B	J	92.3	570	43	B	J
Thallium	mg/kg	0.58	0.58	0.058	U	U	0.64	0.68	0.068	B	J	0.38	0.57	0.057	B	J
Vanadium	mg/kg	28.9	5.8	0.12			22.8	3.4	0.068			17.1	2.9	0.057		J
Zinc	mg/kg	62.9	2.3	0.12			27.9	1.4	0.068			44.7	1.1	0.057		J
PCBs																
Aroclor 1016	mg/kg	0.021	0.021	0.0084	U	U	0.022	0.022	0.009	U	U	0.021	0.021	0.0086	U	U
Aroclor 1221	mg/kg	0.021	0.021	0.01	U	U	0.022	0.022	0.011	U	U	0.021	0.021	0.011	U	U
Aroclor 1232	mg/kg	0.021	0.021	0.01	U	U	0.022	0.022	0.011	U	U	0.021	0.021	0.011	U	U
Aroclor 1242	mg/kg	0.021	0.021	0.0084	U	U	0.022	0.022	0.009	U	U	0.021	0.021	0.0086	U	U
Aroclor 1248	mg/kg	0.021	0.021	0.0084	U	U	0.022	0.022	0.009	U	U	0.021	0.021	0.0086	U	U
Aroclor 1254	mg/kg	0.021	0.021	0.0084	U	U	0.022	0.022	0.009	U	U	0.021	0.021	0.0086	U	U
Aroclor 1260	mg/kg	0.021	0.021	0.0084	U	U	0.022	0.022	0.009	U	U	0.021	0.021	0.0086	U	U
Semivolatiles																
3-Methylphenol and 4-Methylphenol	mg/kg	0.21	0.21	0.031	U	U	0.23	0.23	0.033	U	U	0.22	0.22	0.031	U	U
Acenaphthene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Acenaphthylene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Anthracene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Benzo(a)anthracene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Benzo(a)pyrene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Benzo(b)fluoranthene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Benzo(ghi)perylene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Benzo(k)fluoranthene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Benzoic acid	mg/kg	1.1	1.1	0.37	U	U	1.1	1.1	0.4	U	U	1.1	1.1	0.38	U	U
Benzyl alcohol	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Bis(2-chloroethoxy)methane	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Bis(2-chloroethyl)ether	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.43	0.43	0.085	U	U	0.46	0.46	0.092	U	U	0.44	0.44	0.087	U	U

Appendix A

Soil Data Used in the Screening-Level Ecological Risk Assessment
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 6 of 6)

Parameter	Units	CY1-SB03 CY0009 12/20/2011 3 - 5 Ft					CY1-SB04 CY0012 12/20/2011 1 - 2 Ft					CY1-SB04 CY0013 12/20/2011 3 - 5 Ft				
		Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ	Result	RL	MDL	LQ	VQ
Bromophenyl phenyl ether, 4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Butyl benzy phthalate	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Carbazole	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Chloroaniline, 4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Chloronaphthalene, 2-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Chlorophenol, 2-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Chrysene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Dibenz(a,h)anthracene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Dibenzofuran	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Dichlorobenzene, 1,2-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Dichlorobenzene, 1,3-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Dichlorobenzene, 1,4-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.43	0.43	0.043	U	U	0.46	0.46	0.046	U	U	0.44	0.44	0.044	U	U
Dichlorophenol, 2,4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Diethyl phthalate	mg/kg	0.43	0.43	0.085	U	U	0.46	0.46	0.092	U	U	0.44	0.44	0.087	U	U
Dimethyl phthalate	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Dimethylphenol, 2,4-	mg/kg	0.21	0.21	0.027	U	U	0.23	0.23	0.029	U	U	0.22	0.22	0.027	U	U
Di-n-butyl phthalate	mg/kg	0.43	0.43	0.085	U	U	0.46	0.46	0.092	U	U	0.44	0.44	0.087	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.43	0.43	0.085	U	U	0.46	0.46	0.092	U	U	0.44	0.44	0.087	U	U
Dinitrophenol, 2,4-	mg/kg	1.1	1.1	0.43	U	U	1.1	1.1	0.46	U	U	1.1	1.1	0.44	U	U
Dinitrotoluene, 2,4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Dinitrotoluene, 2,6-	mg/kg	0.21	0.21	0.025	U	U	0.23	0.23	0.027	U	U	0.22	0.22	0.026	U	U
Di-n-octyl phthalate	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Fluoranthene	mg/kg	0.21	0.21	0.021	U	U	0.0313	0.23	0.023	J	J	0.22	0.22	0.022	U	U
Fluorene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Hexachlorobenzene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Hexachlorobutadiene	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Hexachlorocyclopentadiene	mg/kg	0.21	0.21	0.094	U	U	0.23	0.23	0.1	U	U	0.22	0.22	0.096	U	U
Hexachloroethane	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Isophorone	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Methylnaphthalene, 2-	mg/kg	0.21	0.21	0.021	U	U	0.0334	0.23	0.023	J	J	0.22	0.22	0.022	U	U
Methylphenol, 2-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Naphthalene	mg/kg	0.21	0.21	0.034	U	U	0.183	0.23	0.037	J	J	0.22	0.22	0.035	U	U
Nitroaniline, 2-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Nitroaniline, 3-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Nitroaniline, 4-	mg/kg	0.21	0.21	0.043	U	U	0.23	0.23	0.046	U	U	0.22	0.22	0.044	U	U
Nitrobenzene	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Nitrophenol, 2-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Nitrophenol, 4-	mg/kg	1.1	1.1	0.17	U	U	1.1	1.1	0.18	U	U	1.1	1.1	0.17	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
n-Nitrosodiphenylamine	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Pentachlorophenol	mg/kg	1.1	1.1	0.26	U	U	1.1	1.1	0.27	U	U	1.1	1.1	0.26	U	U
Phenanthrene	mg/kg	0.21	0.21	0.021	U	U	0.0255	0.23	0.023	J	J	0.22	0.22	0.022	U	U
Phenol	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Pyrene	mg/kg	0.21	0.21	0.021	U	U	0.0309	0.23	0.023	J	J	0.22	0.22	0.022	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.21	0.21	0.021	U	U	0.23	0.23	0.023	U	U	0.22	0.22	0.022	U	U

FD - Field duplicate.
LQ - Laboratory qualifier.
MDL - Method detection limit.
mg/kg - Milligrams per kilogram.
REG - Regular sample.
RL - Reporting limit.
VQ - Validation qualifier.

APPENDIX B

ECOLOGICAL SCREENING VALUES FOR SOIL

Appendix B

Ecological Screening Values for Soil Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 1 of 3)

Chemical	CAS No.	EPA Eco-SSLs ^a (mg/kg)	Eco Endpoints PRGs ^b (mg/kg)	EPA Region V ESL ^c (mg/kg)	Tox. Benchmark ^d (earthworm only) (mg/kg)	Tox Benchmarks ^e Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Inorganic Analytes							
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
Cyanide							
Cyanide, Total	57-12-5	NSV	NSV	1.33	NSV	NSV	1.33
Polychlorinated Biphenyls							
Aroclor 1016	12674-11-2	NSV	0.371 ^f	0.000332 ^f	NSV	40 ^f	0.371
Aroclor 1221	11104-28-2	NSV	0.371 ^f	0.000332 ^f	NSV	40 ^f	0.371
Aroclor 1232	11141-16-5	NSV	0.371 ^f	0.000332 ^f	NSV	40 ^f	0.371
Aroclor 1242	53469-21-9	NSV	0.371 ^f	0.000332 ^f	NSV	40 ^f	0.371
Aroclor 1254	11097-69-1	NSV	0.371 ^f	0.000332 ^f	NSV	40 ^f	0.371
Aroclor 1260	11096-82-5	NSV	0.371 ^f	0.000332 ^f	NSV	40 ^f	0.371

Appendix B

Ecological Screening Values for Soil Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 2 of 3)

Chemical	CAS No.	EPA Eco-SSLs ^a (mg/kg)	Eco Endpoints PRGs ^b (mg/kg)	EPA Region V ESL ^c (mg/kg)	Tox. Benchmark ^d (earthworm only) (mg/kg)	Tox Benchmarks ^e Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
Organochlorine Pesticides							
4,4'-DDE	72-55-9	0.021 ^g	NSV	0.596	NSV	NSV	0.021
4,4'-DDT	50-29-3	0.021 ^g	NSV	0.0035	NSV	NSV	0.021
Methoxychlor	72-43-5	NSV	NSV	0.0199	NSV	NSV	0.0199
Nitroaromatics							
Amino-2,6-dinitrotoluene, 4-	19406-51-0	NSV	NSV	0.0328 ⁱ	NSV	NSV	0.0328
Amino-4,6-dinitrotoluene, 2-	35572-78-2	NSV	NSV	0.0328 ⁱ	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
Semivolatile Organic Compounds							
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
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
Volatile Organic Compounds							

Appendix B

Ecological Screening Values for Soil Former Plum Brook Ordnance Works, Sandusky, Ohio

(Page 3 of 3)

Chemical	CAS No.	EPA Eco-SSLs ^a (mg/kg)	Eco Endpoints PRGs ^b (mg/kg)	EPA Region V ESL ^c (mg/kg)	Tox. Benchmark ^d (earthworm only) (mg/kg)	Tox Benchmarks ^e Terrestrial Plants (mg/kg)	Selected ESV (mg/kg)
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 ^h	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

EPA - U.S. Environmental Protection Agency.

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

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

^b Efroymson, 1997a, *Preliminary Remediation Goals for Ecological Endpoints*. www.esd.ornl.gov/programs/ecorisk/documents/tm162r2.pdf.

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

^d 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>.

^e 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>

^f Based on the screening value for total PCBs.

^g Based on the screening value for DDT and metabolites.

^h Based on the screening value for dichloroethylene [trans-1,2].

ⁱ Based on the screening value for 2,6-dinitrotoluene.

RESPONSE TO COMMENTS

**Responses to Ohio Environmental Protection Agency Comments on the
Draft Baseline Human Health Risk Assessment and Screening-Level Ecological Risk
Assessment for Ash Pit No. 1 Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio,
Dated May 7, 2013**

Comments by Janusz Byczkowski, Risk Assessor, Ohio Environmental Protection Agency, received June 27, 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 Section 2.2, P. 2-1, L#22, Tabl. 2-3 and SLERA Section 2.2.1, P. 2-3, L#25, Tabl 2-2. The BHHRA document states: “...surface soil is defined as samples collected within the interval of 0 to 1 foot below ground surface...”. The SLERA document states “...For ecological impact, soil from 0 to 6 feet below ground surface (bgs) was used...”. Yet in both, BHHRA Table 2-3 and SLERA Table 2-2, concentrations are listed as “in Surface Soil”.

Using different intervals bgs under the same term “Surface Soil” may be confusing and deserves an explanation at the footnote of each table presenting the soil data. The exact depth of samples is further complicated by statement in BHHRA page 2-1: “...surface soil samples were collected immediately below a layer of fill rock that was used as the base for coal storage; this layer was found to be 0.3 to 1 foot thick...”

Response 2: The title of Table 2-2 in the SLERA will be changed to “Statistical Summary and Selection of Chemicals of Potential Concern in Surface Soil (0 to 6 feet bgs)”.