Final

Ash Pit No. 1 and Ash Pit No. 3
Site Characterization Report Addendum for
Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

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List of Acronyms

bgs	below ground surface
BHRRA	baseline human health risk assessment
BSC	background screening concentration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DNT	dinitrotoluene
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
IDW	investigation-derived waste
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
NASA	National Aeronautics and Space Administration
PBOW	Plum Brook Ordnance Works
PBS	Plum Brook Station
PCB	polychlorinated biphenyl
PETN	pentolite
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RBSC	risk-based screening concentration
SCR	site characterization report
Shaw	Shaw Environmental and Infrastructure, Inc.
SLERA	screening level ecological risk assessment
SWSAP	site-wide sampling and analysis plan
SWSHP	site-wide safety and health plan
SVOC	semivolatile organic compound
TAL	target analyte list
TNT	trinitrotoluene
TNTA	TNT Area A
TNTB	TNT Area B
TNTC	TNT Area C
USACE	U.S. Army Corps of Engineers

Executive Summary

The U.S. Army Corps of Engineers is investigating the former Plum Brook Ordnance Works (PBOW) in Sandusky, Erie County, Ohio, under the Defense Environmental Restoration Program's Formerly Used Defense Sites authorization and funding. The PBOW site was used for the manufacture of explosives during World War II. The former PBOW site is currently operated and maintained by the National Aeronautics and Space Administration as Plum Brook Station, an active testing and research installation associated with the John H. Glenn Research Center of Cleveland, Ohio. The U.S. Army Corps of Engineers contracted Shaw Environmental and Infrastructure, Inc. (Shaw) to conduct an addendum to the existing Ash Pit No. 1 and Ash Pit No. 3 site characterization report (SCR) documenting soil conditions of the Ash Pit No. 1 associated coal yard (Coal Yard No. 1). The specific investigation site is located immediately adjacent to (west) of Powerhouse No. 1, which is located in the central portion of PBOW.

During PBOW explosives manufacturing operations from 1941 to 1945, three power stations, Powerhouse No. 1, Powerhouse No. 2, and Powerhouse No. 3, were present to support the nitroaromatic manufacturing process. Each power station consisted of a main powerhouse, a coal storage area (coal yard), and two aboveground fuel storage tanks. 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. The coal yards were used as storage areas to provide coal for use in the powerhouse boilers. The coal was brought into the yards via train. All stockpiled coal has been removed, but the removal date is not known. Chemical contamination (increase of inorganic compounds) of the soil resulting from the leaching of precipitation through the coal stored in Coal Yard No. 1 is expected to consist primarily of semivolatile organic compounds (SVOC) and target analyte list (TAL) metals or inorganic compounds, although nitroaromatics and volatile organic compounds could be possible.

The SCR for Ash Pit No. 1 and Ash Pit No. 3 was submitted as a final report in November 2010. This addendum details remedial investigation activities for Coal Yard No. 1 and includes soil sample collection, analytical results, and recommendations. This document is one of two planned reports. The remaining report will consist of a remedial investigation summary report and will be submitted under separate cover. The remedial investigation summary report will include information from the

Ash Pit No. 1 and Ash Pit No. 3 site characterization reports including this addendum as well as the baseline human health risk assessments and the screening-level ecological risk assessments that have been prepared for each site.

Activities for investigation of the Coal Yard No. 1 were initiated based upon review of 2009 groundwater analytical data from overburden/shale monitoring well AP1-MW01, located downgradient of Coal Yard No. 1. Manganese and iron concentrations exceeded both risk-based screening levels (RBSC) and background screening levels (BSC) in this monitoring well. Reasons for exceedance of manganese and iron were unclear, although based upon the location of the piezometer and monitoring well and groundwater flow direction, a potential upgradient source (Coal Yard No. 1) appeared likely.

No previous investigations at Coal Yard No. 1 have been conducted.

Remedial investigation activities were conducted by Shaw for Coal Yard No. 1 in December 2011. Field activities included hand auger operation with soil sampling, soil borehole lithologic logging, paperwork completion, surveying, and disposal of investigation-derived waste.

Four soil boring locations were chosen to provide adequate coverage of the coal yards based upon field observations of surface and subsurface coal in the former coal yard area. During field reconnaissance, a pickax was used to dig shallow excavations to determine the presence of coal and the coal thickness. From each boring location, soil samples were collected from three distinct intervals to provide evidence of possible soil contamination. Surface soil samples were collected from soil immediately below the coal material. Subsurface soil samples were collected from 3 to 5 feet and 8 to 10 feet below the existing ground surface. Each soil sample from the selected interval was transferred to a new resealable plastic bag and homogenized. Soil was analyzed for nitroaromatics, SVOCs, and TAL metals. Soil from the 0 to 1 and 3 to 5-feet intervals were also analyzed for polychlorinated biphenyls. Soil sampling was completed on December 20, 2011.

Analytical results from the various media collected were compared to RBSCs derived from November 2011 U.S. Environmental Protection Agency regional screening levels for a residential land-use scenario. These screening levels were used as points of comparison in this SCR addendum. Site contaminants will be further evaluated in risk assessments. In addition, the analytical results for the metals in the 2011 soil samples were compared to soil BSCs.

Significant conclusions from the surface and subsurface soil analytical results are as follows:

- No nitroaromatics or polychlorinated biphenyls were detected in surface or subsurface soil samples.
- No SVOC analytes were detected above the RBSCs in any surface or subsurface soil sample.
- No TAL metals were detected above both the RBSC and BSC values in surface soil samples.
- Only one TAL metal (thallium) was detected at a concentration above both the RBSC and BSC value in subsurface soil samples. However, this result, detected at the 3- to 5-foot interval of a quality assurance sample (i.e., the field split analyzed by an independent lab) at a concentration (1.5 milligrams per kilogram [mg/kg]) slightly above the BSC (1.3 mg/kg), is questionable because thallium was not detected in the associated quality control sample and thallium was detected at a concentration (0.41 mg/kg) that was less than one-third the BSC in the regular sample. Note that the quality control sample is a field duplicate sample analyzed by the same lab as the regular field sample.
- Total organic carbon was measured in the surface soil at a concentration of 0.27 mg/kg.

Conclusion. The surface and subsurface soil of Coal Yard No. 1 appears to be adequately characterized. A baseline human health risk assessment is not needed because all analytes would be screened out, leaving no chemicals of potential concern for evaluation. Ecological risks will be discussed in the remedial investigation report, which will describe that based on low concentrations of analytes in Coal Yard No. 2, no screening-level ecological risk assessment is required. Recommendations of the SCR will be included in a remedial investigation report, submitted under separate cover.

1.0 Introduction

The U.S. Army is conducting studies of the environmental impact of suspected waste sites at previously owned U.S. Department of Defense properties. The former Plum Brook Ordnance Works (PBOW) is located in Sandusky, Erie County, Ohio (Figure 1-1). PBOW is being investigated under the Defense Environmental Restoration Program for Formerly Used Defense Sites. The investigation is being managed and technically overseen by the Nashville, Tennessee, and Huntington, West Virginia, District Offices of the U.S. Army Corps of Engineers (USACE). This 9,000-acre facility was used for the manufacture of explosives during World War II. The site is currently controlled and maintained by the National Aeronautics and Space Administration (NASA) and is operated as the Plum Brook Station (PBS) of the John H. Glenn Research Center at Lewis Field.

Fieldwork and reporting for Ash Pit No. 1 Coal Yard (Coal Yard No. 1) was performed under Delivery Order DX02 for the USACE Louisville Architecture/Engineering Environmental Services Indefinite Delivery/Indefinite Quantity, Contract Number W912DR-08-D-0013. The site characterization report (SCR) for Ash Pit No. 1 and Ash Pit No. 3 was submitted as a final report in November 2010. This addendum details remedial investigation activities for Coal Yard No. 1 and includes soil sample collection, analytical results, and recommendations.

During a previous investigation, an overburden/shale groundwater monitoring well (AP1-MW01) was installed upgradient of Ash Pit No. 1. Groundwater samples from that well indicated elevated manganese and iron in the groundwater. Manganese was present in both the filtered (32,100 micrograms per liter [µg/L]) and unfiltered (32,300 µg/L) groundwater samples, exceeding the risk-based screening concentration (RBSC) limit of 88 µg/L and the background screening concentration (BSC) limit of 636 µg/L. Review of groundwater quality measurements determined the high concentrations were not a result of elevated turbidity. In addition, the concentration of iron (4,990 µg/L) was above the RBSC limit of 2,600 µg/L and the BSC of 1,550 µg/L. Associated piezometer AP1-PZ05 also exhibited manganese concentrations above RBSC and BSC levels in both the filtered sample (3,540 µg/L) and the unfiltered sample (3,370 µg/L). Based on interpreted groundwater flow for Ash Pit No.1, a former powerhouse coal yard (Coal Yard No. 1) was located immediately upgradient of this well. Evaluation of site information suggested that leaching of the coal in the former coal yard may have impacted the groundwater. Therefore, additional soil sampling was recommended to evaluate the former PBOW coal yard as a potential source of contamination.

The field activities completed by Shaw Environmental and Infrastructure. Inc. (Shaw) for investigation of Coal Yard No. 1 were conducted pursuant to the following documents:

- Site-wide accident prevention plan/site-wide health and safety plan (SWSHP) (Shaw, 2008a)
- Site-wide sampling and analysis plan (SWSAP) (Shaw, 2008b)
- Site-wide quality assurance project plan (QAPP) (Shaw, 2008c).
- Site-specific sampling and analysis plan (Shaw, 2011a).

1.1 Scope of Work and Project Objectives

The scope of this SCR addendum (USACE, 2011) includes updating the existing quality control plan, adding site-specific addenda to the SWSHP and SWSAP, soil sampling, installation and sampling of monitoring wells, surveying, laboratory analysis, and investigation-derived waste (IDW) management and disposal. Figure 1-2 identifies the location of Coal Yard No. 1 in relation to other areas of concern and site features.

The objectives of this investigation to address data gaps in soil samples include the following:

- Conduct soil sampling and lithologic logging
- Conduct laboratory analysis of soil
- Management and disposal of IDW
- Submit an SCR addendum
- Update the baseline human health risk assessment (BHHRA) and screening-level ecological risk assessments (SLERA)
- Prepare and submit a geographic information system deliverable.

This document is one of two planned reports. The remaining report will be the remedial investigation report and will summarize the findings of the following documents:

- Ash Pit No. 1
  - Coal Yard No. 1 SCR Addendum
  - Ash Pit No. 1 SCR

- Ash Pit No. 1 BHHRA
- Ash Pit No. 1 SLERA

- Ash Pit No. 3
  - Coal Yard No. 3 SCR Addendum
  - Ash Pit No. 3 SCR
  - Ash Pit No. 3 BHHRA
  - Ash Pit No. 3 SLERA.

The remedial investigation report is planned to be issued in 2013.

1.2 Report Organization

Chapter 2.0 of this report describes PBOW and the Coal Yard No. 1 site, its physical setting, geology, and hydrogeology features. Sampling strategy and field procedures are described in Chapter 3.0. The analytical program and background comparison data are presented in Chapter 4.0. Chapter 5.0 describes specific-site information and historical and current analytical data. Chapter 6.0 presents media conclusions. Recommendations are provided in Chapter 7.0. References that were used in preparing the report are listed in Chapter 8.0.

Sample collection logs, soil boring logs, and land survey data are provided in Appendices A, B, and C, respectively. An IDW manifest is included in Appendix D. Appendices E through H contain analytical data pertinent to the soil sampling event. Appendix I contains the chains of custody for laboratory analysis.

1.3 Facility Location and Description

The former PBOW site is currently utilized and maintained by NASA and is operated as the PBS, a satellite office of the NASA John H. Glenn Research Center, located at Lewis Field in Cleveland, Ohio. Most of the aerospace testing facilities built at the site in the 1960s are on standby or inactive status. The site is located approximately 4 miles south of Sandusky, Ohio, and 59 miles west of Cleveland. Although primarily in Perkins and Oxford Townships, the eastern edge of the site 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 PBOW facility is currently surrounded by a chain-link fence, and the perimeter is patrolled regularly. Access by authorized personnel is limited to established checkpoints. Public access is restricted except during the annual controlled deer hunting season.

1.4 PBOW Site History

The PBOW site was built in early 1941 and manufactured 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite (PETN). Production of explosives began in December 1941 and continued until 1945. During operation, three areas (TNT Area A [TNTA], TNT Area B [TNTB], and TNT Area C [TNTC]) manufactured TNT and DNT and one area manufactured PETN. TNTA consisted of manufacturing lines 1 through 4, TNTB consisted of lines 5 through 7, and TNTC consisted of lines 8 through 12. TNTA is located on the northeast side of PBOW, TNTB is located at the south-central part, and TNTC is located at the southwestern side of PBOW. The PETN manufacturing area is located in the north-central portion of PBOW and lies within the boundaries of Ransom Road on the west, Pentolite Road on the south, and Patrol Road on the north and east. The central portion of the former PETN manufacturing area was occupied by NASA's nuclear reactor, which was decommissioned in 2012 with all aboveground structures demolished and removed from the site.

It is estimated that more than one billion pounds of explosives were manufactured during the 4-year operating period. After the plant was shut down, decontamination of TNT, acid, PETN, and DNT processing lines began. Decontamination was considered complete during the last quarter of 1945. The property was initially transferred to the Ordnance Department after it was certified by the Army to be decontaminated in 1946. This transfer did not include the 2,800 acres comprising the Plum Brook area. The War Assets Administration accepted custody of the remaining acreage (approximately 3,230 acres) in 1946. The Department of the Army reacquired the 3,230 acres in 1954 and performed cleanup efforts during the 1950s through 1963.

Two property use agreements were entered into by the National Advisory Committee of Aeronautics, the predecessor of NASA, and the Army in 1956 and 1958. On March 15, 1963, accountability for and custody of the entire PBOW property (6,030 acres) was transferred to NASA by the Department of the Army. NASA performed further decontamination during 1964. The NASA decontamination process was accomplished in five steps (Dames and Moore, Inc., 1997a):

1. Inspecting and removing contaminated surface soil above the drain tiles, flumes, etc.

2. Spot checking of subsurface soil in the vicinity of drain tiles, flumes, etc., to determine where the contaminated tiles and flumes were located. Where contamination was found, the flumes, tiles, etc., were removed in sections.

3. Removal of some items previously decontaminated to Level 3X (XXX-military decontamination level established primarily for worker safety that indicates potentially contaminated material or previously contaminated material that has been decontaminated to a zero residual contamination level) condition to a storage facility and additional decontamination of the remainder of the items to a 5X (XXXXX – level that indicates a decontaminated material with no detectable residual contamination) condition in order to be sold ("X" indicates the Army's specific decontamination level).

4. Destruction of all buildings by fire followed by removal of all debris and concrete foundations. All the materials, including the earth, in those areas was flashed and the area was then rough graded.

5. Decontamination of all sump basins and removal of the concrete.

The decontamination process also included burning of nitroaromatic-filled flumes that were excavated. As shown in the records review (Dames & Moore, Inc., 1997b) this was performed on July 10, 1963, near the intersection of Fox Road and Snake Road and is suspected to have also occurred at the Additional Burning Ground area.

On April 18, 1978, NASA declared approximately 2,152 acres of land as excess. This excess acreage included former buffer areas that were not formerly used by the Army and were not subject to decontamination efforts. The Perkins Township Board of Education acquired 46 acres of the excess for use as a bus transportation center. The General Services Administration retains the remaining acreage and currently has a use agreement with the Ohio National Guard for 604 acres of the land. NASA presently controls about 6,400 acres and is using the site to conduct space research as a satellite operation of the John H. Glenn Research Center based in Cleveland, Ohio. The details of these land transactions are listed in the site management plan (International Consultants Incorporated, 1995) and can be found at NASA PBS.

1.5 Coal Yard No. 1 Site History

As noted in Section 1.4, PBOW was built in early 1941 and manufactured acid, 2,4,6-TNT, DNT, and pentolite until 1945. Three power stations, Powerhouse No. 1, Powerhouse No. 2, and Powerhouse No. 3, were constructed and utilized to support the 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. 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 Coal Yard No. 1 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. Figure 1-3 shows a historical photograph of the coal yard along with the associated powerhouse and two aboveground fuel oil storage tanks.

No previous environmental investigation has been conducted at Coal Yard No. 1.

2.0 Physical Setting

Figure 2-1 shows the specific site location and general Coal Yard No. 1 features with ground surface topography. 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 are included in the final Ash Pit No. 1 and Ash Pit No. 3 SCR (Shaw, 2010).

During the field investigation, the majority of the former Coal Yard No. 1 area was observed to be overgrown with sparsely spaced brush, with the southern perimeter covered with young trees and brush. The majority of former Coal Yard No. 1 area is fairly level, with the outer 20 feet of the southern, western, and northern portions gently dipping in a radial pattern. Surface water runoff percolates into and through the thin residual layer of coal at the coal yard. Surface water runoff on the southern and western portions drains into the unnamed tributary located to the west, while surface water on the northern section drains into the former Ash Pit No. 1.

3.0 Field Activities

3.1 Introduction

Field activities at Coal Yard No. 1 were performed in accordance with the updated and revised SWSAP (Shaw, 2008b) and site-specific sampling and analysis plan (Shaw, 2011a), as noted in Chapter 1.0. Activities included hand auger operation with soil sampling, soil borehole logging, documentation of field work activities (sample collection logs, daily field notes, etc.), surveying, and disposal of IDW.

Prior to any intrusive work, a NASA authorized dig permit was obtained for Coal Yard No. 1. The dig permit process included review of utility maps for any underground utilities, including storm water, sewer, electrical, natural gas, telephone, cable, or fiber optic lines in the area.

3.2 Soil Sampling

In November 2011 (prior to soil sampling), the upper foot of surface soil was removed with a pickax at select locations throughout the former coal yard area to determine optimal placement for the soil borings. Removal of the surface soil aided in determining both the boundary of the former coal yard and the thicknesses of any remaining coal. Soil boring locations were chosen based on the interpreted extent of the former coal yard. Four soil borings (CY1-SB01, CY1-SB02, CY1-SB03, and CY1-SB04) were completed at Coal Yard No. 1 using either a 2-inch or 3-inch stainless-steel hand auger. Soil collected from a sample interval was transferred to a new, resealable storage bag, thoroughly homogenized, and placed into the appropriate sample container. All hand auger activities were conducted by Shaw personnel on December 20, 2011. Figure 2-1 shows the location of the soil borings.

Three soil samples were collected from each soil boring. A surface soil sample was collected from each boring with depths ranging between 0.3 to 1.3 and 1 to 2 feet, depending on the presence and thickness of coal. Two subsurface soil samples from depths of 3 to 5 and 8 to 10 feet below ground surface (bgs) were also collected from each boring and analyzed for nitroaromatics, semivolatile organic compounds (SVOC), and target analyte list (TAL) metals. Also, the surface soil sample and shallower subsurface soil sample (3 to 5 feet) were analyzed for polychlorinated biphenyls (PCB). One of the surface soil samples was analyzed for total organic carbon. Table 3-1 presents a summary of soil samples collected, and soil sample collection logs are included in Appendix A. Continuous lithologic logs were recorded for all soil

borings during the drilling. Hazardous, toxic, and radiological waste drilling logs for each borehole are included in Appendix B.

Each borehole was abandoned after all soil sampling activities at Coal Yard No. 1 were complete. Bentonite granules were emptied into the 10-foot-deep borehole and brought to a depth of approximately 3 feet bgs. Remaining borehole soil from initial hand auger operations was emptied back into the open borehole portion and brought to ground surface.

3.3 Decontamination Procedures

Decontamination of the hand auger and sampling equipment was performed in accordance with Section 5.0 of the SWSAP (Shaw, 2008b). Specifically, sampling equipment was decontaminated by rinsing in sequence with phosphate-free soapy water, tap water, nitric acid, methanol, hexane, and deionized water. The bucket augers were decontaminated prior to each boring.

3.4 Land Survey

After initial site reconnaissance and selection of soil sampling locations (November 2011), an Ohio-registered professional land surveyor surveyed the soil boring locations. Surveying was conducted prior to actual sampling because surveying was being conducted at another PBOW site (Acid Area No. 1) to reduce mobilization and reporting costs. Horizontal coordinates were surveyed to the closest 0.1 foot and referenced to the Ohio State Plane Coordinate System. The land surface elevation was surveyed to the nearest 0.01 foot and referenced to the 1929 National Geodetic Vertical Datum. Land survey data reports are included in Appendix C.

3.5 Investigation-Derived Waste Management

IDW generated during investigation activities included decontamination water and personal protective equipment. All IDW was managed and handled in accordance with procedures described in the SWSAP (Shaw, 2008b).

All decontamination fluids generated during field activities, except the nitric acid, methanol, and hexane rinse, were stored in a labeled 55-gallon drum. Decontamination fluids (nitric acid, methanol, and hexane) were collected in a stainless-steel pan and evaporated to prevent disposal as a hazardous waste liquid. IDW rinse water was drummed and sampled to determine if it should be classified as a hazardous or nonhazardous material. Soil generated during hand auger operations was placed back into the borehole. Personal protective equipment (Tyvek® suits, latex

gloves, etc.) and general refuse were double bagged and disposed in an on-site, Shaw contracted industrial dumpster.

Following analytical determination that the wastewater was nonhazardous, on January 26, 2012, the IDW decontamination water was transported by Triad Transport, Inc. to the Environmental Quality Company in Detroit, Michigan, for disposal. The waste manifest for disposal of the decontamination fluid is shown in Appendix D.

4.0 Analytical Program

The following sections present the analytical program used in this investigation. This review includes the laboratories used for all samples, the analytical methods used, data quality evaluation, and blank analysis. In addition, a description and derivation of RBSCs is presented in Section 4.2.1. The derivation and use of BSCs and the analytical results are presented in Section 4.2.2.

4.1 Analytical Program and Methodologies

4.1.1 Sample Analysis and Data Validation

Primary and quality control (QC) project samples collected in December 2011 were analyzed by Accutest Laboratories of Orlando, Florida. Quality assurance (QA) samples were analyzed by Test America, Inc., Canton, Ohio. Analysis for nitroaromatic field split samples was performed by Test America of Sacramento, California. Shaw performed the data validation. The validation summaries are provided in Appendix E. The analytical results are summarized in Appendix F. Tables of detected hits (Section 4.1.4) data are included in Appendix G. A data quality evaluation is located in Appendix H, and chains of custody used for soil and IDW samples are included in Appendix I.

All data analyzed were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the U.S. Environmental Protection Agency (EPA) *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA, 2008) and EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2004), the QAPP (Shaw, 2008c), and specific analytical method requirements. Data were evaluated against specific criteria to verify the achievement of precision, accuracy, representativeness, completeness, and comparability goals established to meet the project data quality objectives (DQO). The criteria for blank evaluation were based on those detailed in *Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses* (EPA, 1994) and *Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses* (EPA, 1993).

4.1.2 Analytical Methods

Chemical analyses for the investigation were performed in accordance with guidelines detailed in EPA's *Test Methods for Evaluating Solid Waste (SW-846), Physical/Chemical Methods,* Third Edition, September 1986 (EPA, 1986) and subsequent revisions. The soil samples and associated QA/QC samples were analyzed for PCBs, SVOCs, nitroaromatics, and TAL metals. Methods used for analysis are summarized in Table 4-1.

4.1.3 Data Quality Evaluation

The reliability of the sampling and analytical procedures used during the investigation was demonstrated by implementing the project-specific QA procedures specified in the SWSAP (Shaw, 2008b) and the QAPP (Shaw, 2008c) and its site-specific attachments. Successful execution of these procedures provides strong supporting evidence that the data are representative of the areas under investigation.

The DQOs for this project were to produce scientifically valid data of known accuracy and precision that were complete with respect to identified critical samples, comparable with similar data types, and representative of the media sampled so as to be useful for the cited purposes. Evaluation of the data using the DQOs and the data validation process resulted in the determination that the data set is valid and of sufficient quality to meet the objectives of the investigation.

A complete evaluation of the analytical results is given in the data quality evaluation found in Appendix H.

4.1.4 Blank Evaluation

The purpose of blank analysis is to detect contamination resulting from laboratory and field activities. For this site, field blanks were not required. Only laboratory method blanks were analyzed. Blank evaluation involves qualification of data based on the results of the laboratory method blanks. The criteria for blank evaluation are as follows:

- If a parameter is found in a blank but not detected in the sample, no action is taken.
- For organics, if the sample result is less than 5 times (most analytes) or 10 times (common laboratory contaminants) that of the blank result, the sample result is qualified "B."

- For inorganics, if the sample result is greater than the instrument detection limit but less than 5 times the blank result, the sample result is qualified "B."
- If the sample result is greater than 5 times (most analytes) or 10 times (common laboratory contaminants) the blank result, no action is taken.

In instances where more than one blank is associated with a given sample, qualification is based upon a comparison with the associated blank having the highest concentration of a contaminant. Blank results are not subtracted from sample concentrations. Note that data with “B” validation qualifiers are included in the Chapter 5.0 tables, but the associated concentrations are not included in the tables’ “maximum detected concentration” column because “B” qualified data are not regarded as detected and are not used in PBOW risk assessments.

4.2 Comparison to Screening Criteria

The analytical result tables presented in Chapter 5.0 include a comparison to RBSCs and BSCs as points of reference only. Concentrations of analytes that exceed the RBSCs are highlighted in the tables. RBSCs do not infer a regulatory limit or mandated cleanup level, nor is the identification of an exceedance intended to indicate an unacceptable human health risk or a need for remedial action. Formal evaluation of human health risks will be performed in the BHHRA. Concentrations in individual samples that exceed the respective BSCs are identified in bold type in the Chapter 5.0 result table.

4.2.1 Risk-Based Screening Concentrations

The RBSCs are derived from November 2011 regional screening levels (EPA, 2011) using the methodology described in the Ash Pit No. 1 BHHRA work plan (Shaw, 20011b). Because the area surrounding PBOW is agricultural and residential and because other PBOW sites have been remediated based on unrestricted land use, risk-based screening has been performed based on residential exposure. This assumption is appropriate because the area surrounding the former PBOW facility is rural and residential, and if/when the property is excessed, the land will likely become residential. Soil RBSCs are based on a long-term residential land-use scenario that assumes use by a young child for noncancer effects and use by the combined young child and adult life stages for carcinogenic effects. Together, these capture a plausible case for future land use. The soil RBSCs are based on an incremental lifetime cancer risk of 1E-6 and a hazard quotient of 0.1. As stated in Section 4.2, laboratory analytical results are compared to RBSCs only as a point of reference. Further details on the RBSCs and their derivation are provided in the BHHRA work plan.

4.2.2 Background Screening Concentrations

Derivation and BSC values for PBOW soil are presented in the acid areas site investigation report (IT Corporation, 1998). Table 4-2 presents a complete list for metals in soil. The BSCs were derived from concentrations of these analytes found in PBOW background groundwater monitoring wells and soil data sets. The background soil samples were collected from near the property boundary, away from any potential source areas, and the background groundwater wells were installed in off-site areas upgradient of PBOW sources. Each BSC is the calculated 95th percent upper tolerance limit or the maximum detected concentration of the background data set, whichever value is lower, for each relevant analyte (IT Corporation, 1998). It is noted that the method agreed upon for the development of BSCs by OEPA and USACE, as recorded in the September 11, 2002 PBOW team meeting minutes, differs from that shown in current OEPA (2009) guidance. This PBOW team agreement, which has been used for all PBOW risk assessments to date, takes precedence over the subsequent OEPA (2009) guidance.

5.0 Investigation Results

On December 20, 2011, four soil borings (CY1-SB01, CY1-SB02, CY1-SB03, and CY1-SB04) were completed within Coal Yard No. 1. Surface soil samples were collected from depths of approximately 0.3 to 1.3, 0.5 to 1.5, or 1 to 2 feet bgs due to the presence of coal on the ground surface, 3 to 5 feet bgs, and 8 to 10 feet bgs. Findings of the soil sampling are discussed in the following sections. Analytical results and conclusions are presented in the following sections.

5.1 Site-Specific Soils

As described in the Ash Pit No. 1 SCR (Shaw, 2010), fill sand had been used at PBOW following demolition and early remediation tasks to cover concrete foundations and demolition scars and to promote a natural landscape appearance. At Coal Yard No. 1, no fill sand of this type was encountered on the surface at any of the four soil borings drilled. The ground surface at two of the four soil borings (CY1-SB01 and CY1-SB03) was covered with a mixture of black sand, silt, and coal to a depth of approximately 0.5 foot. A sand, silt, and coal mixture was slightly less at boring CY1-SB02 with a thickness of only 0.3 foot. At the fourth boring (CY1-SB04), the first 1 foot of surface soil consisted of a mixture of black silt with clay, coal, and sand. Figure 2-1 shows a Coal Yard No. 1 site map with soil boring locations.

Below the silt, clay, sand, and coal surface soil, a layer of yellowish-brown, very fine-grain sand with silt of loose consistency was typically encountered to a depth ranging from 3 to 4 feet. This material could be fill material based upon the depth and uniqueness of a fine-grain sand-silt near the surface. Cinders were encountered in boring CY1-SB01 at a depth of 4 to 6 feet bgs, below the fine-grain sand and silt. A historical photograph dated January 19, 1942 shows that a parking area was present prior to the existence of Coal Yard No. 1. It is possible that this sand with silt was the former parking area, was possibly the base for either the parking area or coal storage, or was used to level the ground surface during construction of the powerhouse.

Native soil is believed to have been encountered in the borings at depths ranging from 3 feet in borings CY1-SB01, CY1-SB03 and CY1-SB04 to 6 feet bgs in boring CY1-SB02. Native soil consisted of glacial till, glacial outwash, or possibly a glacial lacustrine (lake) deposit. In three of the four soil borings (CY1-SB01, CY1-SB03, and CY1-SB04), typically a stiff silt with clay or clay with silt was encountered to the total boring depth of 10 feet. The color of the silt or clay was usually gray except in boring CY1-SB02, where it was an olive brown which gradually changed to a dark yellowish brown at a depth of approximately 8 feet. Depth to groundwater

varied from 0.5 foot bgs in CY1-SB01 to 1.5 feet bgs in boring CY1-SB02, and groundwater was not encountered in the remaining two borings (CY1-SB03 and CY1-SB04).

5.2 Soil Analytical Results

A total of 14 soil samples were collected from the four borings. Four surface soil samples and 10 subsurface samples (including 1 QC and 1 QA sample) were collected from depths of 3 to 5 and 8 to 10 feet bgs. Three of the surface soil samples were collected below a nearly 0.5-foot-thick coal layer while the remaining surface soil sample, CY0012, was collected below a coal layer beginning at a depth of 1 foot bgs. Soil samples were analyzed for nitroaromatics, SVOCs, and TAL metals. Also, the surface soil samples and the 3 to 5 feet bgs interval soil samples were analyzed for PCBs. Table 5-1 summarizes detected concentrations of analytes and compares these concentrations to the RBSCs and/or BSCs.

5.2.1 2011 Surface Soil Samples

No nitroaromatics or PCBs were detected in any of the surface soil samples at Coal Yard No. 1. Five SVOCs (fluoranthene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene) were detected in the surface soil sample from boring CY1-SB04 and only one SVOC (2-methylnaphthalene) was detected in boring CY1-SB03, but all were far below their respective RBSCs.

No TAL metal analytical concentrations exceeded both the RBSC and BSC limits in surface soil samples at Coal Yard No. 1.

Total organic carbon was measured in the surface soil at a concentration of 0.27 milligrams per kilogram (mg/kg).

5.2.2 2011 Subsurface Soil Samples

No nitroaromatics or PCBs were detected in the subsurface soil samples at Coal Yard No. 1. The SVOCs dibenzofuran, fluoranthene, fluorene, and pyrene were detected in the 3 to 5 feet bgs subsurface soil sample CY0005 from boring CY1-SB02 and the SVOCs 2-methylnaphthalene, naphthalene, and phenanthrene were detected in the QA (field split) sample CY0010 from boring CY1-SB03. All results were below the respective RBSCs.

Only one TAL metal, thallium, was detected above both the RBSC and BSC. Thallium was found in the 3 to 5 feet subsurface soil sample CY0010 (QA sample) from boring CY1-SB03 at a concentration of 1.5 mg/kg, slightly greater than the RBSC of 0.078 mg/kg and BSC value of 1.3 mg/kg.

6.0 Summary and Conclusions

To determine possible contamination to soil caused by the storage of coal, four soil borings (CY1-SB01, CY1-SB02, CY1-SB03, and CY1-SB04) were completed within Coal Yard No. 1.

Field activities at Coal Yard No. 1 were conducted in November and December 2011 and included hand auger operation, soil sample collection, lithologic logging, documentation, and surveying of boring locations. Disposal of IDW occurred in January 2012. A total of 4 surface soil and 10 subsurface soil (including 1 QA and 1 QC sample) samples were collected. Surface soil samples were collected from depths of either 0.3 to 1.3, 0.5 to 1.5, or 1 to 2 feet bgs (immediately below the existing coal layer), and subsurface soil samples were collected from depths of 3 to 5 and 8 to 10 feet bgs. Soil samples were analyzed for nitroaromatics, SVOCs, and TAL metals. In addition, surface soil and 3 to 5 feet interval samples were analyzed for PCBs. Analytical results obtained from each soil sample were screened against RBSC and BSC values. RBSC values do not infer a regulatory limit or mandated cleanup level, nor does an exceedance necessarily represent an unacceptable human health risk. They are used in this report only as points of reference.

Major findings from Coal Yard No. 1 soil sample results are summarized as follows:

- No nitroaromatics or PCBs were detected in surface or subsurface soil samples.
- Only one SVOC was detected in one of the three surface soil samples (CY0007) and five SVOCs were detected in the surface soil sample (CY0012). None of the SVOCs detected were above their respective RBSCs in any surface or subsurface soil sample.
- A total of seven SVOCs were detected in 2 of the 10 subsurface soil samples, and results of each were below their respective RBSCs.
- Only one TAL metal (thallium) was detected above both the RBSC and BSC value in one subsurface soil sample. Thallium was detected at a concentration of 1.5 mg/kg in the 3- to 5-foot field split (QA) sample (CY0010) from boring CY1-SB01, marginally above the BSC (1.3 mg/kg). This exceedance is questionable because thallium was detected at a concentration (0.41 mg/kg) that is well below the BSC in the regular sample from this location (CY0008), and it was not detected in the associated field split (QC) sample (CY0009).
- Total organic carbon in the surface soil sample from boring CY1-SB01 was detected at a concentration of 0.27 mg/kg.

The soil data collected from Coal Yard No. 1 do not indicate an appreciable impact due to the former storage of coal at the site.

7.0 Recommendations

The surface and subsurface soil of Coal Yard No. 1 appears to be adequately characterized. With the exception of thallium, none of the analytes exceeded both the corresponding RBSC and the BSC values. Thallium only marginally exceeded the BSC in the field split (QA) sample from a single location and was not detected above the BSC in either the regular sample or field duplicate (QC) sample. Therefore, no BHHRA is needed because all analytes would be screened out, leaving no chemicals of potential concern for evaluation. Ecological risks will be discussed in the remedial investigation report, which will describe that based on low concentrations of analytes in Coal Yard No. 1, no screening-level ecological risk assessment is required.

Planned Activities. Completion of a remedial investigation report, which is anticipated for completion in 2013.

8.0 References

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TABLES

Table 3-1

Summary of Soil Samples Collected
Ash Pit 1 and Ash Pit 3 SCR Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Type	Sample Location	Sample Number	Sample Date	Sample Purpose	SDG Number
SS	CY1-SB01	CY0001	20-Dec-11	REG	F88938
DS	CY1-SB01	CY0002	20-Dec-11	REG	F88938
DS	CY1-SB01	CY0003	20-Dec-11	REG	F88938
SS	CY1-SB02	CY0004	20-Dec-11	REG	F88938
DS	CY1-SB02	CY0005	20-Dec-11	REG	F88938
DS	CY1-SB02	CY0006	20-Dec-11	REG	F88938
SS	CY1-SB03	CY0007	20-Dec-11	REG	F88938
DS	CY1-SB03	CY0008	20-Dec-11	REG	F88938
DS	CY1-SB03	CY0009	20-Dec-11	FD	F88938
DS	CY1-SB03	CY0010	20-Dec-11	FS	240-7168-1
DS	CY1-SB03	CY0011	20-Dec-11	REG	F88938
SS	CY1-SB04	CY0012	20-Dec-11	REG	F88938
DS	CY1-SB04	CY0013	20-Dec-11	REG	F88938
DS	CY1-SB04	CY0014	20-Dec-11	REG	F88938

Notes:

SDG - Sample delivery group.

SS - Surface soil.

CY1 - Coal Yard No. 1.

REG - Regular sample.

FD - Field duplicate. Sample sent to same laboratory as primary samples.

FS - Field split. Sample sent to independent laboratory other than primary contract laboratory.

DS - Deep soil (subsurface).

Table 4-1

Summary of Soil and Groundwater Analytical Parameters and Methods for Soil
Ash Pit 1 and Ash Pit 3 SCR Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

Sample Matrix	Analytical Parameters[a]	Analytical Method[b]
Soil	TCL Semivolatile Organic Compounds	SW-846 3550C/8270D
	Nitroaromatic Compounds	SW-846 8330A
	Polychlorinated Biphenyls	SW-846 3550C/8082A
	TAL Metals	SW-846 3050B/6010C/7471B
	Total Organic Carbon	Walkley-Black
Liquid IDW	Target Compound List Volatile Organic Compound	SW-846 8260B
	Target Compound List Semivolatile Organic Compound	SW-846 3510C/8270D
	Nitroaromatics	SW-846 8330A
	Total Recoverable Metals	SW-846 3010A/6010C/7470A
	Ignitability	SW-846 1010A
	pH	SW-846 9040C
	Corrosivity	SW-846 1110A
	Reactive Cyanide	7.3.3/7.3.4
	Reactive Sulfide	7.3.3/7.3.4
Soil IDW	TCLP Volatile Organic Compounds	SW-846 1311/8260B
	TCLP Semivolatile Organic Compounds	SW-846 1311/3510C/8270C
	TCLP Metals	SW-846 1311/3010A/6010C/7470A
	Ignitability	SW-846 1010A
	Corrosivity	SW-846 1110A
	Reactivity	7.3.3.2/7.3.4.2

[a]Target analyte list (TAL) and target compound list (TCL) are used to designate parameter lists with no requirements for Contract Laboratory Program method quality control or data reporting packages.
[b]Analyses found in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* EPA Publication, Third Edition, and *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, March 1983 and subsequent revisions, except as noted.
[c]Water quality parameter.
[d]Field testing will use an appropriate field test kit or method according to EPA 600/4-79-020: Method for Chemical Analysis of Water and Wastes in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, EPA Publication, Third Edition.

IDW - Investigation-derived waste.
SCR - Site characterization report.
TCLP - Toxicity characteristic leaching procedure.
TOC - Total organic carbon.

Table 4-2

Background Screening Concentrations of Metals in Soil[a]
Ash Pit 1 and Ash Pit 3 SCR Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

Chemical Name (mg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Reporting Limits	Statistical Distribution	Arithmetic Mean	95% UTL [b]	Background Screening Criterion [c]
Aluminum	12 / 12	3520 - 15500	NA	L	8.43E+03	2.69E+04	1.55E+04
Antimony	9 / 25	5.9 - 9.3	5.4 - 74	NP	4.68E+00	NA	9.30E+00
Arsenic	23 / 26	2.1 - 36.5	1.2 - 3.7	L	1.08E+01	7.10E+01	3.65E+01
Barium	9 / 12	35.6 - 826	23.2 - 24.7	L	1.16E+02	1.30E+03	8.26E+02
Beryllium	6 / 25	0.57 - 1	0.57 - 1.2	L	5.65E-01	1.17E+00	1.00E+00
Cadmium	0 / 25	NA	0.57 1.2	L	4.49E-01	NA	NA
Calcium	12 / 12	735 - 52300	NA	L	1.13E+04	2.18E+05	5.23E+04
Chromium	25 / 26	4.4 - 29	12.3 - 12.3	NP	1.34E+01	NA	2.90E+01
Cobalt	9 / 12	9.6 - 116	5.8 - 6.2	L	2.26E+01	2.48E+02	1.16E+02
Copper	23 / 26	2.3 - 56.2	2.2 - 2.9	L	1.70E+01	1.47E+02	5.62E+01
Iron	12 / 12	5880 - 234000	NA	L	4.01E+04	3.58E+05	2.34E+05
Lead	26 / 26	1.9 - 48.6	NA	L	1.28E+01	5.13E+01	4.86E+01
Magnesium	12 / 12	629 - 10400	NA	L	3.26E+03	3.08E+04	1.04E+04
Manganese	26 / 26	21 - 13300	NA	L	7.29E+02	3.51E+03	3.51E+03
Mercury	2 / 26	0.085 - 0.085	0.037 - 0.3	L	9.06E-02	5.60E-01	8.50E-02
Nickel	26 / 26	5.4 - 55.1	NA	L	2.28E+01	7.79E+01	5.51E+01
Potassium	11 / 12	579 - 3390	617 - 617	L	1.24E+03	6.08E+03	3.39E+03
Selenium	5 / 25	0.61 - 2	0.57 - 4.9	NP	1.55E+00	NA	2.00E+00
Silver	2 / 26	1.1 - 11.1	1.1 - 1.3	NP	1.00E+00	NA	1.11E+01
Sodium	0 / 12	NA	566 - 663	L	3.03E+02	NA	NA
Thallium	2 / 25	1.2 - 1.3	1.1 - 6.1	NP	1.91E+00	NA	1.30E+00
Vanadium	11 / 12	9 - 40.9	61.7 - 61.7	L	2.48E+01	8.31E+01	4.09E+01
Zinc	26 / 26	6.6 - 655	NA	L	7.30E+01	3.22E+02	3.22E+02

mg/kg - Milligrams per kilogram.
NA - Not applicable; not available.
[a] Data used to determine soil background are based on sampling from IT Corporation, 1998, *Site Investigation of Acid Areas, Plum Brook Ordnance Works, Sandusky, Ohio.*
[b] 95% UTL - 95 percent upper tolerance limit rounded to three significant figures.
[c] The maximum detected concentration is used as the background screening criterion for nonparametric data sets; for normal or lognormal data sets, the 95 percent UTL or the maximum detected concentration, whichever is less, is used.
Note: Detection limits from sample 6990 were deleted when calculating results for antimony, beryllium, cadmium, selenium, and thallium. The detection limits were elevated by dilution factors which greatly exceed any detected concentration and would bias results unrealistically high.

Table 5-1

Detected Constituents Above RBSCs and/or BSCs in Surface and Subsurface Soil at Coal Yard No. 1
Ash Pit 1 and Ash Pit 3 SCR Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION	CY1-SB01						CY1-SB02						CY1-SB03									
				SAMPLE NO	CY0001		CY0002		CY0003		CY0004		CY0005		CY0006		CY0007		CY0008		CY0009		CY0010		CY0011	
				DATE	12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011		12/20/2011	
				DEPTH	0.5 - 1.5 Ft		3 - 5 Ft		8 - 10 Ft		0.3 - 1.3 Ft		3 - 5 Ft		8 - 10 Ft		0.5 - 1.5 Ft		3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		8 - 10 Ft	
				PURPOSE	REG		REG		REG		REG		REG		REG		REG		REG		FD		FS		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES																										
Dibenzofuran	mg/kg	7.8	NE	0.103	-	-	-	-	-	-	-	-	0.103	J	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	0.138	-	-	-	-	-	-	-	-	0.138	J	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	230	NE	0.105	-	-	-	-	-	-	-	-	0.105	J	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	0.0334	-	-	-	-	-	-	-	-	-	-	-	-	0.0264	J	-	-	-	-	0.025		-	-
Naphthalene	mg/kg	3.6	NE	0.183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02		-	-
Phenanthrene	mg/kg	NE	NE	0.0255	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009		-	-
Pyrene	mg/kg	170	NE	0.124	-	-	-	-	-	-	-	-	0.124	J	-	-	-	-	-	-	-	-	-	-	-	-
METALS																										
Aluminum	mg/kg	7,700	15,500	13,100	4,660		10,100		11,000		2,030		6,020		9,910		5,020		11,400		13,100		10000		6,900	
Antimony	mg/kg	3.1	9.3	1.4	0.12	J	-	-	-	-	0.14	J	0.23	J	-	-	-	-	-	-	-	-	1.4	J	-	-
Arsenic	mg/kg	0.39	36.5	34.6	3.1		7.9		8.4		34.6		3.8		7		9		12.5		10.1		19		5.9	
Barium	mg/kg	1,500	826	100	18.5		73.8		79.7		23.9		44		62.7		31.6		84.6		79.8		100		53.6	
Beryllium	mg/kg	16	1	0.67	0.24	J	0.52		0.58		0.061	J	0.5		0.62	J	0.32		0.63		0.67		0.51		0.36	
Cadmium	mg/kg	7	NE	0.8	-	-	0.15	J	0.33	J	-	-	0.52		0.46	J	0.17	J	0.33	J	0.38	J	-	-	-	-
Calcium	mg/kg	NE	52,300	50,000	727		5,470		13,800		447		4,140		3,230		2,340		3,110		2,910		2,600		50,000	
Chromium	mg/kg	NE	29	20.1	7.8		15.4		17.1		3.9		10.7		15.3		8.7		17.8		20.1		18		14.5	
Cobalt	mg/kg	2.3	116	18	3.1		8.3		18		0.79	J	9.5		14.1		3.3		14.1		15.7		11		6.4	
Copper	mg/kg	310	56.2	30	6		19.4		24.9		3.3		18.3		18.1		7.5		24.8		26.7		30		17.6	
Iron	mg/kg	5,500	234,000	43,000	8,320		18,800		22,300		7,840		17,300		17,100		12,700		26,000		20,700		43,000		13,200	
Lead	mg/kg	40	48.6	29.8	4.8		10.7		11.8		5.5		29.8		10.3		7.2		12.8		10.6		14		12.5	
Magnesium	mg/kg	NE	10,400	12,500	614		3,710		6,100		274		1,180		2,260		1,090		3,950		3,710		3,100	B	**12,500**	
Manganese	mg/kg	180	3,506	721	30.6		316		721		23.7		188		401		148		230	J	461	J	290		249	
Mercury	mg/kg	1	0.09	0.076	0.013	J	0.021	J	0.019	J	0.022	J	0.037	J	0.076	J	0.034	J	0.02	J	0.031	J	0.022	J	0.015	J
Nickel	mg/kg	150	55.1	39	7.8		23.1		36		2.3		13.6		34.1		9.4		37.2		39		36		17.5	
Potassium	mg/kg	NE	3,390	1,550	212	J	744	J	1,550		202	J	435	J	770	J	400	J	1,390		1,210		1,000		1,220	
Selenium	mg/kg	39	2	0.53	-	-	-	-	0.53	J	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/kg	39	11.1	0.074	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/kg	NE	NE	115	-	-	-	-	-	-	111	J	-	-	-	-	111	J	-	-	-	-	-	-	115	J
Thallium	mg/kg	0.078	1.3	1.5	-	-	-	-	0.29	J	-	-	-	-	-	-	-	-	0.41	J	-	-	**1.5**	J	-	-
Vanadium	mg/kg	39	40.9	30	15.4		25.2		21.8		8		18.1		18.7		16.6		23.2		28.9		30		14.7	
Zinc	mg/kg	2,300	321.75	163	21.3		43.9		57.6		9.4		157		163		21.1		57		62.9		74		50.5	
GENERAL CHEMISTRY																										
Total organic carbon	Percent	NE	NE	0.27	0.27		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 5-1

Detected Constituents Above RBSCs and/or BSCs in Surface and Subsurface Soil at Coal Yard No. 1
Ash Pit 1 and Ash Pit 3 SCR Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio

				LOCATION	CY1-SB04					
				SAMPLE NO	CY0012		CY0013		CY0014	
				DATE	12/20/2011		12/20/2011		12/20/2011	
				DEPTH	1 - 2 Ft		3 - 5 Ft		8 - 10 Ft	
				PURPOSE	REG		REG		REG	
Parameter	Units	RBSC	BSC	MDC	Result	VQ	Result	VQ	Result	VQ
SEMIVOLATILES										
Dibenzofuran	mg/kg	7.8	NE	0.103	-	-	-	-	-	-
Fluoranthene	mg/kg	230	NE	0.138	0.0313	J	-	-	-	-
Fluorene	mg/kg	230	NE	0.105	-	-	-	-	-	-
Methylnaphthalene, 2-	mg/kg	31	NE	0.0334	0.0334	J	-	-	-	-
Naphthalene	mg/kg	3.6	NE	0.183	0.183	J	-	-	-	-
Phenanthrene	mg/kg	NE	NE	0.0255	0.0255	J	-	-	-	-
Pyrene	mg/kg	170	NE	0.124	0.0309	J	-	-	-	-
METALS										
Aluminum	mg/kg	7,700	15,500	13,100	5,480		8,830	J	8,400	
Antimony	mg/kg	3.1	9.3	1.4	0.17	J	0.13	J	0.16	J
Arsenic	mg/kg	0.39	36.5	34.6	24.6		8.4	J	8.3	
Barium	mg/kg	1,500	826	100	46.5		55.1	J	42.5	
Beryllium	mg/kg	16	1	0.67	0.26	J	0.44	J	0.41	
Cadmium	mg/kg	7	NE	0.8	0.8		0.57	J	0.65	
Calcium	mg/kg	NE	52,300	50,000	1,080		19,800	J	26,500	
Chromium	mg/kg	NE	29	20.1	13		13	J	12.1	
Cobalt	mg/kg	2.3	116	18	3.3	J	9.7	J	6.5	
Copper	mg/kg	310	56.2	30	12		19.9	J	19	
Iron	mg/kg	5,500	234,000	43,000	31,700		19,100	J	15,200	
Lead	mg/kg	40	48.6	29.8	7.6		11.4		12.1	
Magnesium	mg/kg	NE	10,400	12,500	748		8,220	J	6,880	
Manganese	mg/kg	180	3,506	721	93.6		279	J	217	
Mercury	mg/kg	1	0.09	0.076	0.049	J	0.018	J	0.015	J
Nickel	mg/kg	150	55.1	39	9.8		24.7	J	19.9	
Potassium	mg/kg	NE	3,390	1,550	716		1,280	J	1,470	
Selenium	mg/kg	39	2	0.53	-	-	-	-	-	-
Silver	mg/kg	39	11.1	0.074	0.074	J	-	-	-	-
Sodium	mg/kg	NE	NE	115	89.5	J	92.3	J	96.7	J
Thallium	mg/kg	0.078	1.3	1.5	0.64	J	0.38	J	-	-
Vanadium	mg/kg	39	40.9	30	22.8		17.1	J	14.3	
Zinc	mg/kg	2,300	321.75	163	27.9		44.7	J	37.5	
GENERAL CHEMISTRY										
Total organic carbon	Percent	NE	NE	0.27	-	-	-	-	-	-

mg/kg - Milligrams per kilogram.
RBSC - Values reflect an incremental lifetime cancer risk (ICLR) of 1E-6 or a noncancer hazard quotient (HQ) of 0.1. For chemicals that exhibit both cancer and noncancer effects, whichever type of effect results in a lower concentration (using an ICLR of 1E-6 and an HQ of 0.1), that concentration is selected as the RBSC.
BSC - Background screening concentration.
MDC - Maximum detected concentration for the area of concern.
Shaded cell indicates value is greater than RBSC.
Bolded text indicates values are greater than BSC.
NE - Not established (RBSCs), not evaluated (BSCs).
"-" - Not detected.

Validation Qualifiers (VQ)
J - The analyte was positively identified; the reported value is estimated.
B - The analyte was not detected significantly above the levels found in the associated method blank or field blanks.

FIGURES

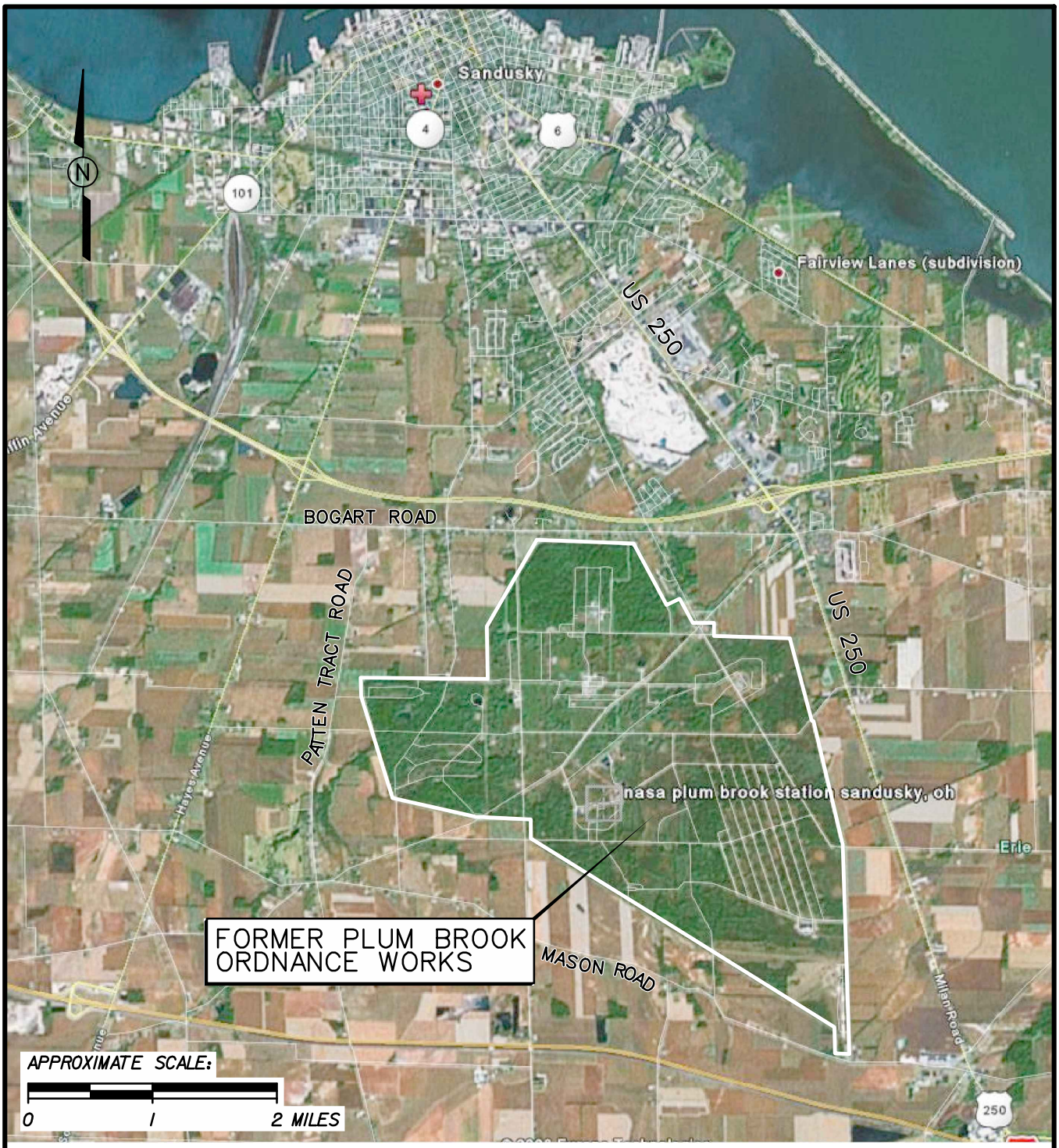

FIGURE 1-1
PBOW VICINITY MAP

ASH PIT 1 AND ASH PIT 3 SCR
ADDENDUM FOR COAL YARD No.1
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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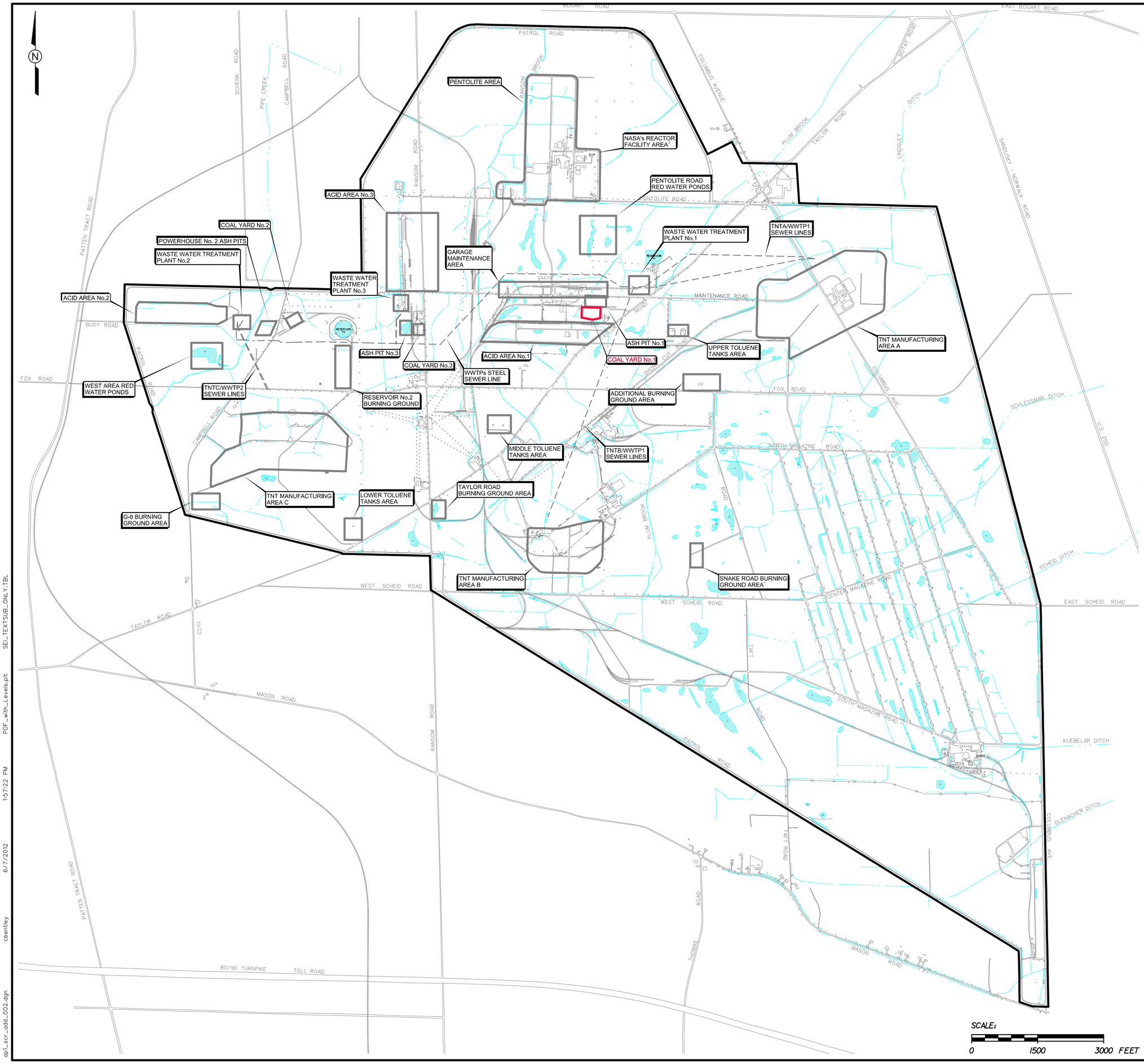

LEGEND:

- AREA OF CONCERN
- APPROXIMATE LOCATION OF SEWER LINES
- POND
- CREEK, DITCH, CONVEYANCE
- FORMER RAILROAD
- ROAD
- 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.

SCALE:

0 1500 3000 FEET

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

ASH PIT 1 AND ASH PIT 3 SCR ADDENDUM FOR COAL YARD No.1
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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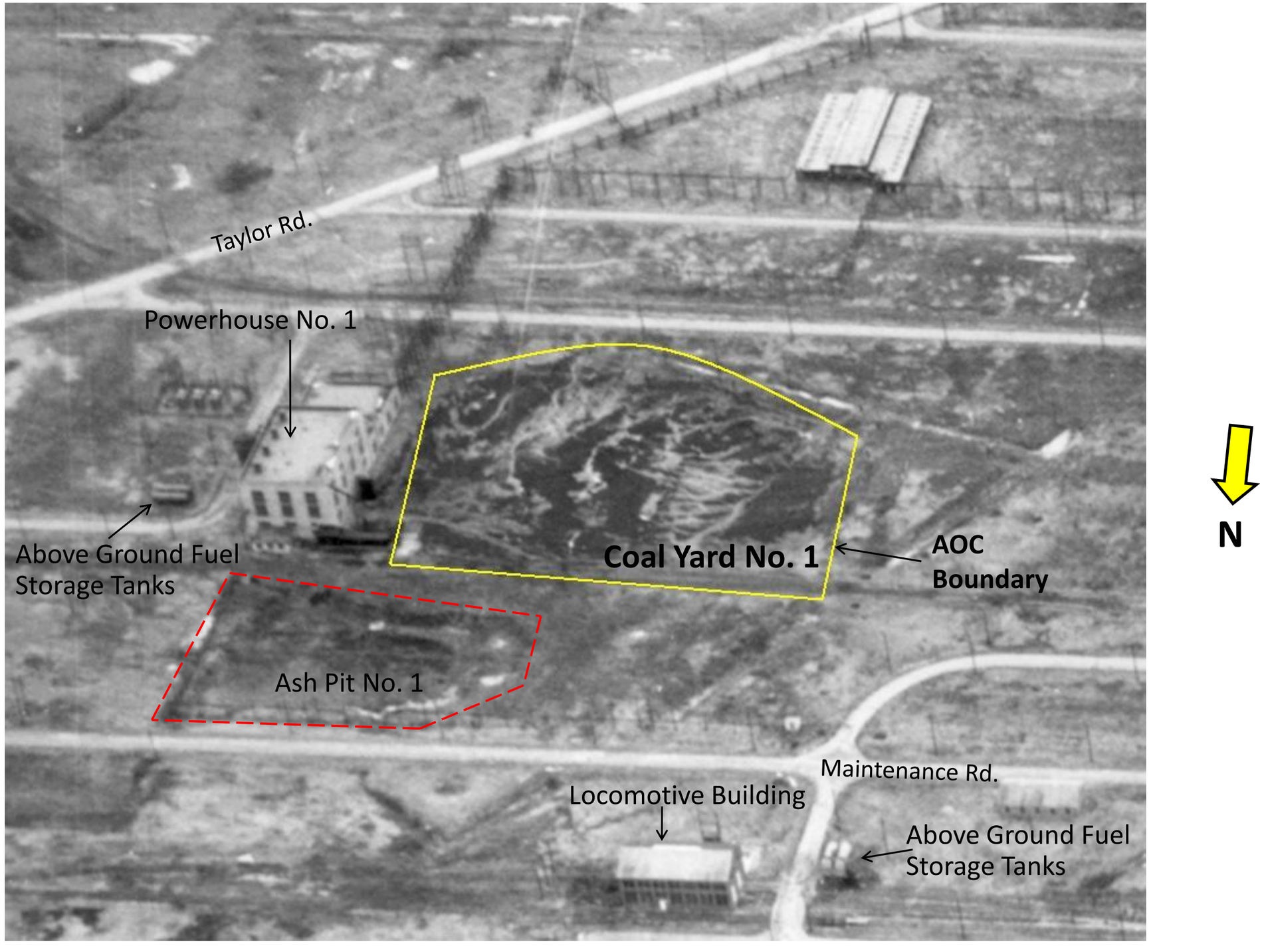
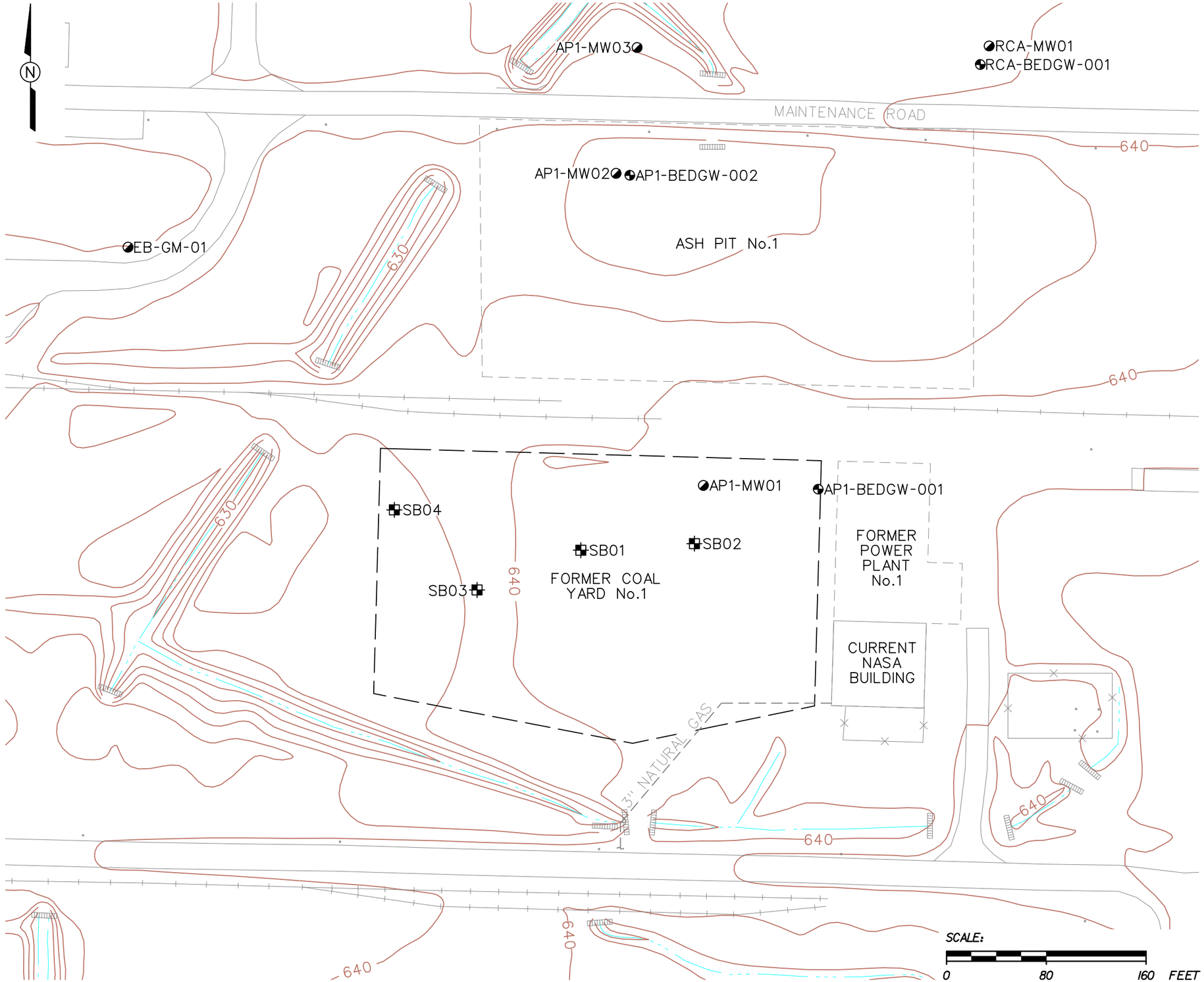


Figure 1-3
Coal Yard No. 1, Circa 1958 Photo (view is to the South)



LEGEND:

- OVERBURDEN MONITORING WELL (SCREENED IN SHALE)
- BEDROCK MONITORING WELL (SCREENED IN LIMESTONE)
- 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 2-1
GENERAL SITE FEATURES OF COAL YARD No.1 WITH SITE TOPOGRAPHY AND SAMPLE LOCATIONS

ASH PIT 1 AND ASH PIT 3 SCR ADDENDUM FOR COAL YARD No.1
FORMER PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION
SANDUSKY, OHIO

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APPENDIX A

SOIL BORING SAMPLE COLLECTION LOGS

Shaw™
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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB01
Sample Number: CY0001
Sample Name: PB11-SS-CY1-SB01-CY0001-(0-1)-REG
Sampling Method: HA
Sample Type: SS *Sample Purpose:* REG
Sampling Equip: Stainless Steel bucket auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: ~~EW 1105~~ 1100
Start Depth: ~~EW 0.2'~~ 0.5'
End Depth: ~~EW 1.2'~~ 1.5'
Sample Matrix: SOIL

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/EW/KB

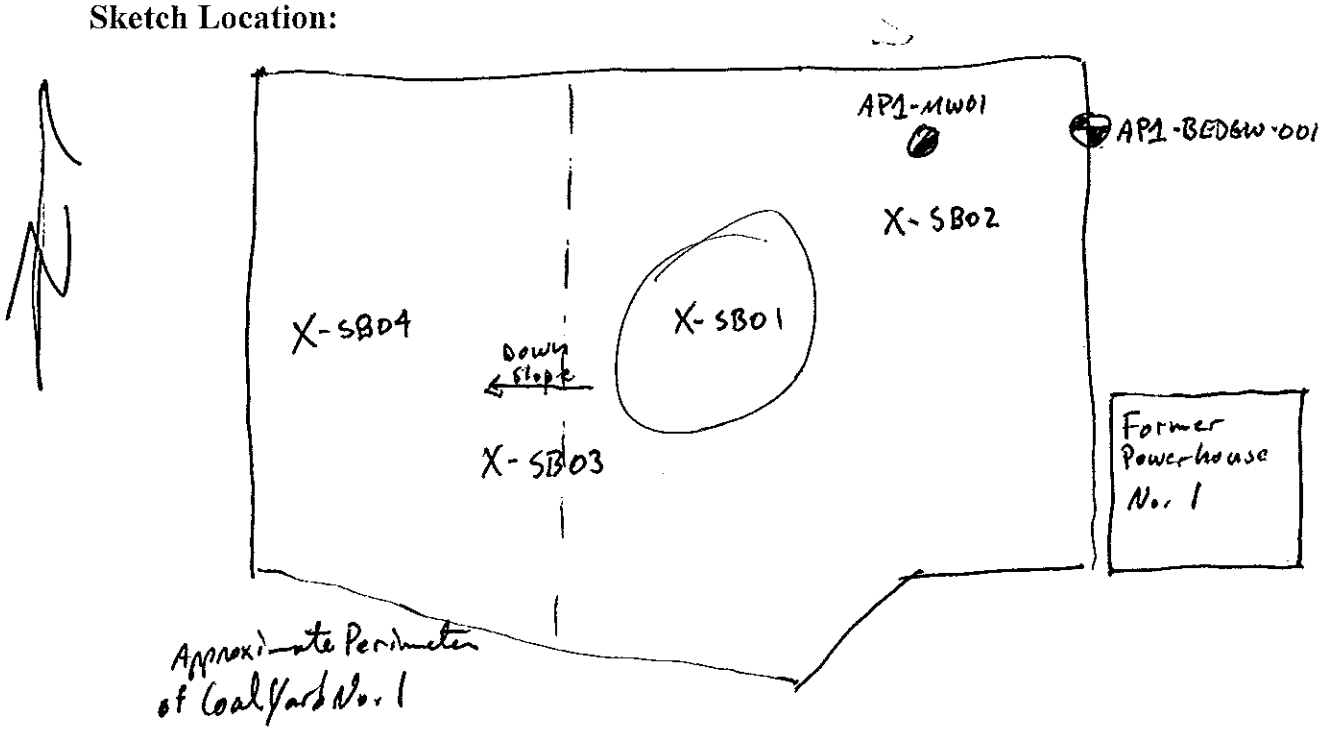
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM
TOC	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: 12-20-11 *Reviewed BY / Date:* 1/23/2012

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB01
Sample Number: CY0002
Sample Name: PB11-DS-CYA-SB01-CY0002-~~(0-1)~~ 3-5'-REG
Sampling Method: SS
Sample Type: DS *Sample Purpose:* REG
Sampling Equip: Stainless Steel bucket auger,

Task: GMA_OCT2011
Collection Date: ~~12-20-11~~ 12-20-11
Collection Time: ~~1119~~ 1115
Start Depth: ~~3'~~ 3'
End Depth: ~~8'~~ 5'
Sample Matrix: SOIL
Sample Team: GW/~~SB~~ GW/KB

QC Partners:
(TB) (ER) (FB)

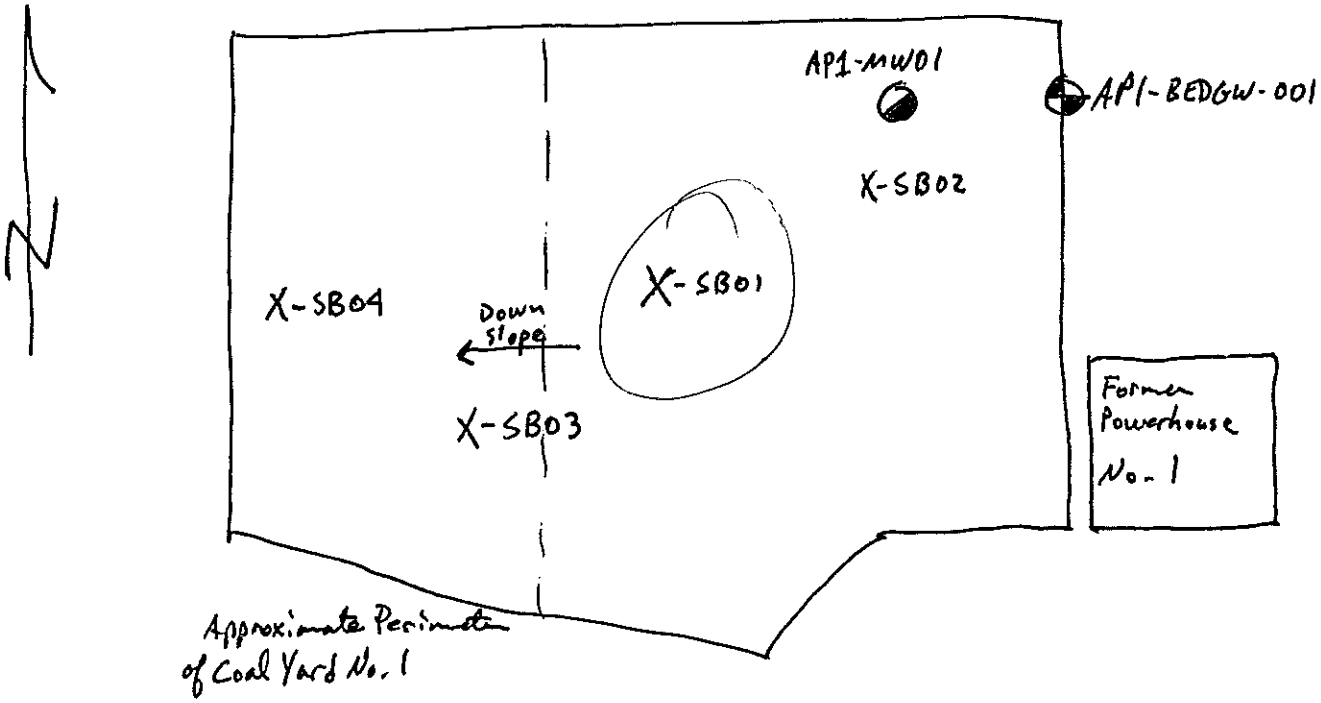
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: L. W. Weaver 12-20-11 *Reviewed BY / Date:* Edward [illegible] 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111 ACCT

Location Code: CY1-SB01
Sample Number: CY0003
Sample Name: PB11-DS-CY1-SB01-CY0003-(8-10)-REG
Sampling Method: SS
Sample Type: DS *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: ~~12-19-11~~ 12-20-11
Collection Time: ~~1140~~ 1145
Start Depth: 8'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

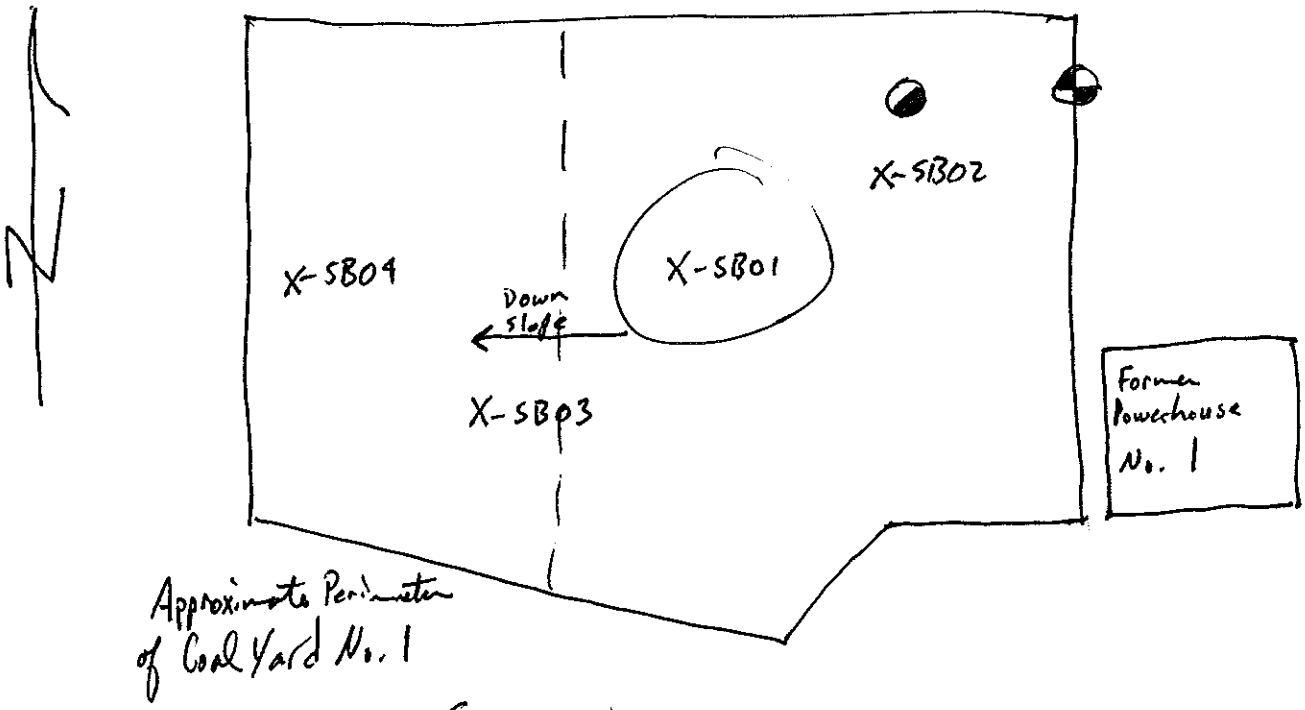
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E. W. Weaver 12-2011

Reviewed BY / Date: Edward S. Nixon 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB02
Sample Number: CY0004
Sample Name: PB11-SS-CY1-SB02-CY0004-(0-1)-REG
Sampling Method: HA
Sample Type: SS *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1000
Start Depth: 0.3
End Depth: 1.3
Sample Matrix: SOIL
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

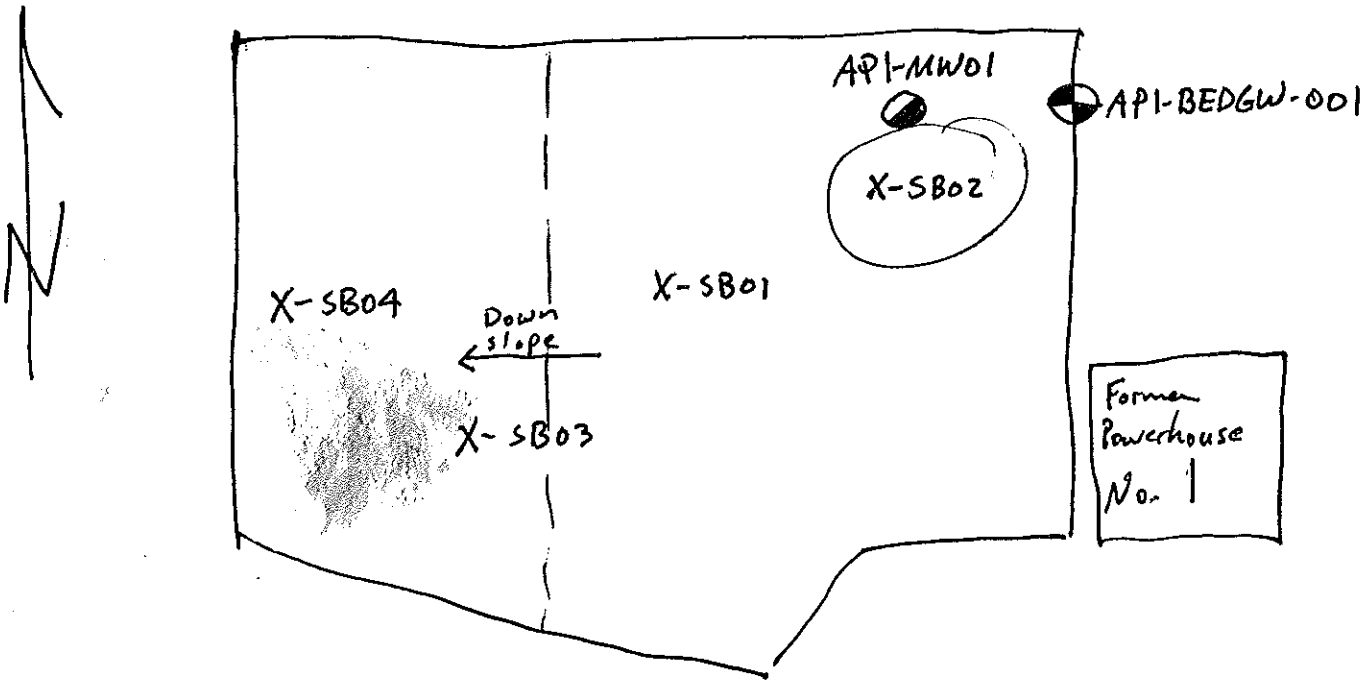
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: 12-20-11 *Reviewed BY / Date:* 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB02
Sample Number: CY0005
Sample Name: PB11-DS-CY1-SB02-CY0005-(3-5)-REG
Sampling Method: SS
Sample Type: DS *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1015
Start Depth: 3'
End Depth: 5'
Sample Matrix: SOIL
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

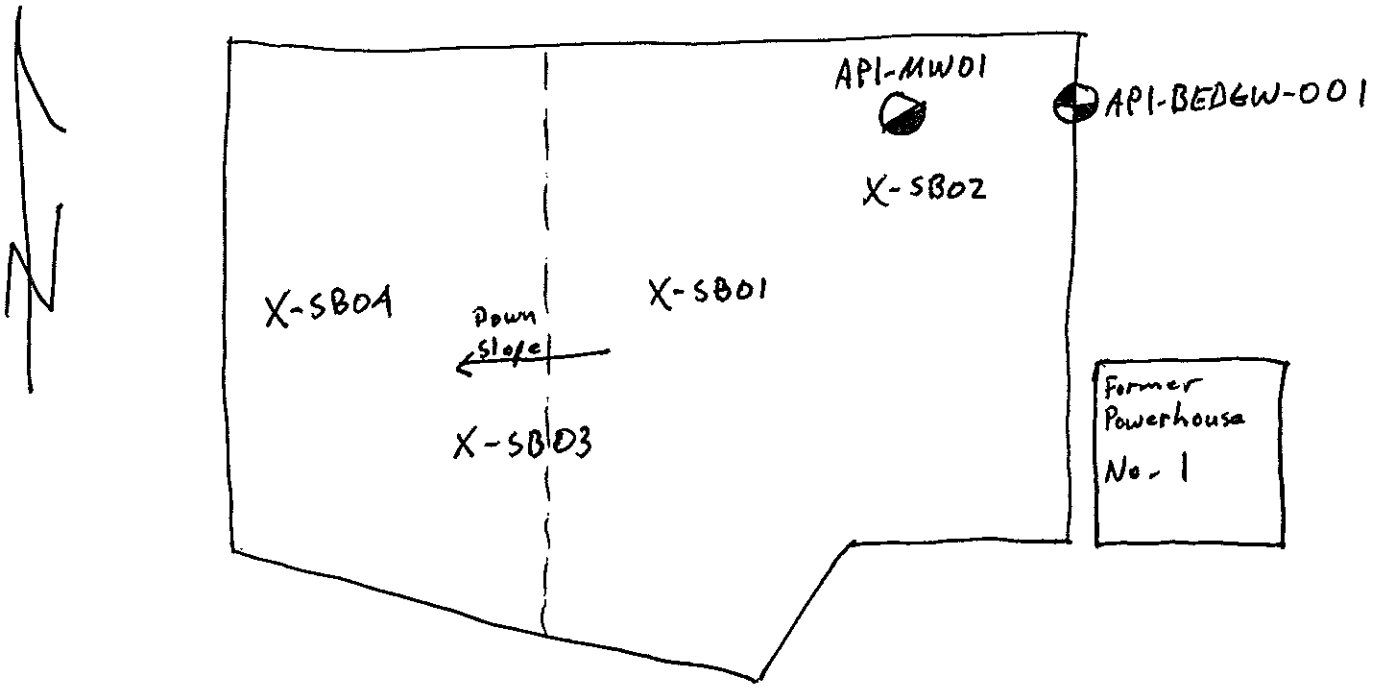
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: 12-20-11 *Reviewed BY / Date:* 1-23-12

Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB02

Sample Number: CY0006

Sample Name: PB11-DS-CY1-SB02-CY0006-(8-10)-REG

Sampling Method: SS

Sample Type: DS *Sample Purpose:* REG

Sampling Equip: Stainless Steel Bucket Auger

QC Partners:

(TB) (ER) (FB)

Task: GMA_OCT2011

Collection Date: 12-20-11

Collection Time: 1042

Start Depth: 8'

End Depth: 10'

Sample Matrix: SOIL

Sample Team: EW/KB

ERPIMS Values:

Sacode:

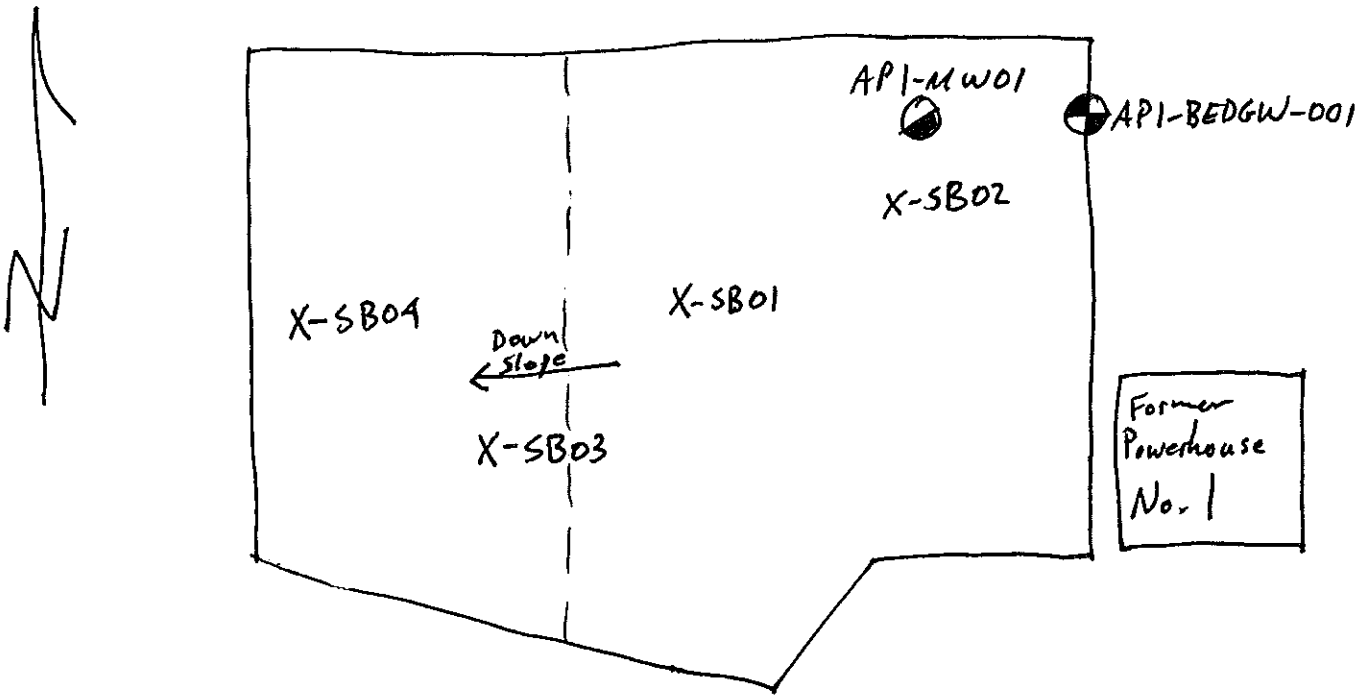
Lot Control#:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

Comments:

Sketch Location:



Logged BY / Date: 12-20-11 *Reviewed BY / Date:* 1-23-12

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Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB03
Sample Number: CY0007
Sample Name: PB11-SS-CY1-SB03-CY0007-(0-1)-REG
Sampling Method: HA
Sample Type: SS *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1155
Start Depth: 0.5'
End Depth: 1.5'
Sample Matrix: SOIL
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

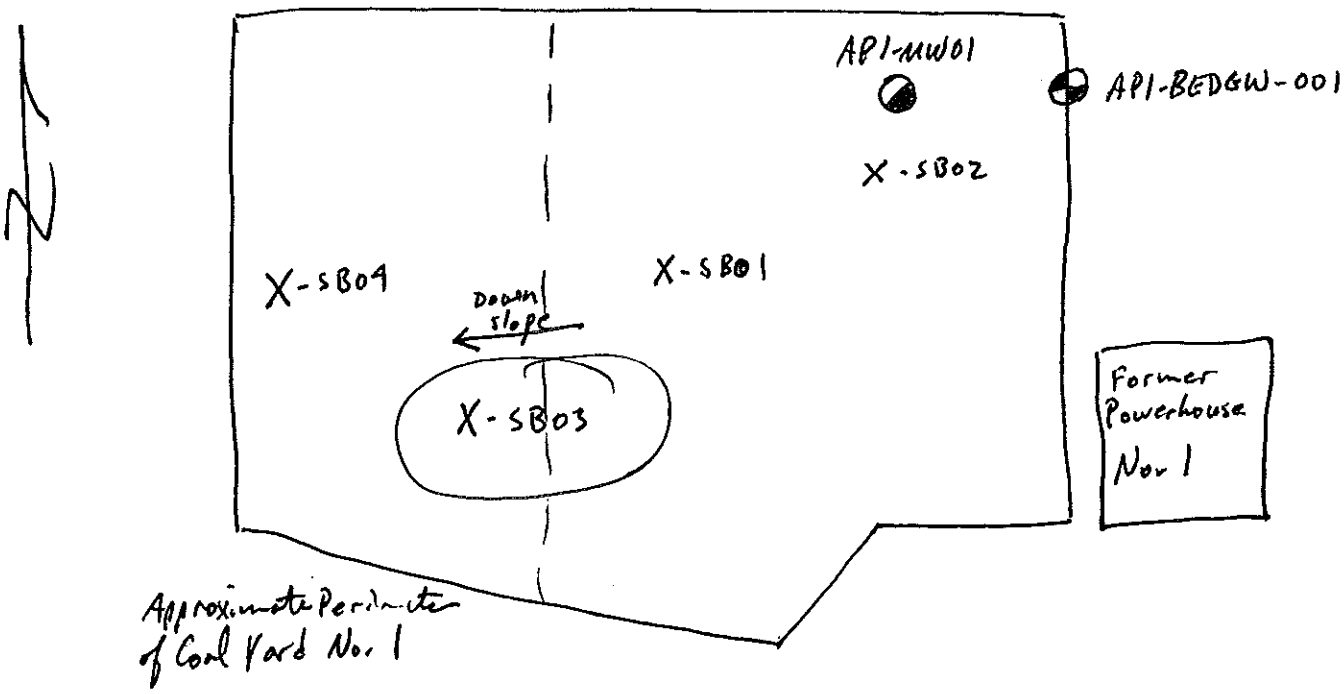
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: Eric W. Weaver 12-20-11 *Reviewed BY / Date:* Edward S. Weaver 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB03
Sample Number: CY0008
Sample Name: PB11-DS-CY1-SB03-CY0008-(3-5)-REG
Sampling Method: SS
Sample Type: DS *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1205
Start Depth: 3'
End Depth: 5'
Sample Matrix: SOIL

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

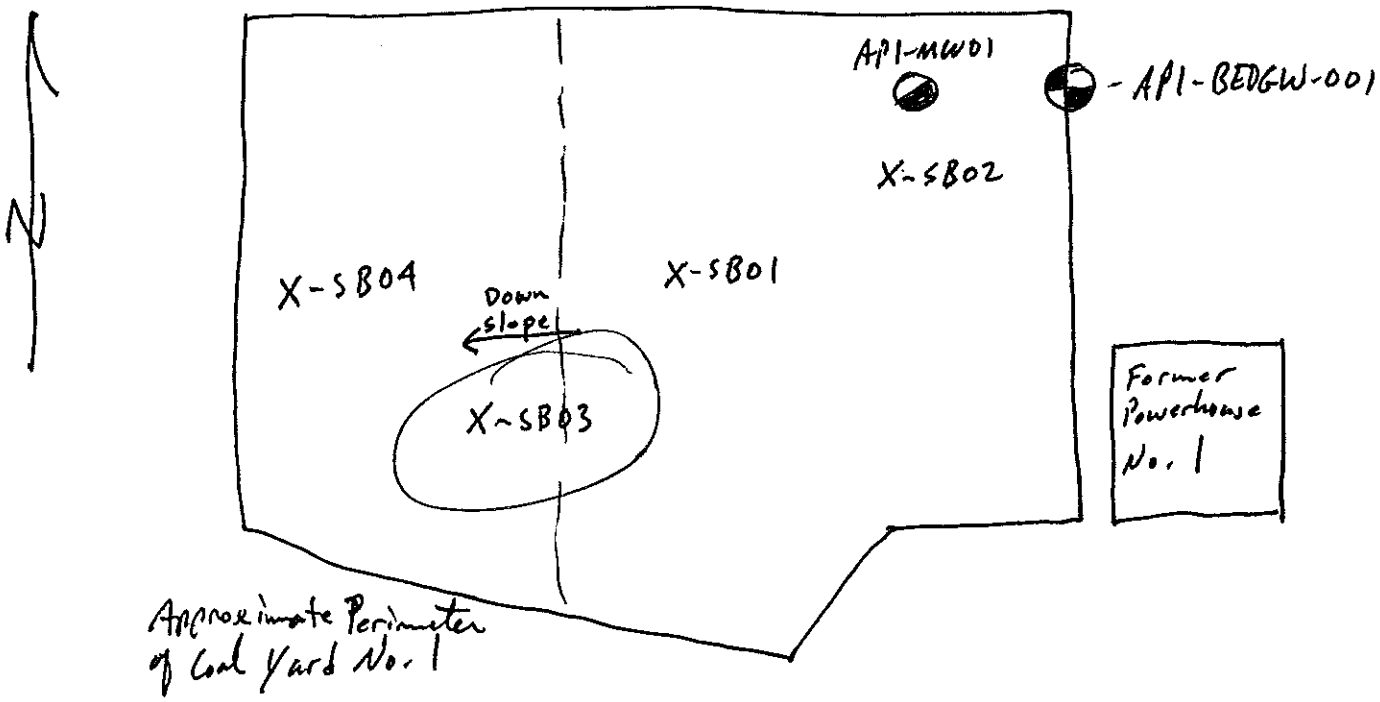
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also collected FD (CY0009) and FS (CY0010) at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 12-20-11

Reviewed BY / Date: Edward Scribner 1-23-12

Shaw E & I, Inc.

Sample Collection Log

132457 PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111 ACCT

Location Code: **CY1-SB03**

Sample Number: **CY0009**

Sample Name: **PB11-DS-CY1-SB03-CY0009-(3-5)-FD**

Sampling Method: **SS**

Sample Type: **DS** *Sample Purpose:* **FD**

Sampling Equip: Stainless Steel Bucket Auger

QC Partners:

(TB) (ER) (FB)

Task: **GMA_OCT2011**

Collection Date: 12-20-11

Collection Time: 1205

Start Depth: 3'

End Depth: 5'

Sample Matrix: **SOIL**

Sample Team: EW/KB

ERPIMS Values:

Sacode:

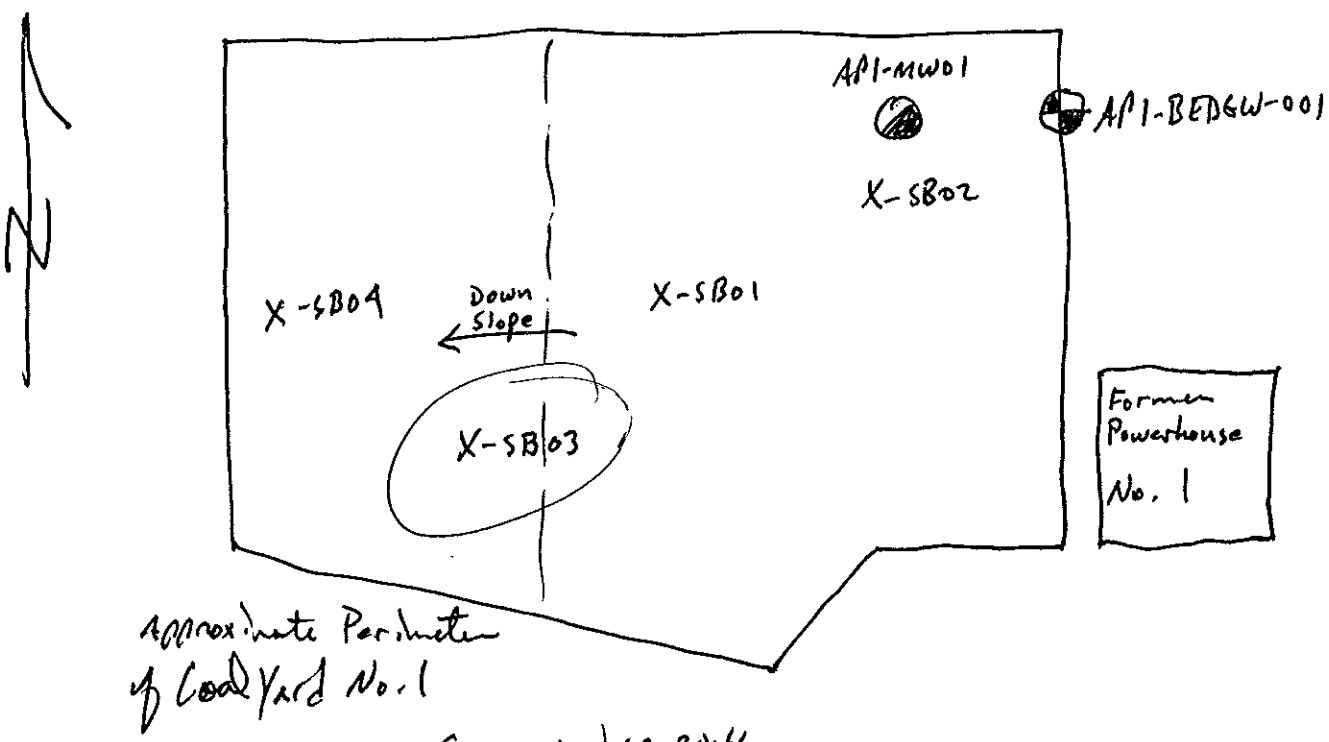
Lot Control#:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

Comments: Also collected regular sample (CY0008) and FS (CY0010) at this location.

Sketch Location:



Logged BY / Date: Eric W. Power 12-20-11

Reviewed BY / Date: Edward S. Wilson 1-23-12

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Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111TA

Location Code: CY1-SB03
Sample Number: CY0010
Sample Name: PB11-DS-CY1-SB03-CY0010-(3-5)-FS
Sampling Method: SS
Sample Type: DS *Sample Purpose:* FS
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1205
Start Depth: 3'
End Depth: 5'
Sample Matrix: SOIL
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

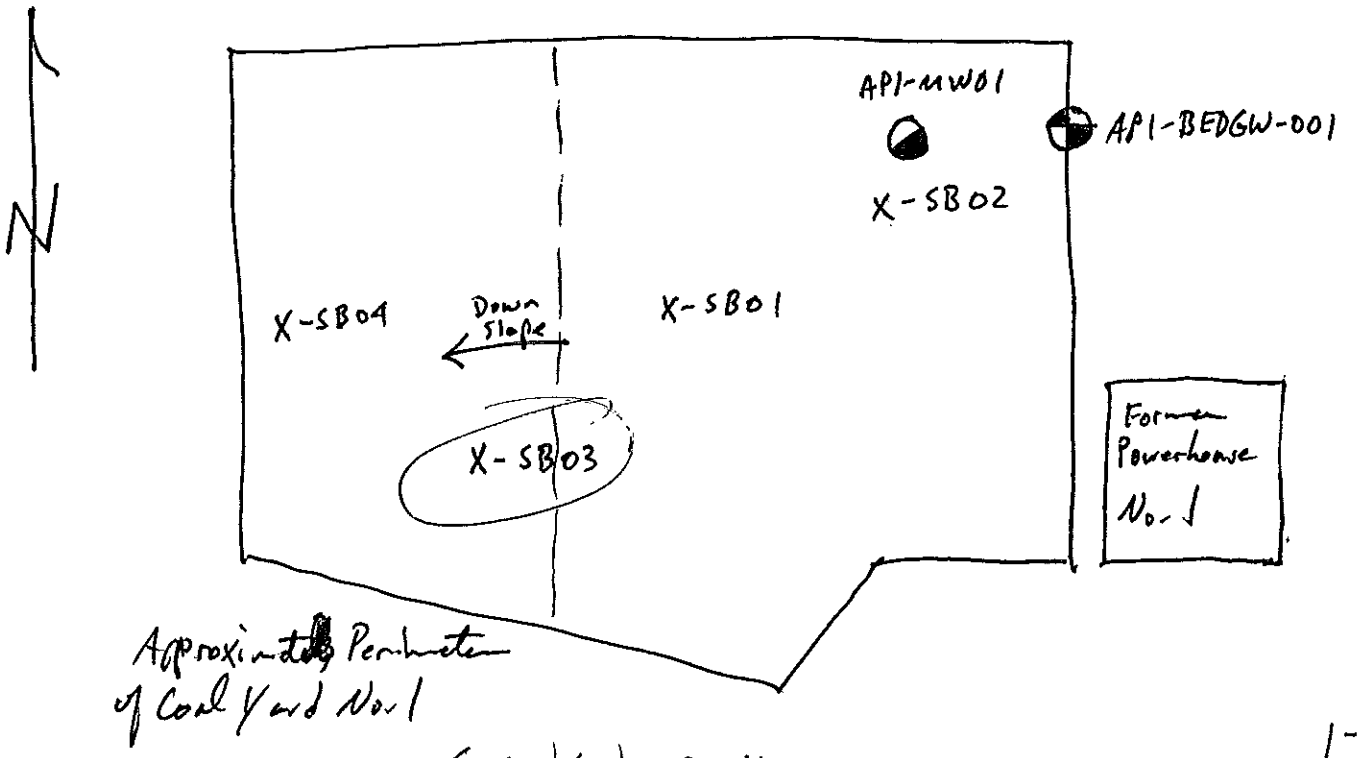
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	1	4	oz	CWM
METALS3	N	B	1	8	oz	CWM
PCB3	N	B	1	8	oz	CWM
SEMIVOLATILES3	N	B	1	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also collected regular sample (CY0008) and FD (CY0009) at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 12-20-11 *Reviewed BY / Date:* Edward S. Meaux 1-23-12

Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111 ACCT

Location Code: CY1-SB03

Sample Number: CY0011

Sample Name: PB11-DS-CY1-SB03-CY0011-(8-10)-REG

Sampling Method: SS

Sample Type: DS *Sample Purpose:* REG

Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011

Collection Date: 12-20-11

Collection Time: ~~EW 1242~~ 1225

Start Depth: ~~EW 6.0'~~ 8'

End Depth: ~~EW 8.0'~~ 10'

Sample Matrix: SOIL

Sample Team: EW/KB

QC Partners:

(TB) (ER) (FB)

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

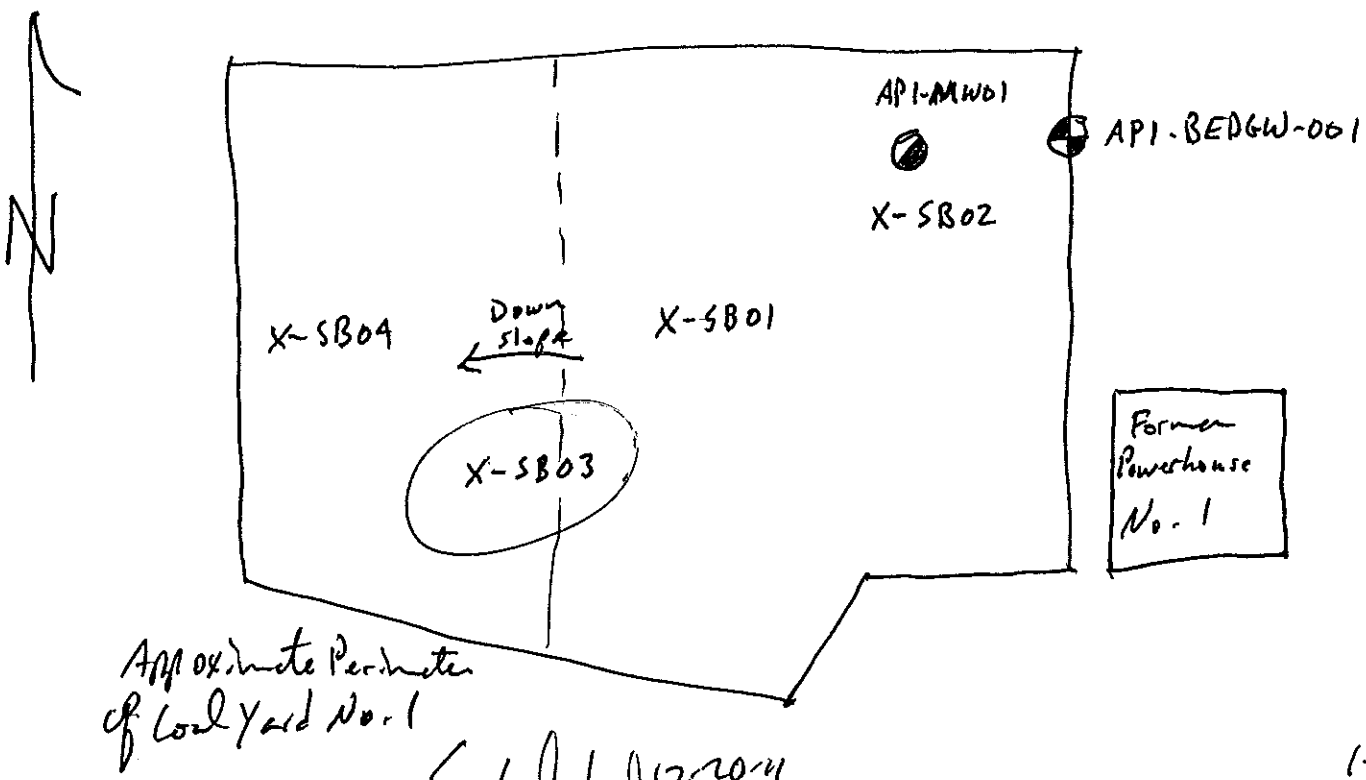
ERPIMS Values:

Sacode:

Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E.W. Weaver 12-20-11 *Reviewed BY / Date:* Edward Sanborn 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB04
Sample Number: CY0012
Sample Name: PB11-SS-CY1-SB04-CY0012-(0-1)-REG
Sampling Method: HA
Sample Type: SS *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1242
Start Depth: 1.0'
End Depth: 2.0'
Sample Matrix: SOIL
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

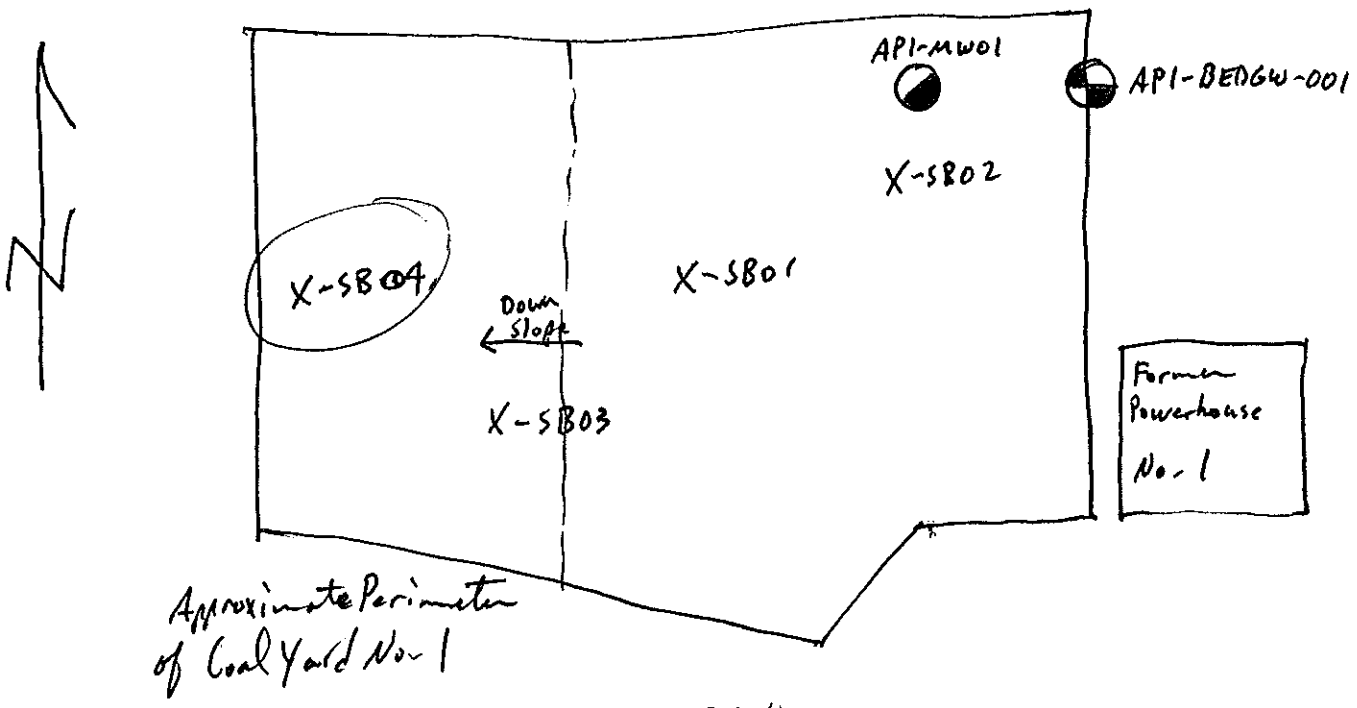
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: ~~Also collected MS (CY0013MS) and MSD (CY0013MSD) at this location.~~ EW

Sketch Location:



Logged BY / Date: E. W. Weaver 12-20-11 *Reviewed BY / Date:* Edward [illegible] 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: **CY1-SB04**
Sample Number: **CY0013**
Sample Name: **PB11-DS-CY1-SB04-CY0013-(3-5)-REG**
Sampling Method: **SS**
Sample Type: **DS** *Sample Purpose:* **REG**
Sampling Equip: Stainless Steel Bucket Auger

Task: **GMA_OCT2011**
Collection Date: 12-20-11
Collection Time: 1250
Start Depth: 3'
End Depth: 5'
Sample Matrix: **SOIL**
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

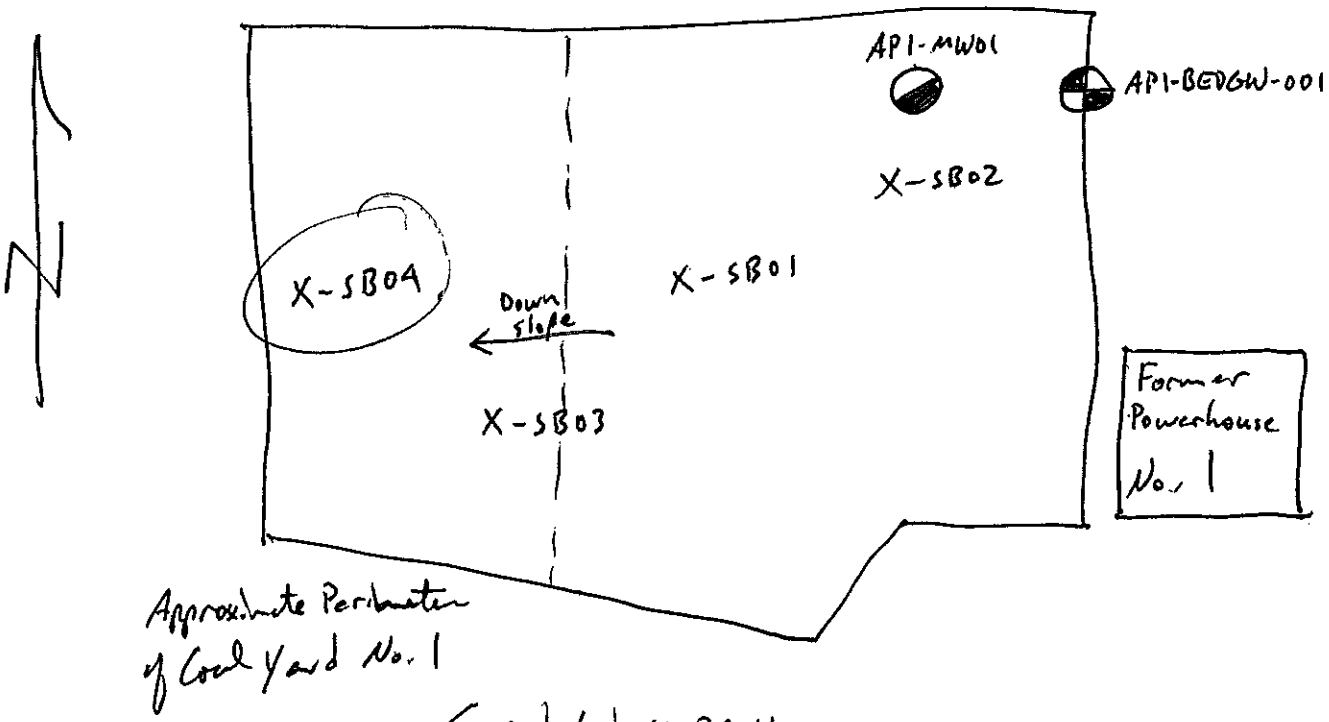
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also collected MS (CY0013MS) and MSD (CY0013MSD) at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver 12-20-11 *Reviewed BY / Date:* Edward [illegible] 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS
Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB04
Sample Number: CY0013MS
Sample Name: PB11-DS-CY1-SB04-CY0013MS-(3-5)-MS
Sampling Method: SS
Sample Type: DS *Sample Purpose:* MS
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1250
Start Depth: 3'
End Depth: 5'
Sample Matrix: SOIL

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

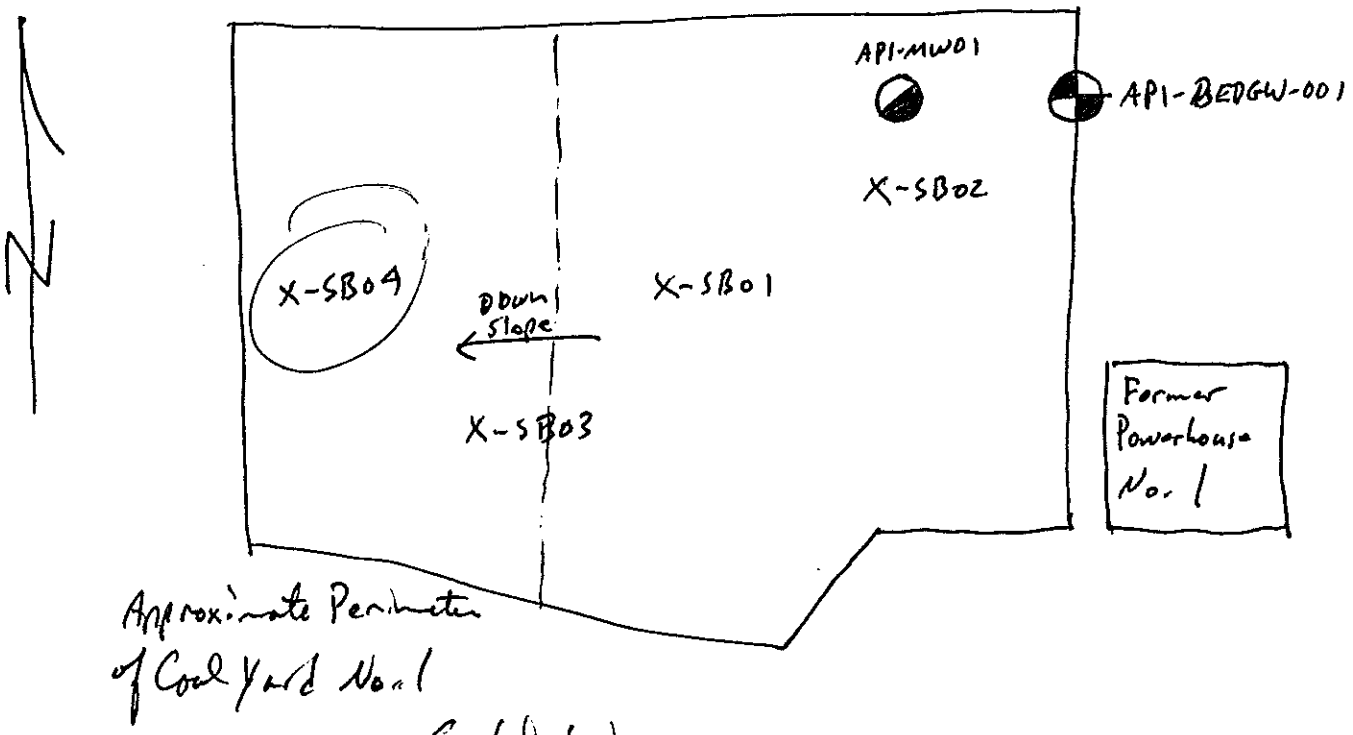
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also collected regular sample (CY0013) and MSD (CY0013MSD) at this location.

Sketch Location:



Logged BY / Date: E. W. Weaver *Reviewed BY / Date:* [signature] 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB04
Sample Number: CY0013MSD
Sample Name: PB11-DS-CY1-SB04-CY0013MSD-(3-5)-MSD
Sampling Method: SS
Sample Type: DS *Sample Purpose:* MSD
Sampling Equip: Stainless Steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1250
Start Depth: 3'
End Depth: 5'
Sample Matrix: SOIL
Sample Team: EW/KB

QC Partners:
(TB) (ER) (FB)

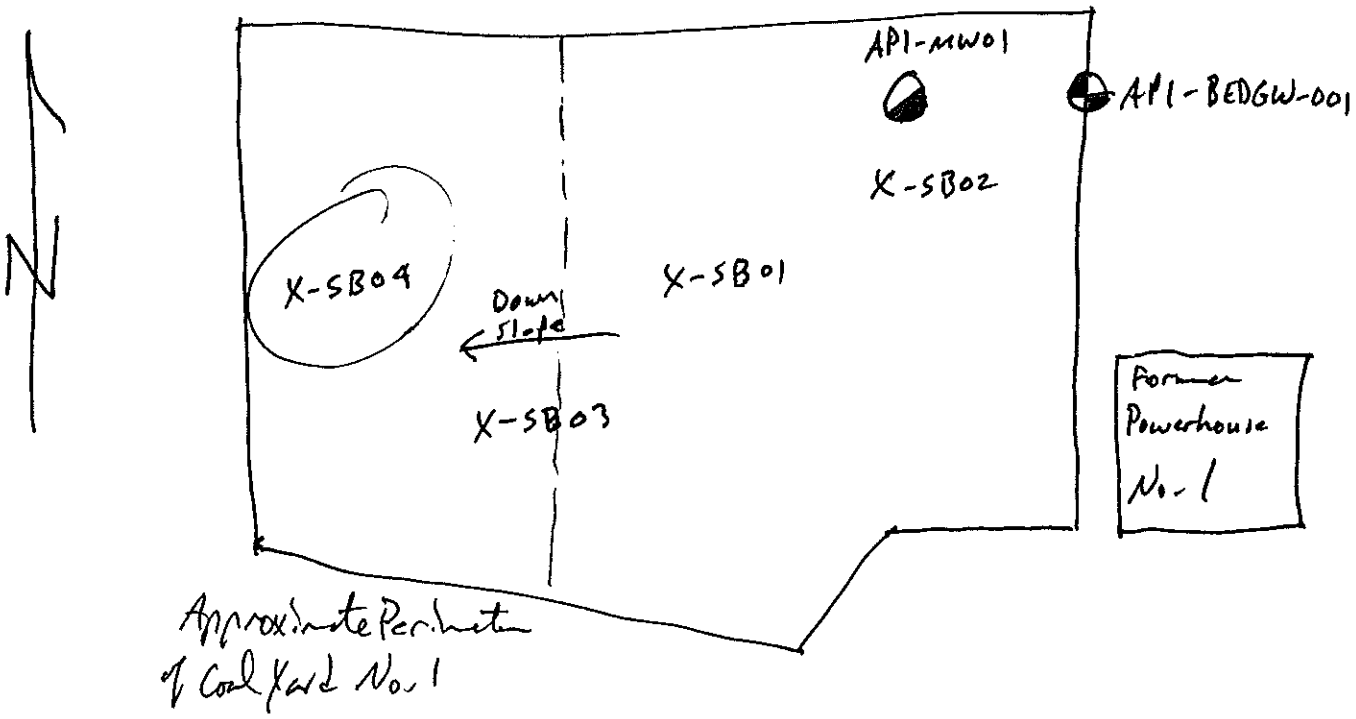
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
PCB3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments: Also collected regular sample (CY0013) and MS (CY0013MS) at this location.

Sketch Location:



Logged BY / Date: E.W. Weaver 12-20-11 *Reviewed BY / Date:* Edward E. Weaver 1-23-12

Shaw™
Shaw E & I, Inc.

Sample Collection Log

132457 - PLUM BROOK ORDNANCE WKS

Manager: Steve Downey

RFA / COC Number: PB122111ACCT

Location Code: CY1-SB04
Sample Number: CY0014
Sample Name: PB11-DS-CY1-SB04-CY0014-(8-10)-REG
Sampling Method: SS
Sample Type: DS *Sample Purpose:* REG
Sampling Equip: Stainless steel Bucket Auger

Task: GMA_OCT2011
Collection Date: 12-20-11
Collection Time: 1340
Start Depth: 8'
End Depth: 10'
Sample Matrix: SOIL

QC Partners:
(TB) (ER) (FB)

Sample Team: EW/KB

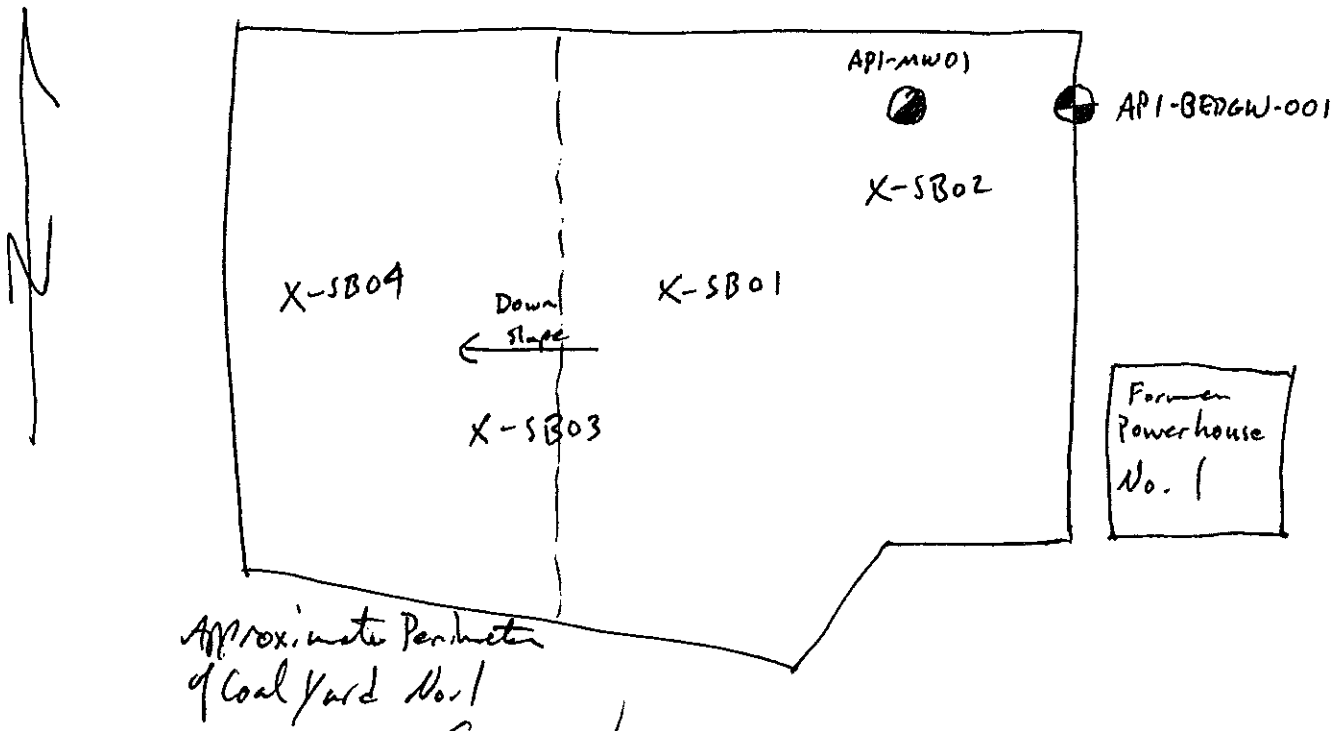
Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
EXPLOSIVES	N	A	2	8	oz	CWM
METALS3	N	A	2	8	oz	CWM
SEMIVOLATILES3	N	A	2	8	oz	CWM

ERPIMS Values:
Sacode:
Lot Control#:

Comments:

Sketch Location:



Logged BY / Date: E W Weaver

Reviewed BY / Date: Edward E Weaver 1-23-12

APPENDIX B

SOIL BORING HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE DRILL LOGS

HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	CY1-SB01
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	NA
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	NA
6. MANUFACTURER'S DESIGNATION OF DRILL	NA
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2" Stainless Steel Bucket Auger 3" Stainless Steel Bucket Auger
8. HOLE LOCATION	Coal Yard #1
9. SURFACE ELEVATION	640.31 N-623312.31 E-1918693.70
10. DATE STARTED	12-20-11
11. DATE COMPLETED	12-20-11
12. OVERBURDEN THICKNESS	>10'
15. DEPTH GROUNDWATER ENCOUNTERED	0.5'
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

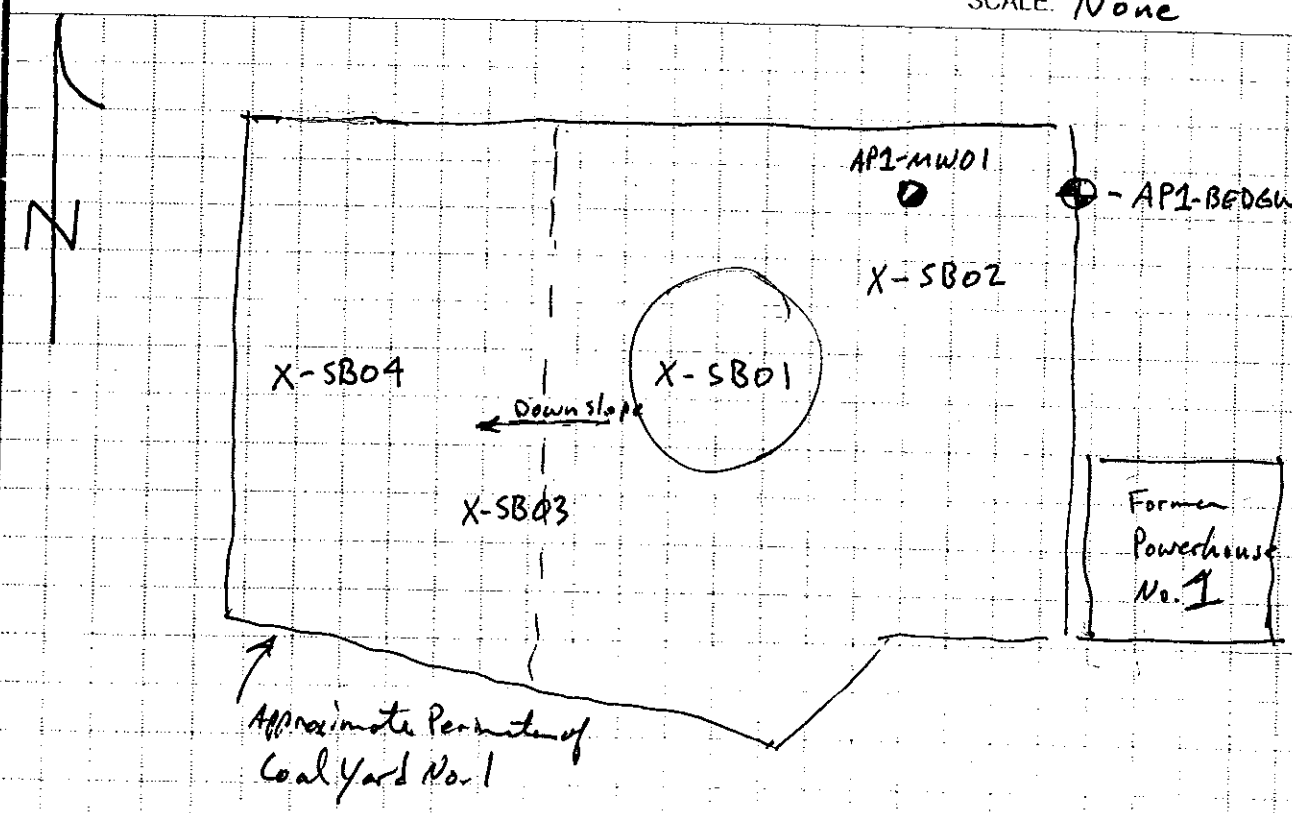
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	✓	Explosives	SVOC's	PCB's	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	—	—	E. W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. CY1-SB01

DAC

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: CY1-SB01

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	~~Geotech. Sample or Core Box No.~~	Analytical Sample No.	Recovery (ft)	Remarks
		Black (10YR 2/1) silt with sand, coal, moist, soft. 0.5'	ML		Time			
	1	Dark yellowish brown (10YR 4/6) fine grain sand with silt, wet, loose. 3'	SM		1100	0.5'-1.5' CY0001		
	3	Gray (10YR 5/1) silt with clay, wet, soft. 6'	ML		1115	3.0'-5.0' CY0002		
	6	Gray (10YR 5/1) clay with sand, moist, stiff.	CL		1145	8.0'-10.0' CY0003		
	10	Total Depth = 10 Ft						

Project: PBOW

Hole Number: CY1-SB01

HTRW DRILLING LOG

DKR

1. COMPANY NAME	Shaw E+I
DISTRICT	Nashville
HOLE NUMBER	CY1-SB02
2. DRILL SUBCONTRACTOR	NA
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	NA
6. MANUFACTURER'S DESIGNATION OF DRILL	NA
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2" Stainless Steel Bucket Auger 3" Stainless Steel Bucket Auger
8. HOLE LOCATION	Coal Yard #1
9. SURFACE ELEVATION	640.42 N-623317.59 E-1918784.80
10. DATE STARTED	12-20-11
11. DATE COMPLETED	12-20-11
12. OVERBURDEN THICKNESS	>10'
15. DEPTH GROUNDWATER ENCOUNTERED	1.5'
13. DEPTH DRILLED INTO ROCK	0
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
14. TOTAL DEPTH OF HOLE	10'
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

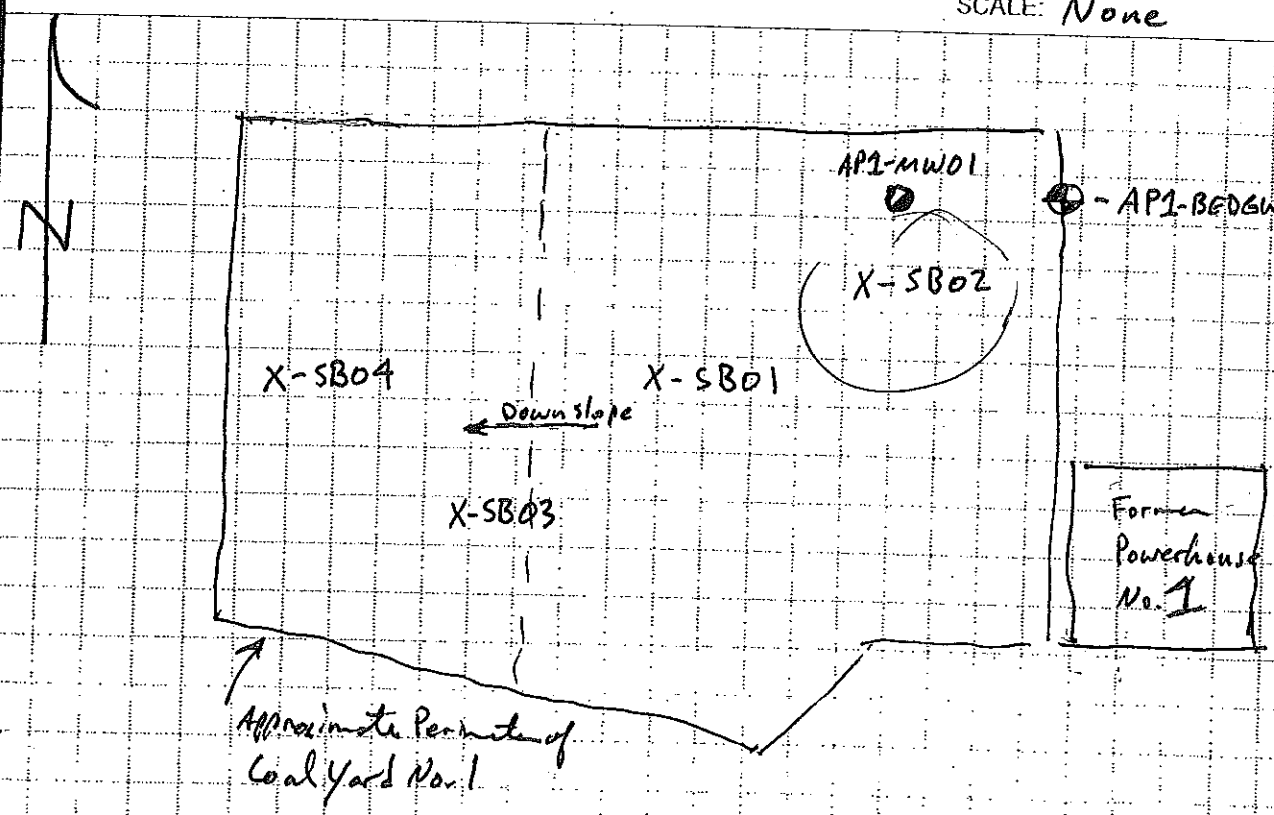
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	✓	Explosives	SVOC's	PCB's	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	—	—	Eric W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. CY1-SB02

DKR

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: CYI-SB02

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	~~Geotech. Sample or Core Box No.~~	Analytical Sample No.	Recovery (ft)	Remarks
		Very dark gray (10YR 3/1) silt with sand, coal, moist, soft 0.3'	ML		Time			
		Yellowish brown (10YR 5/6) very fine grain sand with silt, moist, loose.	SM		1000	0.3'-1.3' CY0004		
	1	—wet						
	2							
	3					3.0'-5.0' CY0005		
	4	4'			1015			
		Black (10YR 2/1) silt with clay, sand, cinders, wet, soft.	ML					
	5							
	6	6'						
		Olive brown (2.5Y 4/3) silt with sand, clay, moist, stiff.						
	7							
	8	8'						
		Dark yellowish brown (10YR 4/6) clay with silt, moist, stiff.	CL			8.0'-10.0' CY0006		
	9				1042			
	10	Total Depth = 10 ft						

Project: PBOW

Hole Number: CYI-SB02

DAK

HTRW DRILLING LOG

1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	NA
DISTRICT	Nashville
HOLE NUMBER	CYI-SB03
SHEET / SHEETS	1 OF 2
3. PROJECT	PBOW
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	NA
6. MANUFACTURER'S DESIGNATION OF DRILL	NA
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2" Stainless Steel Bucket Auger 3" Stainless Steel Bucket Auger
8. HOLE LOCATION	Coal Yard #1
9. SURFACE ELEVATION	636.99 N-623280.45 E-1918640.43
10. DATE STARTED	12-20-11
11. DATE COMPLETED	12-20-11
12. OVERBURDEN THICKNESS	>10'
13. DEPTH DRILLED INTO ROCK	0
14. TOTAL DEPTH OF HOLE	10'
15. DEPTH GROUNDWATER ENCOUNTERED	None
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—

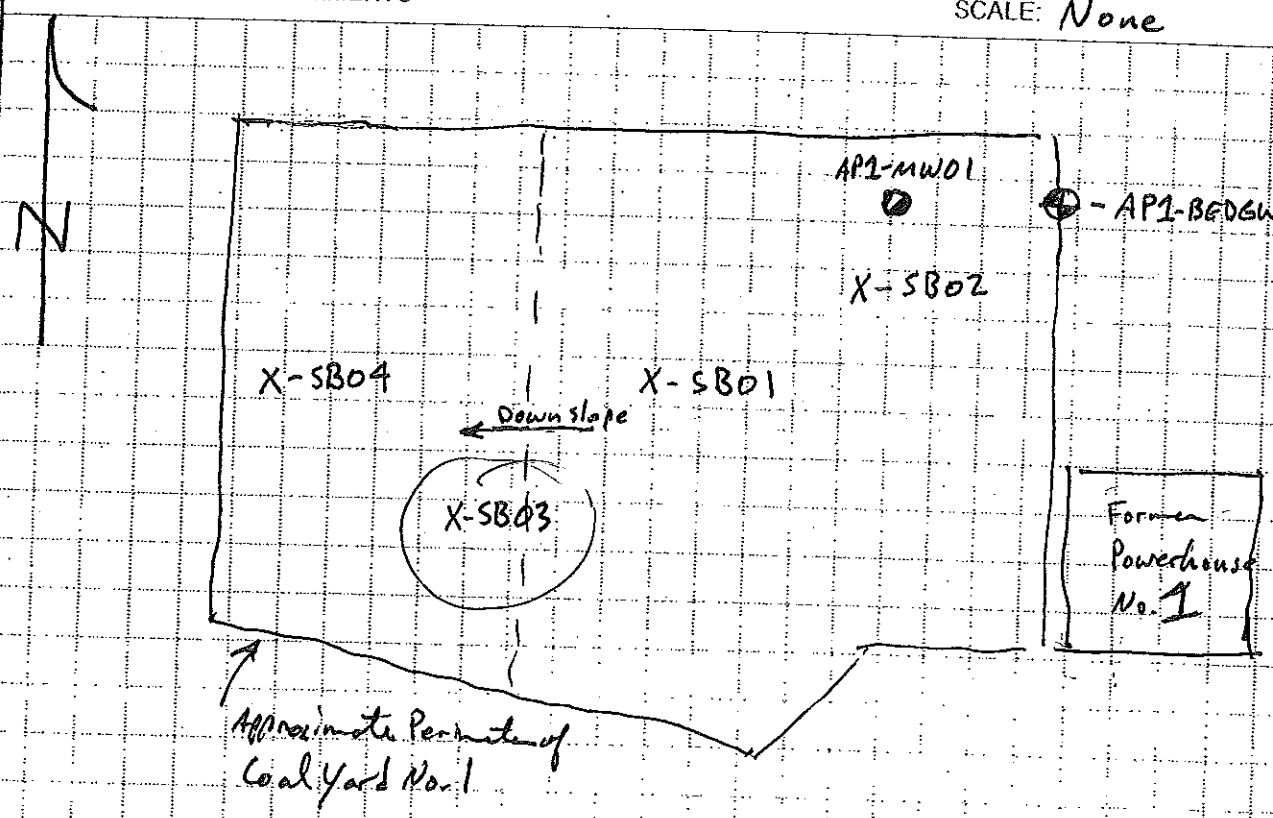
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
—	—	—	—

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
✓	—	✓	Explosives	SVOC's	~~PCB's~~	— %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
	✓	—	—	Eric W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. CYI-SB03

DKK

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: CY1-SB03

Project: PBOW

Geologist: E. Weaver

Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	~~Geotech. Sample or Core Box No.~~	Analytical Sample No.	Recovery (ft)	Remarks
		Black (10YR 2/1) silt with clay, coal moist, soft. 0.5'	ML		Time			
		Very dark gray (10YR 3/1) silt with clay, sand, moist, medium stiff. 3'			1155	0.5'-1.5'		
		Gray (10YR 6/1) clay with sand, moist, stiff. 5'	CL		1205	3.0'-5.0'		
		Dark gray (10YR 4/1) clay with sand, moist, stiff.			1225	8.0-10.0'		
	10	Total Depth - 10 ft						

Project: PBOW

Hole Number: CY1-SB03

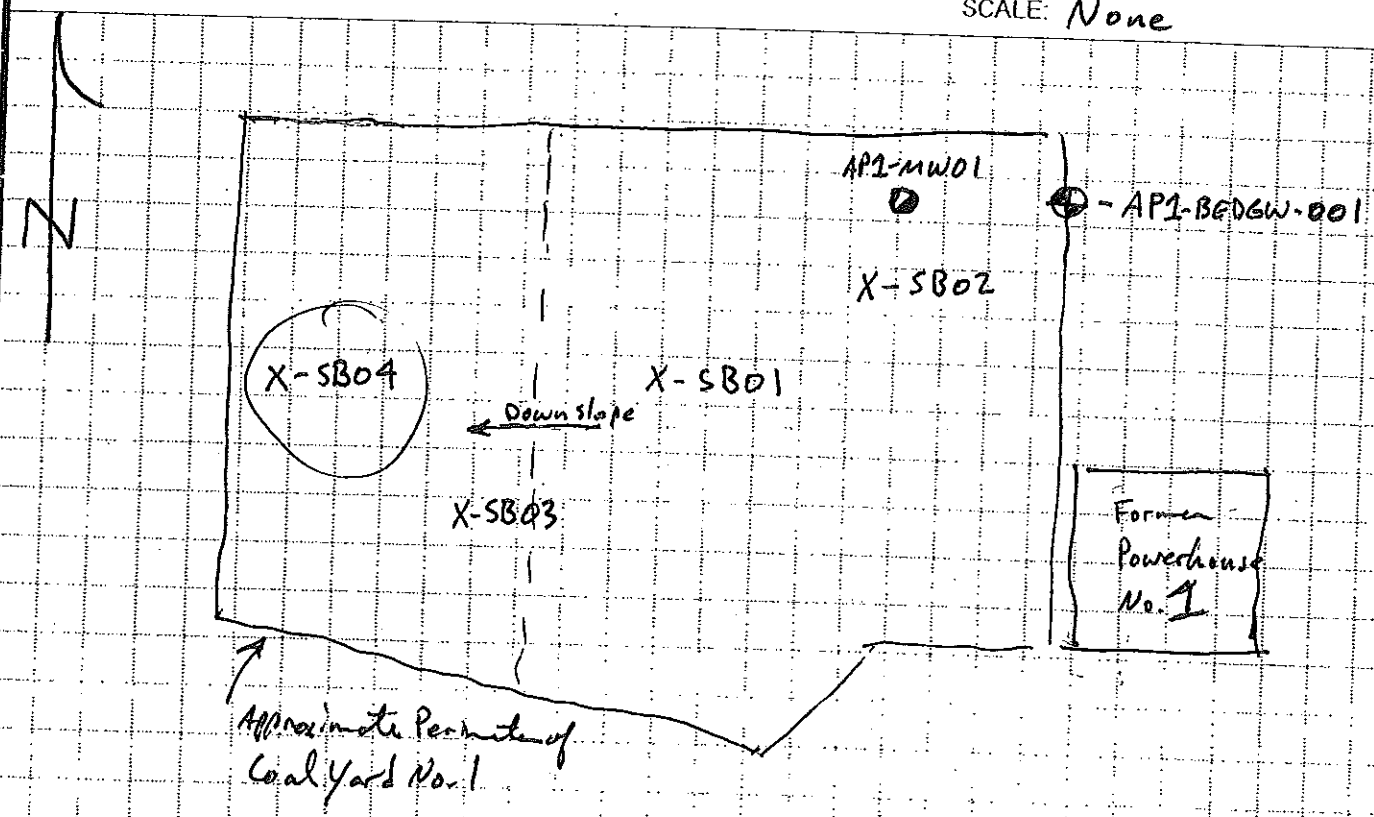
DEE

HTRW DRILLING LOG

DISTRICT	Nashville
HOLE NUMBER	CY1-SB04
SHEET / SHEETS	1 of 2
1. COMPANY NAME	Shaw E+I
2. DRILL SUBCONTRACTOR	NA
3. PROJECT	PBOW
4. LOCATION	Sandusky, Ohio
5. NAME OF DRILLER	NA
6. MANUFACTURER'S DESIGNATION OF DRILL	NA
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	2" Stainless Steel Bucket Auger; 3" Stainless Steel Bucket Auger
8. HOLE LOCATION	Coal Yard #1
9. SURFACE ELEVATION	636.46 N-623344.70 E-1918544.11
10. DATE STARTED	12-20-11
11. DATE COMPLETED	12-20-11
12. OVERBURDEN THICKNESS	>10'
13. DEPTH DRILLED INTO ROCK	0
14. TOTAL DEPTH OF HOLE	10
15. DEPTH GROUNDWATER ENCOUNTERED	None
16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED	—
17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)	—
18. GEOTECHNICAL SAMPLES	—
DISTURBED	—
UNDISTURBED	—
19. TOTAL NUMBER OF CORE BOXES	—
20. SAMPLES FOR CHEMICAL ANALYSIS	✓
VOC	—
METALS	✓
OTHER (SPECIFY)	Explosives
OTHER (SPECIFY)	SVOC's
OTHER (SPECIFY)	PCB's
21. TOTAL CORE RECOVERY	— %
22. DISPOSITION OF HOLE	
BACKFILLED	✓
MONITORING WELL	—
OTHER (SPECIFY)	—
23. SIGNATURE OF INSPECTOR	Eric W. Weaver

LOCATION SKETCH/COMMENTS

SCALE: None



PROJECT PBOW

HOLE NO. CY1-SB04

DKL

Shaw
Shaw E&I, Inc.

HTRW DRILLING LOG (continuation sheet)

Hole Number: CY1-SB04

Project: PBOW | Geologist: E. Weaver | Sheet 2 of 2 Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS	Field Screening Results (ppm)	~~Geotech. Sample or Core Box No.~~	Analytical Sample No.	Recovery (ft)	Remarks
		Black (10YR 2/1) Silt with clay, coal, sand, moist, soft.	ML		Time			
	1					1.0'-2.0' CY0012		
		1.5'						
		Dark yellowish brown (10YR 4/6) fine grain sand with silt, moist, loose.	SM		1242			
	2							
	3	3'						
		Gray (10YR 6/1) clay with sand, moist, moist, stiff.	CL			3.0'-5.0' CY0013 CY0013MS CY0013MSD		
	4				1250			
	5	5'						
		Dark gray (10YR 4/1) clay with sand, moist, stiff.						
	6							
	7							
	8					8.0-10.0 CY0014		
	9				1340			
	10	Total Depth = 10 ft						

Project: PBOW | Hole Number: CY1-SB04

DKK

APPENDIX C

LAND SURVEY DATA

FINAL REPORT
of
SURVEYING SERVICES PERFORMED
by
SACKS SURVEYING & MAPPING, P.C. / KUSMER & ASSOCIATES J.V.
at the
PLUMBROOK ORDNANCE WORKS, SANDUSKY, OH
for
SHAW E & I
MAY - NOVEMBER, 2011

SUMMARY OF WORK PERFORMED

Between May, 2011 and November, 2011, Sacks Surveying & Mapping, PC, in joint venture with Kusmer & Associates, Inc., surveyed a total of 255 environmental sampling locations (soil samples, soil bores, test pits, sediment samples, piezometers, and monitoring wells) throughout the Plumbrook Ordnance Works facility. Surveying was performed over the course of three separate mobilizations, described more particularly as follows:

1st Mobilization (23-27 May, 2011) - 44 survey points: Unloading Area (12 points); Sellite Area (11 points); Wastewater Treatment Plant #2 site (10 points); and TNT C Sewer Line (11 points).
2ND Mobilization (26-30 September, 2011) – 176 survey points: Wastewater Treatment Plant #2 site (4 points); TNT C Sewer Line (3 points); Steel Sewer Line (40 points); Sellite Area (23 points); Unloading Area (3 points); TNT A Sewer Line (24 points); Ash Pit #3 (3 points); and Acid Area #1 (76 points).
3RD Mobilization (7-10 November, 2011) – 35 survey points: Acid Area #1 (12 points); Sellite Area (11 points); Coal Yard #1 (4 points); Coal yard 32 (4 points); and Coal Yard #3 (4 points)

Work was performed in accordance with Shaw E & I surveying specifications under purchase orders #680616-000 OP, 680686-000 OP, 680702-000 OP, and 680711-000 OP.

KEY PERSONNEL

W. Robert Kusmer – Ohio Land Surveyor S-6754
Stanley Robert Sacks – North Carolina Surveyor L-2913
Michael A. McKibbin – North Carolina Surveyor L-4519, Hazmat Project Manager
Jeff Bucholtz – On-site Party Chief *
Paul Lewis – Survey Technician *
* all on-site personnel for this project are OSHA 29 CFR 1910.120 40-hour trained and medically monitored in accordance with Shaw E & I requirements.

FIELD PROCEDURES

All sampling locations reported below were surveyed with a Topcon GTS-235 Total Station using conventional angle and distance measurements to determine the horizontal and vertical position thereof. Survey control used meets or exceeds the standards for a Third Order, Class II horizontal and Third Order vertical survey as defined in the Standards and Specifications for Geodetic Control Networks (1984). The survey control points used in this operation were established by this firm, presently or previously (January, 2009), by direct static differential GPS observation using three Ashtech Promark II GPS receivers with reference to NGS Monument

"Sky D" as a fixed horizontal reference and NGS Monument "J-318" (a first order benchmark) as a fixed vertical reference. The horizontal datum is NAD 83(1995). The vertical datum is NGVD 29. Values were scaled to the Ohio State Plane Coordinate System (North Zone) using a combined scale and ellipsoid factor of 0.999927034.

SKY D:	J-318:
Northing (y) 196,085.494 m	Northing (y) 196,170 m +/-
Easting (x) 586,761.658 m	Easting (x) 583,400 m +/-
Orthometric Elevation 175.30 m +/-	Orthometric Elevation 182.801 m
(SKYD not used as vertical control)	(First Order Class II NGVD 29 Benchmark)

CERTIFICATION

I, Warren Robert Kusmer, Ohio Professional Surveyor #S-6754, hereby certify that the information in this survey report is true to the best of my knowledge and belief.

W Robert Kusmer

Warren Robert Kusmer,
Ohio Professional Surveyor #S-6754

12/29/2011

Date

SAMPLE LOCATIONS:

Sellite Area (May 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
176	623869.42	1916750.44	637.70	636.3	PZ-01/SB-01
190	624014.07	1916719.34	635.50	633.5	PZ-02/SB-02
188	624020.14	1916786.02	635.51	632.9	PZ-03/SB-08
178	623929.48	1916752.25	639.51	636.6	PZ-04/SB-11
184	623934.02	1916892.19	634.43	633.7	PZ-05/SB-12
182	623872.51	1916884.23	634.37	633.8	PZ-06/SB-14
186	623895.85	1916986.31	634.44	632.9	PZ-07
193	623956.38	1916636.65	637.76	634.9	PZ-08
174	623798.08	1916683.07	636.59		SB-06
173	623786.75	1916777.79	636.27		SB-07
194	623888.92	1916843.75	636.95		SB-13

Sellite Area (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1351	623784.44	1916774.54	639.23	636.3	FSB MW-01
1339	623876.91	1916738.07	638.99	635.9	FSB MW-02
1335	624104.10	1916731.84	637.31	634.5	FSB MW-03
1341	624087.55	1916684.17	634.67		FSBSB-15
1347	623629.46	1917087.66	633.09		FSBSD-01
1346	623776.17	1917073.42	631.57		FSBSD-02
1365	623907.05	1917011.31	630.62		FSBSD-03
1364	624003.39	1916967.91	630.28		FSBSD-04
1362	624042.36	1916741.69	632.46		FSBSD-05
1363	623994.37	1916632.10	630.44		FSBSD-06
1357	623902.10	1916716.24	636.31		FSBSS-01
1359	623901.30	1916753.54	636.35		FSBSS-02
1358	623885.21	1916694.10	636.85		FSBSS-03
1360	623890.92	1916784.72	636.34		FSBSS-04
1356	623857.12	1916694.62	636.61		FSBSS-05
1361	623859.54	1916784.34	636.24		FSBSS-06
1355	623830.07	1916703.62	636.60		FSBSS-07
1354	623807.59	1916713.95	636.40		FSBSS-08
1353	623801.60	1916743.43	636.21		FSBSS-09
1352	623808.70	1916775.45	636.09		FSBSS-10
1445	623865.15	1916885.40	633.95		FSBTOC-01
1446	623932.91	1916885.13	633.99		FSBTOC-02
1447	624015.89	1916713.76	633.89		FSBTOC-03

Sellite Area (November 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1573	623883.26	1916668.05	637.11		SELSS-14
1575	623923.25	1916681.43	636.44		SELSS-15
1576	623943.21	1916722.42	636.04		SELSS-16
1577	623921.93	1916798.71	636.90		SELSS-17
1567	623853.57	1916821.88	636.27		SELSS-18
1568	623810.03	1916811.69	636.44		SELSS-19
1569	623759.95	1916739.76	636.59		SELSS-20
1566	623813.26	1916892.50	634.84		SELSS-21
1570	623813.21	1916632.33	637.07		SELSS-22
1571	623834.86	1916668.04	637.22		SELSS-23
1572	623890.63	1916627.56	636.31		SELSS-24

Unloading Area (May 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
165	623921.17	1917391.09	637.81	634.9	PZ-01/SB-01
163	623922.42	1917456.71	639.09	635.6	PZ-02/SB-04
151	623746.08	1917524.35	639.19	637.5	PZ-03/SB-11
154	623845.17	1917437.12	636.83	636.0	PZ-04/SB-02
161	623948.26	1917535.43	639.75	636.9	PZ-05
171	623948.78	1917093.30	634.92	633.9	PZ-06
169	623972.05	1917234.56	636.91	634.1	PZ-07
156	623752.04	1917199.54	633.98	633.3	PZ-08
166	623930.55	1917322.87	633.71		SB-06
167	623924.05	1917228.33	634.30		SB-07
170	623913.67	1917151.13	633.88		SB-09
152	623770.64	1917492.33	637.19		SB-12

Unloading Area (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1345	623759.93	1917202.98	636.19	633.2	ULA MW-01
1326	623917.73	1917163.13	636.97	633.9	ULA MW-02
1330	624017.95	1917082.01	636.80	633.7	ULA MW-03

Wastewater Treatment Plant #2 (May 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
554	623195.57	1911020.62	632.24	631.0	PZ-01
540	623108.02	1910684.85	641.47	638.4	PZ-02/SB-02
537	623144.69	1910827.50	640.32	637.8	PZ-03/SB-03
544	623058.08	1910992.40	633.38	631.7	PZ-04
549	623080.30	1910781.11	640.60	637.9	PZ-05/SB-05
564	622607.16	1910804.90	634.71	631.6	PZ-06/SB-06
541	623187.47	1910808.30	637.72		SB-01
538	623097.30	1910811.38	638.67		SB-04
542	623033.63	1910866.71	633.10		SB-07
550	622983.08	1910735.71	637.95		SB-08

Wastewater Treatment Plant #2 (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1429	623207.36	1910619.96	644.37	641.7	WWTP2 MW-01
1433	623085.26	1910791.36	640.39	637.8	WWTP2 MW-02
1437	623147.10	1910834.46	640.06	637.5	WWTP2 MW-03
1441	623044.98	1910991.57	635.02	631.9	WWTP2 MW-04

TNT Area C Sewer Line (May 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
552	622788.18	1910747.40	637.23	634.8	PZ-01/SB-01
556	622453.95	1910931.11	634.16	631.7	PZ-02/SB-02
558	622398.23	1910961.31	633.76	631.2	PZ-03/SB-03
560	622308.19	1910977.84	632.98	631.0	PZ-04/SB-04
562	622256.01	1911033.31	637.05	634.5	PZ-05/SB-05
570	621987.34	1911159.29	642.27	640.6	PZ-06/SB-06
572	621977.78	1911141.29	642.43	640.5	PZ-07/SB-07
566	621963.90	1911117.11	643.00	641.1	PZ-08/SB-08
574	621870.49	1911217.73	642.81	641.4	PZ-09/SB-09
576	621787.53	1911234.38	643.08	641.1	PZ-10/SB-10
578	621653.06	1911296.36	643.26	641.0	PZ-11/SB-11

TNT Area C Sewer Line (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1419	622408.93	1910955.79	634.01	631.4	TNTCSL MW-01
1414	621962.33	1911149.14	643.24	640.4	TNTCSL MW-02
1410	621457.27	1911382.57	645.19	642.6	TNTCSL MW-03

Steel Sewer Line (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1314	624207.78	1918010.06	635.11	631.7	SSL MW-01
1715	622883.53	1915564.71	638.96	635.9	SSL MW-02
1403	622637.39	1912719.90	640.63	637.7	SSL MW-03
1303	623886.12	1919381.30	636.39		SSL-TP1
1302	624009.95	1919173.97	638.01		SSL-TP2
1301	624073.83	1919068.79	636.98		SSL-TP3
1309	624152.86	1918928.22	633.47		SSL-TP4
1308	624153.15	1918615.50	633.86		SSL-TP5
1307	624159.13	1918372.96	632.97		SSL-TP6
1310	624163.81	1918020.97	632.14		SSL-TP7
1318	624175.91	1917084.86	632.51		SSL-TP8
1319	624177.58	1916916.80	633.52		SSL-TP9
1368	623956.34	1916571.69	634.21		SSL-TP11
1371	623585.64	1916234.80	632.54		SSL-TP12
1716	622874.51	1915562.57	636.12		SSL-TP13
1719	622755.28	1915453.34	638.07		SSL-TP14
1722	622571.26	1915283.29	639.46		SSL-TP15
1723	622574.78	1915168.09	637.75		SSL-TP16
1394	622605.96	1913620.05	640.77		SSL-TP17
1404	622623.59	1912721.64	637.37		SSL-TP18
1405	622632.23	1912646.98	637.76		SSL-TP19
1406	622629.17	1912619.75	638.07		SSL-TP20
1422	622610.61	1911714.53	639.71		SSL-TP21
1421	622652.39	1911593.26	639.63		SSL-TP22
1420	622656.36	1911533.51	640.26		SSL-TP23
1423	622655.95	1911264.17	630.28		SSL-TP24
1424	622657.42	1911187.19	631.10		SSL-TP25
1425	622658.15	1911118.09	631.57		SSL-TP26
1444	622674.01	1910717.04	634.20		SSL-TP27
1443	622674.85	1910643.89	634.22		SSL-TP28
1442	622861.59	1910645.64	642.45		SSL-TP30
1300	623927.48	1919565.67	638.27		SSLUTL-01
1369	623778.12	1916411.67	636.87		SSLUTL-02
1370	623694.24	1916334.79	635.88		SSLUTL-03
1706	623047.03	1915726.29	634.04		SSLUTL-04
1707	622976.47	1915659.23	633.97		SSLUTL-05
1709	623104.14	1915779.14	638.54	636.2	SSL-PZ02
1710	622891.58	1915551.55	638.84	635.8	SSL-PZ03
1718	622800.09	1915490.11	640.81	638.3	SSL-PZ04
1721	622733.22	1915418.55	640.92	638.9	SSL-PZ05

TNT Area A Sewer Line (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1457	624602.74	1921705.79	628.82		SLSB-02
1471	624326.70	1922541.92	630.17		SLSB-05
1472	624321.95	1922542.98	630.72		SLSB-11
1473	624328.53	1922551.60	630.25		SLSB-12
1474	624331.64	1922540.29	630.69		SLSB-13
1475	624325.12	1922532.16	630.64		SLSB-14
1452	624603.71	1921686.40	628.85		SLSB-15
1453	624608.61	1921697.12	628.87		SLSB-16
1454	624600.16	1921695.20	628.85		SLSB-17
1455	624608.15	1921706.14	628.70		SLSB-18
1456	624598.59	1921705.76	629.12		SLSB-19
1458	624605.09	1921717.51	628.79		SLSB-20
1459	624595.56	1921714.41	628.80		SLSB-21
1460	624600.20	1921724.09	628.47		SLSB-22
1461	624321.46	1922512.67	630.73		SLSB-23
1462	624333.58	1922551.28	630.73		SLSB-24
1463	624323.74	1922552.17	630.74		SLSB-25
1464	624336.76	1922570.87	630.79		SLSB-26
1465	624331.95	1922571.35	630.29		SLSB-27
1466	624327.14	1922571.94	630.66		SLSB-28
1467	624340.09	1922589.79	630.68		SLSB-29
1468	624335.01	1922590.95	630.37		SLSB-30
1469	624330.01	1922591.43	630.57		SLSB-31
1470	624338.73	1922610.57	630.27		SLSB-32

Ash Pit #3 (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1382	622910.53	1914684.10	638.03	638.5	AP3 MW-01
1379	622958.84	1914572.39	640.24	637.3	AP3 MW-02
1388	623077.56	1914421.69	639.28	636.2	AP3 MW-03

Acid Area #1 (September 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29) Adjacent Ground Elev.	Shaw Designation
1503	623078.28	1917106.10	638.42	AA1SS-01
1502	623076.73	1917171.83	638.44	AA1SS-02
1501	623075.70	1917246.79	638.55	AA1SS-03
1500	623039.17	1917293.39	638.66	AA1SS-04
1499	622984.40	1917293.03	638.45	AA1SS-05
1512	622954.08	1917229.01	639.05	AA1SS-06
1511	622955.77	1917164.58	639.23	AA1SS-07
1508	622956.83	1917089.10	639.38	AA1SS-08
1510	623001.76	1917066.77	638.34	AA1SS-09
1515	622887.69	1917172.92	639.32	AA1SS-10
1516	622907.05	1917233.67	639.03	AA1SS-11
1517	622881.62	1917304.26	637.83	AA1SS-12
1518	622814.45	1917329.70	638.00	AA1SS-13
1520	622707.29	1917340.43	638.81	AA1SS-14
1521	622704.30	1917231.64	639.59	AA1SS-15
1496	622975.86	1917587.10	638.45	AA1SS-16
1495	623037.08	1917589.53	637.75	AA1SS-17
1480	623064.78	1917704.91	639.12	AA1SS-18
1479	623065.08	1917637.67	638.31	AA1SS-19
1481	623061.83	1917804.59	638.68	AA1SS-20
1484	623034.78	1917834.69	638.79	AA1SS-21
1485	622967.39	1917835.92	638.45	AA1SS-22
1491	622930.15	1917771.74	639.63	AA1SS-23
1492	622932.71	1917708.65	639.61	AA1SS-24
1493	622932.60	1917633.33	639.48	AA1SS-25
1604	622853.23	1917648.95	637.16	AA1SS-26
1528	622885.14	1917706.18	638.86	AA1SS-27
1531	622854.06	1917806.49	638.63	AA1SS-28
1539	622847.55	1917891.08	638.74	AA1SS-29
1540	622856.20	1917976.35	638.90	AA1SS-30
1541	622842.99	1918045.69	638.99	AA1SS-31
1563	622887.57	1918118.44	639.50	AA1SS-32
1564	622871.73	1918216.54	639.13	AA1SS-33
1553	622718.83	1918169.12	639.00	AA1SS-34
1551	622689.36	1918097.34	639.17	AA1SS-35
1538	622734.26	1917941.52	638.97	AA1SS-36
1536	622731.20	1917882.54	638.98	AA1SS-37
1532	622745.39	1917809.30	639.30	AA1SS-38
1533	622743.92	1917731.23	639.22	AA1SS-39
1534	622680.36	1917678.76	638.85	AA1SS-40
1530	622763.83	1917641.77	637.77	AA1SS-41
1556	622682.28	1918569.02	640.38	AA1SS-42

Acid Area #1 (September 2011) <cont.>

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29) Adjacent Ground Elev.	Shaw Designation
1559	622763.35	1918563.10	639.48	AA1SS-43
1560	622863.21	1918513.54	639.33	AA1SS-44
1561	622877.63	1918588.87	640.14	AA1SS-45
1562	622835.66	1918657.90	641.27	AA1SS-46
1554	622762.05	1918053.62	639.05	AA1SS-47
1519	622766.70	1917335.77	638.24	AA1SS-48
1509	622993.80	1917064.17	634.75	AA1SS-49
1498	623073.71	1917303.80	638.33	AA1SS-50
1513	622960.42	1917323.23	634.30	AA1SS-51
1524	622880.86	1917372.21	636.65	AA1SS-52
1525	622817.11	1917387.41	636.81	AA1SS-53
1523	622718.26	1917391.44	637.72	AA1SS-54
1522	622654.66	1917361.08	639.01	AA1SS-55
1497	623070.51	1917436.15	638.27	AA1SS-56
1514	622976.12	1917448.41	635.40	AA1SS-57
1527	622789.91	1917432.10	636.82	AA1SS-58
1526	622860.52	1917484.11	636.20	AA1SS-59
1478	623066.03	1917555.87	638.37	AA1SS-60
1494	622947.89	1917558.68	639.17	AA1SS-61
1529	622821.39	1917639.93	637.26	AA1SS-62
1482	623057.97	1917895.33	638.61	AA1SS-63
1486	623007.09	1917906.72	637.40	AA1SS-64
1487	622973.47	1917899.89	637.77	AA1SS-65
1490	622942.18	1917877.79	638.98	AA1SS-66
1535	622691.85	1917886.00	639.52	AA1SS-67
1483	623053.10	1917979.40	638.31	AA1SS-68
1488	623006.56	1917959.29	636.95	AA1SS-69
1489	622941.52	1917963.82	638.03	AA1SS-70
1537	622690.45	1917944.62	639.31	AA1SS-71
1552	622678.71	1918186.89	638.95	AA1SS-72
1565	622869.25	1918282.09	638.99	AA1SS-73
1555	622685.10	1918492.13	640.51	AA1SS-74
1557	622618.06	1918574.96	640.05	AA1SS-75
1558	622699.47	1918653.16	640.08	AA1SS-76

Acid Area #1 (November 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1596	622702.09	1917439.32	637.52		AA1SS-77
1595	622650.07	1917422.19	638.74		AA1SS-78
1598	622648.39	1917885.23	639.34		AA1SS-79
1597	622650.25	1917964.73	638.95		AA1SS-80
1600	622745.55	1918688.23	639.71		AA1SS-81
1601	622692.32	1918741.84	640.68		AA1SS-82
1602	622639.59	1918661.45	640.79		AA1SS-83
1592	623121.40	1917266.85	639.48		AA1SS-84
1591	623133.18	1917184.05	639.34		AA1SS-85
1594	622575.71	1917360.29	637.60		AA1SS-86
1599	622560.41	1917915.86	637.94		AA1SS-87
1603	622637.03	1918781.36	640.23		AA1SS-88

Coal Yard #1 (November 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1586	623312.31	1918693.70	640.31		COAL1-SB01
1587	623317.59	1918784.80	640.42		COAL1-SB02
1589	623280.45	1918610.43	636.99		COAL1-SB03
1590	623344.70	1918544.11	636.46		COAL1-SB04

Coal Yard #2 (November 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1585	623081.60	1911875.80	637.87		COAL2-SB01
1584	623034.37	1911903.68	638.12		COAL2-SB02
1582	623066.83	1911941.56	638.10		COAL2-SB03
1583	623069.44	1911988.57	637.94		COAL2-SB04

Coal Yard #3 (November 2011)

SS&M Pt. #	N(y) - NAD 83/95 Ohio State Plane	E(x) - NAD 83/95 North Zone	Elev (NGVD 29)	Adjacent Ground Elev.	Shaw Designation
1580	622941.18	1914858.88	639.33		COAL3-SB01
1578	622897.02	1914797.95	639.11		COAL3-SB02
1579	622921.16	1914832.59	639.18		COAL3-SB03
1581	622870.43	1914828.65	639.16		COAL3-SB04

APPENDIX D

INVESTIGATION-DERIVED WASTE MANIFEST

009108643JJK

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: OH3 800 015 379
2. Page 1 of 1
3. Emergency Response Phone: (800) 255-3924
4. Manifest Tracking Number: 009108643 JJK

5. Generator's Name and Mailing Address: NASA - PLUMBROOK STATION
6100 COLUMBUS AVE
SANDUSKY, OH 44870
Generator's Phone: (419) 621-3234

Generator's Site Address (if different than mailing address):
6100 COLUMBUS AVE
SANDUSKY, OH 44870

6. Transporter 1 Company Name: TRIAD TRANSPORT, INC.
U.S. EPA ID Number: OKD 981 588 791

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address: EQ DETROIT, INC.
1923 FREDERICK
DETROIT, MI 48211
Facility's Phone: (313) 347-1300
U.S. EPA ID Number: MID 980 991 566

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. NON DOT HAZARDOUS, NON RCRA REGULATED	35	DM	1800	G	029L
	2.					
	3.					
	4.					

14. Special Handling Instructions and Additional Information
01. D098220DET / NON HAZARDOUS IDW WATER

NASA # N12002

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Robert F. Lallier Jr.
Signature: Robert Lallier on behalf of NASA GRC
Month 12 Day 26 Year 12

16. International Shipments ☐ Import to U.S. ☐ Export from U.S.
Transporter signature (for exports only):
Port of entry/exit:
Date leaving U.S.:

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: MARK R. SMEALLIE
Signature: Mark R Smeallie
Month 1 Day 26 Year 12

Transporter 2 Printed/Typed Name:
Signature:
Month Day Year

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

18b. Alternate Facility (or Generator)
Manifest Reference Number:
U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)
1. LIW 2. 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Julie Denzich
Signature:
Month 1 Day 10 Year 12

GENERATOR | INT'L | TRANSPORTER | DESIGNATED FACILITY

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO DESTINATION STATE (IF REQUIRED)

APPENDIX E

DATA VALIDATION SUMMARIES

Data Validation Summary Report
Coal Yard 1 Sampling December 2011
Former Plum Brook Ordnance Works
Sandusky, Ohio

1.0 Introduction

Level IV data validation was performed on 100 percent of the environmental soil samples collected for the December 2011 sampling events. The analytical data consisted of one sample delivery group (SDG) (F88938) analyzed by Accutest of Orlando, Florida. In addition, field split samples were collected and validated, one SDG (240-7168-1), was analyzed by Test America, and findings are discussed in Section 5.0 of this report.

The following samples were validated for this investigation:

SDG Number	Sample Number
F88938	CY0001, CY0002, CY0003, CY0004, CY0005, CY0006, CY0007, CY0008, CY0009, CY0011, CY0012, CY0013, CY0014
240-7168-1	CY0010

The chemical parameters for which the samples were analyzed are identified below:

Parameter (Prep/Analytical Method)
Semivolatile Organics by GC/MS SW846 3550C/8270D
Total and Dissolved Metals by SW846 3050B/6010C and 7471B
Nitroaromatic and Nitramine Explosives by SW846 8330A
PCBs by SW846 3550C/8082A
Wet Chemistry (TOC)

GC/MS - Gas chromatography/mass spectrometry. TOC - Total organic carbon.
PCB - Polychlorinated biphenyl.

2.0 Procedures

The sample data were validated following the logic identified in the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (January 2010) and the EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Review (June 2008) for all areas except blanks. EPA Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (April 1993) and Region 3 Modifications to National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration (September 1994) were applied to the areas associated with blank contamination. Specific quality control (QC) criteria as identified in the quality assurance plan, analytical methods, and laboratory standard operating procedures were applied to all sample results. As a result of the use of Update III SW846 test methods for the analytical data and the application of the CLP guidelines during the validation process, there were instances where the specific QC requirements for all target compounds were not defined. This primarily occurred in the organic, GC/MS calibration areas and is due to the fact that the analytical methods are performance-based and allow the use of average calibration responses in lieu of individual responses, which are defined by CLP protocol. In light of

applying CLP guidelines to SW846 methods and evaluating the usability of the data during the validation process, specific QC criteria were determined to address all target compounds and are identified in this report for each parameter, as well as in the validation checklists, which function as worksheets. For those analytical methods not addressed by the CLP and Region 3 guidelines, the validation was based on the method requirements (i.e., SW846, Code of Federal Regulations, Standard Operating Procedures) and technical judgment, following the logic of the CLP validation guidelines. Laboratory-specific criteria may be found in Attachment A.

3.0 Summary of Data Validation Findings

The overall quality of the data was determined to be acceptable with minimal qualifications. An individual validation report has been prepared for the parameters analyzed, and the overall results of the validation findings are summarized in this report. A listing of the validation qualifiers and the reason codes, along with their definitions, is found in Attachment A. The following section highlights the key findings of the data validation process. No data were rejected.

4.0 Analysis-Specific Data Validation Summaries

4.1 Semivolatile Organics by GC/MS SW846 8270C

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The initial calibration (ICAL) and continuing calibrations (CCAL) associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits.

Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicate (MS/MSD) analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample

Laboratory control sample (LCS) analysis was performed for the project samples, and all QC criteria were met.

Field Duplicates
Original and field duplicate results were evaluated, and no problems were identified.

Internal Standards
All internal standards met QC criteria.

Quantitation
Results quantitated between the method detection limit (MDL) and the reporting limit (RL), which the laboratory qualified as "J," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

4.2 Total and Dissolved Metals by SW846 6010B/7470A/7471
Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times
Technical holding time criteria were met for all samples.

Sample Preservation
Sample preservation criteria were met for all samples.

Initial and Continuing Calibration
The ICAL and CCAL associated with the project samples met QC criteria.

Blanks
The 5X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Matrix Spike/Matrix Spike Duplicate
MS/MSD analysis was performed for the project samples, and all QC criteria were met with the following exceptions:

SDG Number	Sample(s) Affected	Analyte(s)	Validation Qualifier
F88938	CY0013	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Nickel, Potassium, Selenium, Silver, Sodium, Vanadium, Zinc	J/UJ

Laboratory Duplicate Sample Analysis
A laboratory duplicate sample analysis was performed for the project samples, and all QC criteria were met with the following exceptions:

SDG Number	Samples Affected	Analyte(s)	Validation Qualifier
F88938	CY0013	Barium	J

Laboratory Control Sample
LCS analysis was performed for the project samples, and all QC criteria were met.

Interference Check Sample
All interference check sample percent recoveries were met.

Inductively Coupled Plasma Serial Dilutions
All QC criteria were met for the serial dilutions associated with the project samples with the following exceptions:

SDG	Sample(s) Affected	Analyte(s)	Validation Qualifier
F88938	CY0013	Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel, Potassium, Vanadium, Zinc	J

Field Duplicates
Original and field duplicate results were evaluated, and no problems were identified with the following exceptions:

SDG	Samples Affected	Analyte(s)	Validation Qualifier
F88938	CY0008 (original), CY0009 (Field Duplicate)	Manganese	J

Quantitation
Results quantitated between the MDL and the RL, which the laboratory qualified as "B," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

4.3 Nitroaromatic and Nitroamine Explosives by SW846 8330
Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times
Technical holding time criteria were met for all samples.

Sample Preservation
Sample preservation criteria were met for all samples.

Initial and Continuing Calibration
The ICAL and CCAL associated with the project samples met QC criteria.

Blanks
The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries
All surrogate recoveries were within QC limits.

Matrix Spike/Matrix Spike Duplicate
MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample
LCS analysis was performed for the project samples, and all QC criteria were met.

Field Duplicates
Original and field duplicate results were evaluated, and no problems were identified.

Second Column Confirmation
Samples having analytes with positive detects were verified on a second confirmation column; QC criteria (40 percent relative percent difference [RPD]) were met.

Quantitation
Results quantitated between the MDL and the RL, which the laboratory qualified as "J," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

4.4 Polychlorinated Biphenyls by SW846 8082
Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times
Technical holding time criteria were met for all samples.

Sample Preservation
Sample preservation criteria were met for all samples.

Initial and Continuing Calibration
The ICAL and CCAL associated with the project samples met QC criteria.

Blanks
The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries
All surrogate recoveries were within QC limits for all the project samples.

Matrix Spike/Matrix Spike Duplicate
MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample
LCS analysis was performed for the project samples, and all QC criteria were met.

Field Duplicates
Original and field duplicate results were evaluated, and no problems were identified.

Second Column Confirmation
Samples having analytes with positive detects were verified on a second confirmation column; QC criteria (40 percent RPD) were met.

Quantitation
Results quantitated between the MDL and the RL, which the laboratory qualified as "J," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

4.5 Wet Chemistry (TOC)
Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times
Technical holding time criteria were met for all samples.

Sample Preservation
Sample preservation criteria were met for all samples.

Initial and Continuing Calibration
All ICAL and CCAL associated with the project samples met QC criteria.

Blanks
The 5X rule for contaminants found in the associated equipment rinses and method blanks was applied to all sample results. All were found to be acceptable.

Matrix Spike/Matrix Spike Duplicate
MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Duplicate Sample Analysis
A laboratory duplicate sample analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample
LCS analysis was performed for the project samples, and all QC criteria were met.

Field Duplicates
No original and field duplicate samples were analyzed for the wet chemistry parameters.

Quantitation
Results quantified between the MDL and RL, which the laboratory qualified as "J," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

5.0 Quality Assurance Field Split Sample Data Evaluation

Data from the quality assurance split sample, CY0010 (SDG 240-7168-1), were validated. The field split sample was analyzed for semivolatiles by SW846 8270C, explosives by SW846 8330, PCBs by SW846 8280, and total and dissolved metals by SW 846 6010B and 7471A. The following section highlights the key findings of the data validation for each analysis.

The following samples were validated for this site investigation:

SDG Number	Sample Number
240-7168-1	CY0010

Sample/Field Duplicate/Field Split
CY0008 (Original) / CY0009 (Field Duplicate) / CY0010 (Field Split)

5.1 Semivolatile Organics by GC/MS SW846 8270C

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The ICAL and CCAL associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits.

Matrix Spike/Matrix Spike Duplicate

MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample

LCS analysis was performed for the project samples, and all QC criteria were met.

Internal Standards

All internal standards met QC criteria.

Field Splits
Table 2 in Appendix H shows the regular/field duplicate/field split comparison of the data. An RPD is calculated for the analytes that were positive detects.

Quantitation
Results quantitated between the MDL and the RL, which the laboratory qualified as "J," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

5.2 Total and Dissolved Metals by SW846 6010B/7470A/7471
Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times
Technical holding time criteria were met for all samples.

Sample Preservation
Sample preservation criteria were met for all samples.

Initial and Continuing Calibration
The ICAL and CCAL associated with the project samples met QC criteria.

Blanks
The 5X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Matrix Spike/Matrix Spike Duplicate
MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample
LCS analysis was performed for the project samples, and all QC criteria were met.

Interference Check Sample
All interference check sample percent recoveries were acceptable. All QC criteria were met.

Inductively Coupled Plasma Serial Dilutions
All QC criteria were met for the serial dilutions associated with the project samples.

Field Splits
Table 2 of Appendix H shows the regular/field duplicate/field split comparison of the data. An RPD is calculated for the analytes that were positive detects.

Quantitation
Results quantitated between the MDL and the RL, which the laboratory qualified as "B," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

5.3 Nitroaromatic and Nitroamine Explosives by SW846 8330

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration

The ICAL and CCAL associated with the project samples met QC criteria.

Blanks

The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries

All surrogate recoveries were within QC limits for the project samples.

Matrix Spike/Matrix Spike Duplicate

MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample

LCS analysis was performed for the project samples, and all QC criteria were met.

Second Column Confirmation

Samples having analytes with positive detects were verified on a second confirmation column; QC criteria (40 percent RPD) were met.

Field Splits

Table 2 of Appendix H shows the regular/field duplicate/field split comparison of the data. An RPD is calculated for the analytes that were positive detects.

Quantitation

Results quantitated between the MDL and the RL, which the laboratory qualified as “J,” were qualified as estimated (“J”) unless blank contamination was present or the results were rejected.

5.4 Polychlorinated Biphenyls by SW846 8082

Overall, the data are of good quality and are usable as reported by the laboratory with the exceptions noted below. Data were reviewed for the following:

Holding Times

Technical holding time criteria were met for all samples.

Sample Preservation

Sample preservation criteria were met for all samples.

Initial and Continuing Calibration
The ICAL and CCAL associated with the project samples met QC criteria.

Blanks
The 5X/10X rule for contaminants found in the associated equipment rinses, trip blanks, and method blanks was applied to all sample results. All were found to be acceptable.

Surrogate Recoveries
All surrogate recoveries were within QC limits.

Matrix Spike/Matrix Spike Duplicate
MS/MSD analysis was performed for the project samples, and all QC criteria were met.

Laboratory Control Sample
LCS analysis was performed for the project samples, and all QC criteria were met.

Second Column Confirmation
Samples having analytes with positive detects were verified on a second confirmation column; QC criteria (40 percent RPD) were met.

Field Splits
Table 2 in Appendix H shows the regular/field duplicate/field split comparison of the data. An RPD is calculated for the analytes that were positive detects.

Quantitation
Results quantitated between the MDL and the RL, which the laboratory qualified as "J," were qualified as estimated ("J") unless blank contamination was present or the results were rejected.

ATTACHMENT A

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America Laboratories, Inc.		
	Water - LCS	Water - MS/MSD		Water - LCS	Water - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
Volatile Organic Compounds, SW846 8260B						
Acetone	59 - 134	59 - 134	14	N/A	N/A	N/A
Acrolein	N/A	N/A	N/A	N/A	N/A	N/A
Acrylonitrile	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	83 - 124	83 - 124	11	78 - 118	78 - 118	N/A
Bromobenzene	N/A	N/A	N/A	N/A	N/A	N/A
Bromochloromethane	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	76 - 116	76 - 116	10	N/A	N/A	N/A
Bromomethane	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	68 - 128	68 - 128	11	N/A	N/A	N/A
2-Butanone	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	87 - 115	87 - 115	9	76 - 117	76 - 117	N/A
Chloroethane	54 - 166	54 - 166	20	N/A	N/A	N/A
Chloromethane	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	85 - 123	85 - 123	10	N/A	N/A	N/A
2-Chlorotoluene	N/A	N/A	N/A	N/A	N/A	N/A
4-Chlorotoluene	N/A	N/A	N/A	N/A	N/A	N/A
Carbon disulfide	67 - 147	67 - 147	12	N/A	N/A	N/A
Carbon tetrachloride	74 - 139	74 - 139	13	N/A	N/A	N/A
1,2-Dibromoethane	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	82 - 127	82 - 127	10	N/A	N/A	N/A
1,1-Dichloroethylene	75 - 133	75 - 133	13	62 - 130	62 - 130	N/A
1,1-Dichloropropene	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	76 - 122	76 - 122	11	N/A	N/A	N/A
1,2-Dichloropropane	81 - 120	81 - 120	11	N/A	N/A	N/A
1,2-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dichloropropane	N/A	N/A	N/A	N/A	N/A	N/A
2,2-Dichloropropane	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	74 - 116	74 - 116	11	N/A	N/A	N/A
Dibromomethane	N/A	N/A	N/A	N/A	N/A	N/A
Dichlorodifluoromethane	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dibromo-3-chloropropane	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	81 - 114	81 - 114	10	N/A	N/A	N/A
cis-1,3-Dichloropropene	83 - 119	83 - 119	10	N/A	N/A	N/A
trans-1,2-Dichloroethylene	82 - 126	82 - 126	10	N/A	N/A	N/A
trans-1,3-Dichloropropene	87 - 123	87 - 123	10	N/A	N/A	N/A
Ethylbenzene	87 - 118	87 - 118	10	N/A	N/A	N/A
Hexachlorobutadiene	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	58 - 125	58 - 125	14	N/A	N/A	N/A
Isopropylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
4-Isopropyltoluene	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	62 - 125	62 - 125	13	N/A	N/A	N/A
Methyl bromide	55 - 151	55 - 151	21	N/A	N/A	N/A
Methyl chloride	55 - 173	55 - 173	22	N/A	N/A	N/A
Methylene chloride	69 - 125	69 - 125	11	N/A	N/A	N/A
Methyl ethyl ketone	61 - 127	61 - 127	13	N/A	N/A	N/A
Methyl tert-Butyl Ether	N/A	N/A	N/A	N/A	N/A	N/A
n-Butylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	N/A	N/A	N/A	N/A	N/A	N/A
n- Propylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
sec-Butylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	78 - 118	78 - 118	11	N/A	N/A	N/A
1,1,1-Trichloroethane	79 - 133	79 - 133	11	N/A	N/A	N/A
1,1.1,2-Tetrachloroethane	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	71 - 120	71 - 120	11	N/A	N/A	N/A
1,1,2-Trichloroethane	80 - 114	80 - 114	11	N/A	N/A	N/A

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America Laboratories, Inc.		
	Water - LCS	Water - MS/MSD		Water - LCS	Water - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
1,2,3-Trichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3-Trichloropropane	N/A	N/A	N/A	N/A	N/A	N/A
1,3,5-Trimethylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,2,4-Trichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,2,4-Trimethylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene	80 - 131	80 - 131	12	N/A	N/A	N/A
tert-Butylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	86 - 116	86 - 116	10	70 - 119	70 - 119	N/A
Trichloroethylene	85 - 124	85 - 124	10	62 - 130	62 - 130	N/A
Trichlorofluoromethane	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	57 - 153	57 - 153	22	N/A	N/A	N/A
Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A
m-Xylene/p-Xylene	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	N/A	N/A	N/A	N/A	N/A	N/A
Xylene (total)	86 - 120	86 - 120	10	N/A	N/A	N/A
Surrogates						
Dibromofluoromethane	87 - 116	87 - 116	N/A	85-115	85-115	N/A
1,2-Dichloroethane-D4	76 - 127	76 - 127	N/A	70-120	70-120	N/A
Toluene-D8	86 - 112	86 - 112	N/A	85-120	85-120	N/A
4-Bromofluorobenzene	84 - 120	84 - 120	N/A	75-120	75-120	N/A
Semivolatile Organic Compounds, SW-846 8270C						
Benzoic Acid	10 - 50	10 - 50	40	N/A	N/A	N/A
2-Chlorophenol	44 - 103	44 - 103	29	27 - 110	27 - 110	30
4-Chloro-3-methyl phenol	53 - 105	53 - 105	24	39 - 110	39 - 110	30
2,4-Dichlorophenol	53 - 108	53 - 108	26	N/A	N/A	N/A
2,4-Dimethylphenol	37 - 91	37 - 91	28	N/A	N/A	N/A
2,4-Dinitrophenol	37 - 111	37 - 111	30	N/A	N/A	N/A
4,6-Dinitro-o-cresol	62 - 115	62 - 115	26	N/A	N/A	N/A
2-Methylphenol	35 - 91	35 - 91	30	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
3&4-Methylphenol	32 - 85	32 - 85	29	N/A	N/A	N/A
2-Nitrophenol	49 - 111	49 - 111	30	N/A	N/A	N/A
4-Nitrophenol	13 - 55	13 - 55	31	12 - 130	12 - 130	30
Pentachlorophenol	57 118	57 118	26	26 - 110	26 - 110	30
Phenol	13 - 54	13 - 54	34	14 - 112	14 - 112	30
2,4,5-Trichlorophenol	59 - 106	59 - 106	23	N/A	N/A	N/A
2,4,6-Trichlorophenol	58 - 107	58 - 107	24	N/A	N/A	N/A
Acenaphthene	58 - 106	58 - 106	21	40 - 110	40 - 110	30
Acenaphthylene	58 - 105	58 - 105	21	N/A	N/A	N/A
Anthracene	65 - 108	65 - 108	19	N/A	N/A	N/A
Benzo(a)anthracene	63 - 111	63 - 111	19	N/A	N/A	N/A
Benzo(a)pyrene	62 - 106	62 - 106	20	N/A	N/A	N/A
Benzo(b)fluoranthene	63 - 109	63 - 109	20	N/A	N/A	N/A
Benzo(g,h,i)perylene	61 - 111	61 - 111	21	N/A	N/A	N/A
Benzo(k)fluoranthene	64 - 111	64 - 111	20	N/A	N/A	N/A
4-Bromophenol phenyl ether	64 - 107	64 - 107	20	N/A	N/A	N/A
Butyl benzyl phthalate	59 - 114	59 - 114	20	N/A	N/A	N/A
Benzyl Alcohol	34 - 98	34 - 98	27	N/A	N/A	N/A
2-Chloronaphthalene	54 - 105	54 - 105	24	N/A	N/A	N/A
4-Chloroaniline	53 - 103	53 - 103	22	N/A	N/A	N/A
Carbazole	66 - 109	66 - 109	20	N/A	N/A	N/A
Chrysene	64 - 111	64 - 111	19	N/A	N/A	N/A
bis(2-Chloroethyoxy)methane	48 - 101	48 - 101	28	N/A	N/A	N/A
bis(2-Chloroethyl)ether	51 - 108	51 - 108	27	N/A	N/A	N/A
bis(2-Chloroisopropyl)ether	43 - 106	43 - 106	27	N/A	N/A	N/A
4-Chlorophenyl pheny ether	61 - 107	61 - 107	20	N/A	N/A	N/A
1,2-Dichlorobenzene	41 - 102	41 - 102	28	N/A	N/A	N/A
1,3-Dichlorobenzene	38 - 100	38 - 100	28	N/A	N/A	N/A

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America Laboratories, Inc.		
	Water - LCS	Water - MS/MSD		Water - LCS	Water - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
1,4-Dichlorobenzene	40 - 100	40 - 100	28	19 - 110	19 - 110	30
2,4-Dinitrotoluene	60 - 109	60 - 109	20	52 - 123	52 - 123	30
2,6-Dinitrotoluene	58 - 104	58 - 104	21	N/A	N/A	N/A
3,3'-Dichlorobenzidine	57 - 105	57 - 105	25	N/A	N/A	N/A
Dibenzo(a,h)antracene	62 - 112	62 - 112	20	N/A	N/A	N/A
Dibenzofuran	61 - 108	61 - 108	20	N/A	N/A	N/A
Di-n-butyl phthalate	62 - 109	62 - 109	20	N/A	N/A	N/A
Di-n-octyl phthalate	60 - 120	60 - 120	24	N/A	N/A	N/A
Diethyl phthalate	62 - 109	62 - 109	19	N/A	N/A	N/A
Dimethyl phthalate	63 - 106	63 - 106	19	N/A	N/A	N/A
Diphenylamine	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Ethylhexyl)phthalate	59 - 116	59 - 116	21	N/A	N/A	N/A
Fluoranthene	65 - 114	65 - 114	21	N/A	N/A	N/A
Fluorene	61 - 106	61 - 106	19	N/A	N/A	N/A
Hexachlorobenzene	62 - 107	62 - 107	20	N/A	N/A	N/A
Hexachlorobutadiene	38 - 107	38 - 107	30	N/A	N/A	N/A
Hexachlorocyclopentadiene	19 - 84	19 - 84	35	N/A	N/A	N/A
Hexachloroethane	35 - 101	30 - 101	29	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	61 - 113	61 - 113	20	N/A	N/A	N/A
Isophorone	56 - 111	56 - 111	26	N/A	N/A	N/A
2-Metlhyl-4,6-dinitrophenol	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylnaphthalene	56 - 112	56 - 112	26	N/A	N/A	N/A
2-Nitroaniline	60 - 109	60 - 109	20	N/A	N/A	N/A
3-Nitroaniline	52 - 107	52 - 107	21	N/A	N/A	N/A
4-Nitroaniline	59 - 111	59 - 111	21	N/A	N/A	N/A
Naphthalene	50 - 104	50 - 104	28	N/A	N/A	N/A
Nitrobenzene	52 - 105	52 - 105	28	N/A	N/A	N/A
N-Nitroso-di-n-propylamine	51 - 104	51 - 104	28	37 - 121	37 - 121	30
N-Nitrosodimethylamine	N/A	N/A	N/A	N/A	N/A	N/A
N-Nitrosodiphenylamine	57 - 110	57 - 110	19	N/A	N/A	N/A
Phenanthrene	65 - 108	65 - 108	20	N/A	N/A	N/A
Pyrene	60 - 113	60 - 113	20	55 - 120	55 - 120	30
1,2,4-Trichlorobenzene	45 - 104	45 - 104	28	25 - 110	25 - 110	30
Surrogates						
2-Fluorophenol	14 - 62	14 - 62	N/A	20-110	20-110	N/A
Phenol-d5	10 - 40	10 - 40	N/A	10-115	10-115	N/A
2,4,6-Tribromophenol	33 - 118	33 - 118	N/A	40-125	40-125	N/A
Nitrobenzene-d5	42 - 108	42 - 108	N/A	40-110	40-110	N/A
2-Fluorobiphenyl	40 - 106	40 - 106	N/A	50-110	50-110	N/A
Terphenyl-d14	39 - 121	39 - 121	N/A	50-135	50-135	N/A
Nitroaromatics and Nitroamines, SW-846 8330						
HMX	74 - 152	74 - 152	21	80 - 115	80 - 115	30
RDX	80 - 124	80 - 124	20	50 - 160	50 - 160	30
1,3-Dinitrobenzene	84 - 123	84 - 123	23	45 - 160	45 - 160	30
2,6-Dinitrotoluene	84 - 133	84 - 133	23	60 - 135	60 - 135	30
2,4-Dinitrotoluene	77 - 116	77 - 116	26	60 - 135	60 - 135	30
2-amino-4,6-Dinitrotoluene	78 - 117	78 - 117	28	55 - 155	55 - 155	30
4-amino-2,6-Dinitrotoluene	84 - 123	84 - 123	27	55 - 155	55 - 155	30
Nitrobenzene	76 - 128	76 - 128	28	50 - 140	50 - 140	30
o-Nitrotoluene	76 - 120	76 - 120	30	50 - 130	50 - 130	30
m-Nitrotoluene	74 - 124	74 - 124	32	45 - 135	45 - 135	30
p-Nitrotoluene	81 - 125	81 - 125	34	50 - 130	50 - 130	30
Tetryl	62 - 117	62 - 117	28	20 - 175	20 - 175	30
1,3,5-Trinitrobenzene	85 - 127	85 - 127	21	65 - 140	65 - 140	30
2,4,6-Trinitrotoluene	71 - 128	71 - 128	21	50 - 145	50 - 145	30
Nitroglycerin	N/A	N/A	N/A	76 - 116	76 - 116	30
PETN	N/A	N/A	N/A	69 - 117	69 - 117	30
Surrogate						

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America Laboratories, Inc.		
	Water - LCS	Water - MS/MSD		Water - LCS	Water - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
3,4-Dinitrotoluene	70 - 136	70 - 136	N/A	79-111	79-111	N/A
PCBs, SW-846 8082						
Aroclor-1016	76 - 117	76 - 117	16	44 - 119	10 - 199	30
Aroclor-1260	65 - 117	65 - 117	23	41 - 118	10 - 199	30
Surrogates						
Tetrachloro-m-xylene	38 - 127	38 - 127	N/A	27-130	27-130	N/A
Decachlorobiphenyl	25 - 137	25 - 137	N/A	10-127	10-127	N/A
Metals, SW-846 6010B/6020A/7470A						
Aluminum	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Antimony	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Arsenic	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Barium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Beryllium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Cadmium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Calcium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Chromium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Cobalt	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Copper	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Iron	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Lead	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Magnesium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Manganese	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Nickel	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Potassium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Selenium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Silver	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Sodium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Thallium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Vanadium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Zinc	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Mercury	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Water Quality						
Chloride	90 - 110	90 - 110	20	90 - 110	80 - 120	20
Hardness as CaCO3	N/A	N/A	N/A	88 - 110	87 - 114	20
Nitrate	90 - 110	90 - 110	20	90 - 110	34 - 125	20
Sulfate	90 - 110	90 - 110	20	90 - 110	80 - 120	20
Total Alkalinity	90 - 113	90 - 113	20	90 - 127	10 - 160	24
Total Cyanide	90 - 110	90 - 110	20	69 - 118	42 - 140	20
Total Dissolved Solids	N/A	N/A	5	88 - 110	N/A	20
Total Suspended Solids	N/A	N/A	5	73 - 113	N/A	20
Turbidity	N/A	N/A	8	75 - 125	N/A	20

LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
N/A - Not Applicable

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America		
	Soil - LCS	Soil - MS/MSD		Soil - LCS	Soil - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
Volatile Organic Compounds, SW846 8260B						
Acetone	61 - 144	61 - 144	29	N/A	N/A	N/A
Acrolein	N/A	N/A	N/A	N/A	N/A	N/A
Acrylonitrile	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	78 - 130	78 - 130	25	75 - 129	75 - 129	N/A
Bromobenzene	N/A	N/A	N/A	N/A	N/A	N/A
Bromochloromethane	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	73 - 122	73 - 122	25	N/A	N/A	N/A
Bromoform	70 - 139	70 - 139	26	N/A	N/A	N/A
Bromomethane	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	83 - 122	83 - 122	23	75 - 127	75 - 127	N/A
Chloroethane	61 - 153	61 - 153	31	N/A	N/A	N/A
Chloromethane	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	79 - 129	79 - 129	27	N/A	N/A	N/A
2-Chlorotoluene	N/A	N/A	N/A	N/A	N/A	N/A
4-Chlorotoluene	N/A	N/A	N/A	N/A	N/A	N/A
Carbon disulfide	61 - 142	61 - 142	27	N/A	N/A	N/A
Carbon tetrachloride	79 - 135	79 - 135	29	N/A	N/A	N/A
1,2-Dibromoethane	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dibromo-3-chloropropane	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	77 - 132	77 - 132	26	N/A	N/A	N/A
1,1-Dichloroethylene	66 - 132	66 - 132	27	55 - 142	55 - 142	N/A
1,2-Dichloroethane	78 - 129	78 - 129	24	N/A	N/A	N/A
1,2-Dichloropropane	74 - 127	74 - 127	27	N/A	N/A	N/A
1,3-Dichloropropane	N/A	N/A	N/A	N/A	N/A	N/A
2,2-Dichloropropane	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloropropene	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	78 - 117	78 - 117	27	N/A	N/A	N/A
Dibromomethane	N/A	N/A	N/A	N/A	N/A	N/A
Dichlorodifluoromethane	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	74 - 123	74 - 123	26	N/A	N/A	N/A
cis-1,3-Dichloropropene	79 - 130	79 - 130	23	N/A	N/A	N/A
trans-1,2-Dichloroethylene	77 - 129	77 - 129	27	N/A	N/A	N/A
trans-1,3-Dichloropropene	87 - 131	87 - 131	27	N/A	N/A	N/A
Ethylbenzene	82 - 124	82 - 124	25	N/A	N/A	N/A
2-Hexanone	67 - 130	67 - 130	29	N/A	N/A	N/A
Hexachlorobutadiene	N/A	N/A	N/A	N/A	N/A	N/A
Isopropylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
4-Isopropyltoluene	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	69 - 125	69 - 125	24	N/A	N/A	N/A
Methyl bromide	60 - 146	60 - 146	31	N/A	N/A	N/A
Methyl chloride	58 - 163	58 - 163	26	N/A	N/A	N/A
Methylene chloride	62 - 140	62 - 140	25	N/A	N/A	N/A
Methyl ethyl ketone	66 - 134	66 - 134	23	N/A	N/A	N/A
Methyl tert-Butyl ether	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	N/A	N/A	N/A	N/A	N/A	N/A
n-Butylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
n-Propylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	79 - 123	79 - 123	28	N/A	N/A	N/A
sec-Butylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	80 - 133	80 - 133	27	N/A	N/A	N/A
1,2,3-Trichloropropane	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1,2-Tetrachloroethane	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	70 - 128	70 - 128	30	N/A	N/A	N/A

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America		
	Soil - LCS	Soil - MS/MSD		Soil - LCS	Soil - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
1,1,2-Trichloroethane	76 - 118	76 - 118	28	N/A	N/A	N/A
1,3,5-Trimethylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3-Trichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,2,4-Trichlorobenzene	N/A	N/A	N/A	N/A	N/A	N/A
1,2,4-Trimethylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
tert-Butylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene	79 - 132	79 - 132	27	N/A	N/A	N/A
Toluene	80 - 123	80 - 123	26	71 - 130	71 - 130	N/A
Trichloroethylene	78 - 132	78 - 132	28	70 - 131	70 - 131	N/A
Trichlorofluoromethane	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl acetate	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	60 - 145	60 - 145	29	N/A	N/A	N/A
m-Xylene/p-Xylene	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	N/A	N/A	N/A	N/A	N/A	N/A
Xylene (total)	83 - 127	83 - 127	24	N/A	N/A	N/A
Surrogates						
Dibromofluoromethane	80 - 121	80 - 121	N/A	68-110	68-110	N/A
Toluene-D8	71 - 130	71 - 130	N/A	69-128	69-128	N/A
4-Bromofluorobenzene	59 - 148	59 - 148	N/A	64-130	64-130	N/A
1,2-Dichloroethane-D4	77 - 123	77 - 123	N/A	64-130	64-130	N/A
Semivolatile Organic Compounds, SW-846 8270C						
Benzoic Acid	44 - 116	44 - 116	36	N/A	N/A	N/A
2-Chlorophenol	54 - 97	54 - 97	31	32 - 110	32 - 110	30
4-Chloro-3-methyl phenol	59 - 102	59 - 102	27	32 - 117	32 - 117	30
2,4-Dichlorophenol	60 - 101	60 - 101	30	N/A	N/A	N/A
2,4-Dimethylphenol	49 - 89	49 - 89	31	N/A	N/A	N/A
2,4-Dinitrophenol	39 - 107	39 - 107	40	N/A	N/A	N/A
4,6-Dinitro-o-cresol	58 - 109	58 - 109	37	N/A	N/A	N/A
2-Methylphenol	53 - 94	53 - 94	29	N/A	N/A	N/A
3&4-Methylphenol	54 - 95	54 - 95	31	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitrophenol	55 - 96	55 - 96	30	N/A	N/A	N/A
4-Nitrophenol	56 - 106	56 - 106	29	10 - 125	10 - 125	30
Pentachlorophenol	50 - 115	50 - 115	33	10 - 182	10 - 182	30
Phenol	55 - 99	55 - 99	28	10 - 144	10 - 144	30
2,4,5-Trichlorophenol	60 - 101	60 - 101	28	N/A	N/A	N/A
2,4,6-Trichlorophenol	60 - 100	60 - 100	27	N/A	N/A	N/A
Acenaphthene	59 - 97	59 - 97	29	10 - 200	10 - 200	30
Acenaphthylene	58 - 98	58 - 98	30	N/A	N/A	N/A
Anthracene	61 - 104	61 - 104	29	N/A	N/A	N/A
Benzo(a)anthracene	60 - 106	60 - 106	31	N/A	N/A	N/A
Benzo(a)pyrene	59 - 102	59 - 102	32	N/A	N/A	N/A
Benzo(b)fluoranthene	60 - 107	60 - 107	31	N/A	N/A	N/A
Benzo(g,h,i)perylene	56 - 103	56 - 103	32	N/A	N/A	N/A
Benzo(k)fluoranthene	61 - 107	61 - 107	30	N/A	N/A	N/A
4-Bromophenol phenyl ether	60 - 104	60 - 104	26	N/A	N/A	N/A
Butyl benzyl phthalate	57 - 110	57 - 110	28	N/A	N/A	N/A
Benzyl Alcohol	N/A	N/A	N/A	N/A	N/A	N/A
Butyl Alcohol	51 - 102	51 - 102	34	N/A	N/A	N/A
2-Chloronaphthalene	57 - 95	57 - 95	28	N/A	N/A	N/A
4-Chloroaniline	19 - 85	19 - 85	34	N/A	N/A	N/A
Carbazole	60 - 106	60 - 106	30	N/A	N/A	N/A
Chrysene	60 - 107	60 - 107	31	N/A	N/A	N/A
bis(2-Chloroethyoxy)methane	51 - 89	51 - 89	30	N/A	N/A	N/A
bis(2-Chloroethyl)ether	50 - 96	50 - 96	33	N/A	N/A	N/A
bis(2-Chloroisopropyl)ether	44 - 94	44 - 94	32	N/A	N/A	N/A
4-Chlorophenyl phenyl ether	60 - 101	60 - 101	26	N/A	N/A	N/A
1,2-Dichlorobenzene	47 - 91	47 - 91	35	N/A	N/A	N/A

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America		
	Soil - LCS	Soil - MS/MSD		Soil - LCS	Soil - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
1,3-Dichlorobenzene	45 - 86	45 - 86	36	N/A	N/A	N/A
1,4-Dichlorobenzene	45 - 88	45 - 88	36	26 - 110	26 - 110	30
2,4-Dinitrotoluene	59 - 103	59 - 103	30	42 - 118	42 - 118	30
2,6-Dinitrotoluene	57 - 99	57 - 99	30	N/A	N/A	N/A
3,3'-Dichlorobenzidine	34 - 88	34 - 88	31	N/A	N/A	N/A
Dibenzo(a,h)antracene	57 - 105	57 - 105	29	N/A	N/A	N/A
Dibenzofuran	58 - 103	58 - 103	27	N/A	N/A	N/A
Di-n-butyl phthalate	59 - 105	59 - 105	27	N/A	N/A	N/A
Di-n-octyl phthalate	59 - 117	59 - 117	28	N/A	N/A	N/A
Diethyl phthalate	59 - 106	59 - 106	27	N/A	N/A	N/A
Dimethyl phthalate	60 - 100	60 - 100	26	N/A	N/A	N/A
bis(2-Ethylhexyl)phthalate	57 - 111	57 - 111	29	N/A	N/A	N/A
Fluoranthene	60 - 110	60 - 110	32	N/A	N/A	N/A
Fluorene	60 - 99	60 - 99	30	N/A	N/A	N/A
Hexachlorobenzene	58 - 103	58 - 103	27	N/A	N/A	N/A
Hexachlorobutadiene	49 - 95	49 - 95	33	N/A	N/A	N/A
Hexachlorocyclopentadiene	36 - 94	36 - 94	41	N/A	N/A	N/A
Hexachloroethane	44 - 89	44 - 89	38	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	57 - 104	57 - 104	33	N/A	N/A	N/A
Isophorone	58 - 97	58 - 97	30	N/A	N/A	N/A
2-Methylnaphthalene	57 - 103	57 - 103	32	N/A	N/A	N/A
2-Nitroaniline	53 - 106	53 - 106	29	N/A	N/A	N/A
3-Nitroaniline	29 - 85	29 - 85	31	N/A	N/A	N/A
4-Nitroaniline	49 - 104	49 - 104	31	N/A	N/A	N/A
Naphthalene	54 - 93	54 - 93	32	N/A	N/A	N/A
Nitrobenzene	53 - 92	53 - 92	32	N/A	N/A	N/A
N-Nitroso-di-n-propylamine	49 - 94	49 - 94	28	30 - 121	30 - 121	30
N-Nitrosodimethylamine	N/A	N/A	N/A	N/A	N/A	N/A
N-Nitrosodiphenylamine	53 - 107	53 - 107	28	N/A	N/A	N/A
Phenanthrene	61 - 103	61 - 103	32	N/A	N/A	N/A
Pyrene	58 - 109	58 - 109	33	10 - 200	10 - 200	30
Diphenylamine	N/A	N/A	N/A	N/A	N/A	N/A
1,2,4-Trichlorobenzene	52 - 93	52 - 93	32	33 - 110	33 - 110	30
Surrogates						
2-Fluorophenol	40 - 102	40 - 102	N/A	35-105	35-105	N/A
Phenol-d5	41 - 100	41 - 100	N/A	40-100	40-100	N/A
2,4,6-Tribromophenol	42 - 108	42 - 108	N/A	35-125	35-125	N/A
Nitrobenzene-d5	40 - 105	40 - 105	N/A	35-100	35-100	N/A
2-Fluorobiphenyl	43 - 107	43 - 107	N/A	45-105	45-105	N/A
Terphenyl-d14	45 - 119	45 - 119	N/A	30-125	30-125	N/A
Nitroaromatics and Nitroamines, SW-846 8330						
HMX	75 - 156	75 - 156	27	75 - 125	75 - 125	N/A
RDX	77 - 131	77 - 131	28	70 - 135	70 - 135	N/A
1,3-Dinitrobenzene	82 - 134	82 - 134	20	80 - 125	80 - 125	N/A
2,6-Dinitrotoluene	86 - 142	86 - 142	17	80 - 120	80 - 120	N/A
2,4-Dinitrotoluene	74 - 129	74 - 129	18	80 - 125	80 - 125	N/A
2-amino-4,6-Dinitrotoluene	83 - 123	83 - 123	22	80 - 125	80 - 125	N/A
4-amino-2,6-Dinitrotoluene	85 - 137	85 - 137	18	80 - 125	80 - 125	N/A
Nitrobenzene	82 - 138	82 - 138	19	75 - 125	75 - 125	N/A
o-Nitrotoluene	85 - 129	85 - 129	21	75 - 120	75 - 120	N/A
m-Nitrotoluene	85 - 136	85 - 136	22	80 - 125	80 - 125	N/A
p-Nitrotoluene	86 - 133	86 - 133	19	75 - 125	75 - 125	N/A
Tetryl	53 - 124	53 - 124	22	10 - 150	10 - 150	N/A
1,3,5-Trinitrobenzene	81 - 138	81 - 138	24	75 - 125	75 - 125	N/A
2,4,6-Trinitrotoluene	70 - 137	70 - 137	29	55 - 140	55 - 140	N/A
Surrogates						
3,4-Dinitrotoluene	72 - 145	72 - 145	N/A	78-108	78-108	N/A
PCBs, SW-846 8082						

Laboratory Control Limits for QC Samples
Plum Brook Ordnance Works
Sandusky, Ohio

Spiked Compound	Accutest			Test America		
	Soil - LCS	Soil - MS/MSD		Soil - LCS	Soil - MS/MSD	
	% Recovery Range	% Recovery Range	Precision RPD (%)	% Recovery Range	% Recovery Range	Precision RPD (%)
Aroclor-1016	69 - 117	69 - 117	26	10 - 199	10 - 199	30
Aroclor-1260	71 - 121	71 - 121	30	10 - 199	10 - 199	30
Surrogates						
Tetrachloro-m-xylene	44 - 126	44 - 126	N/A	40-140	40-140	N/A
Decachlorobiphenyl	39 - 157	39 - 157	N/A	60-125	60-125	N/A
Metals, SW-846 6010B/7470A						
Aluminum	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Antimony	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Arsenic	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Barium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Beryllium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Cadmium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Calcium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Chromium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Cobalt	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Copper	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Iron	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Lead	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Magnesium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Manganese	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Nickel	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Potassium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Selenium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Silver	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Sodium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Thallium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Vanadium	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Zinc	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Mercury	80 - 120	80 - 120	20	80 - 120	75 - 125	20
Total Organic Carbon (TOC) SW-846 9060						
TOC			25			

LCS - Laboratory Control Sample
MS/MSD - Matrix Spike/Matrix Spike Duplicate
RPD - Relative Percent Difference
N/A - Not Applicable

APPENDIX F

CHEMICAL ANALYTICAL DATA SUMMARY

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB01			CY1-SB01			CY1-SB01			CY1-SB02			CY1-SB02			CY1-SB02			CY1-SB03			CY1-SB03		
Sample Number:		CY0001			CY0002			CY0003			CY0004			CY0005			CY0006			CY0007			CY0008		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		0.5 - 1.5 Ft			3 - 5 Ft			8 - 10 Ft			0.3 - 1.3 Ft			3 - 5 Ft			8 - 10 Ft			0.5 - 1.5 Ft			3 - 5 Ft		
Sample Purpose:		REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Explosives																									
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Dinitrobenzene, 1,3-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Dinitrotoluene, 2,4-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Dinitrotoluene, 2,6-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
HMX	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Nitrobenzene	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Nitrotoluene, 2-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Nitrotoluene, 3-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Nitrotoluene, 4-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
RDX	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Tetryl	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.19	U	U	0.15	U	U	0.19	U	U	0.16	U	U	0.16	U	U	0.15	U	U	0.17	U	U	0.17	U	U
Semivolatiles																									
3-Methylphenol and 4-Methylph	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Acenaphthene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Acenaphthylene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
ACETOPHENONE	mg/kg	0			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Atrazine	mg/kg	0			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzaldehyde	mg/kg	0			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Benzo(a)pyrene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Benzo(b)fluoranthene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Benzo(ghi)perylene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Benzo(k)fluoranthene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Benzoic acid	mg/kg	1	U	U	1.1	U	U	1.1	U	U	1	U	U	4.2	U	U	1	U	U	0.99	U	U	1.1	U	U
Benzyl alcohol	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
BIBENZENE	mg/kg	0			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Bis(2-chloroethyl)ether	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.4	U	U	0.43	U	U	0.43	U	U	0.41	U	U	1.7	U	U	0.42	U	U	0.4	U	U	0.43	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Butyl benzyl phthalate	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB01			CY1-SB01			CY1-SB01			CY1-SB02			CY1-SB02			CY1-SB02			CY1-SB03			CY1-SB03		
Sample Number:		CY0001			CY0002			CY0003			CY0004			CY0005			CY0006			CY0007			CY0008		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		0.5 - 1.5 Ft			3 - 5 Ft			8 - 10 Ft			0.3 - 1.3 Ft			3 - 5 Ft			8 - 10 Ft			0.5 - 1.5 Ft			3 - 5 Ft		
Sample Purpose:		REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Caprolactam	mg/kg	0			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Chloroaniline, 4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Chloronaphthalene, 2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Chlorophenol, 2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Chrysene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dibenz(a,h)anthracene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dibenzofuran	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.103	J	J	0.21	U	U	0.2	U	U	0.21	U	U
Dichlorobenzene, 1,2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dichlorobenzene, 1,3-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dichlorobenzene, 1,4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.4	U	U	0.43	U	U	0.43	U	U	0.41	U	U	1.7	U	U	0.42	U	U	0.4	U	U	0.43	U	U
Dichlorophenol, 2,4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Diethyl phthalate	mg/kg	0.4	U	U	0.43	U	U	0.43	U	U	0.41	U	U	1.7	U	U	0.42	U	U	0.4	U	U	0.43	U	U
Dimethyl phthalate	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dimethylphenol, 2,4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Di-n-butyl phthalate	mg/kg	0.4	U	U	0.43	U	U	0.43	U	U	0.41	U	U	1.7	U	U	0.42	U	U	0.4	U	U	0.43	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.4	U	U	0.43	U	U	0.43	U	U	0.41	U	U	1.7	U	U	0.42	U	U	0.4	U	U	0.43	U	U
Dinitrophenol, 2,4-	mg/kg	1	U	U	1.1	U	U	1.1	U	U	1	U	U	4.2	U	U	1	U	U	0.99	U	U	1.1	U	U
Dinitrotoluene, 2,4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Dinitrotoluene, 2,6-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Di-n-octyl phthalate	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Fluoranthene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.138	J	J	0.21	U	U	0.2	U	U	0.21	U	U
Fluorene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.105	J	J	0.21	U	U	0.2	U	U	0.21	U	U
Hexachlorobenzene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Hexachlorobutadiene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Hexachlorocyclopentadiene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Hexachloroethane	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Isophorone	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Methylnaphthalene, 2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.0264	J	J	0.21	U	U
Methylphenol, 2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Naphthalene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Nitroaniline, 2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Nitroaniline, 3-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB01			CY1-SB01			CY1-SB01			CY1-SB02			CY1-SB02			CY1-SB02			CY1-SB03			CY1-SB03		
Sample Number:		CY0001			CY0002			CY0003			CY0004			CY0005			CY0006			CY0007			CY0008		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		0.5 - 1.5 Ft			3 - 5 Ft			8 - 10 Ft			0.3 - 1.3 Ft			3 - 5 Ft			8 - 10 Ft			0.5 - 1.5 Ft			3 - 5 Ft		
Sample Purpose:		REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Nitroaniline, 4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Nitrobenzene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Nitrophenol, 2-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Nitrophenol, 4-	mg/kg	1	U	U	1.1	U	U	1.1	U	U	1	U	U	4.2	U	U	1	U	U	0.99	U	U	1.1	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
n-Nitrosodiphenylamine	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Pentachlorophenol	mg/kg	1	U	U	1.1	U	U	1.1	U	U	1	U	U	4.2	U	U	1	U	U	0.99	U	U	1.1	U	U
Phenanthrene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Phenol	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Pyrene	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.124	J	J	0.21	U	U	0.2	U	U	0.21	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.2	U	U	0.21	U	U	0.21	U	U	0.2	U	U	0.84	U	U	0.21	U	U	0.2	U	U	0.21	U	U
Pesticides/PCBs																									
Aroclor 1016	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Aroclor 1221	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Aroclor 1232	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Aroclor 1242	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Aroclor 1248	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Aroclor 1254	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Aroclor 1260	mg/kg	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U	-	-	-	0.02	U	U	0.021	U	U
Metals - Unfiltered																									
Aluminum	mg/kg	4660			10100			11000			2030			6020			9910			5020			11400		
Antimony	mg/kg	0.12	B	J	2.1	U	U	2	U	U	0.14	B	J	0.23	B	J	5.3	U	U	1.2	U	U	1.9	U	U
Arsenic	mg/kg	3.1			7.9			8.4			34.6			3.8			7			9			12.5		
Barium	mg/kg	18.5			73.8			79.7			23.9			44			62.7			31.6			84.6		
Beryllium	mg/kg	0.24	B	J	0.52			0.58			0.061	B	J	0.5			0.62	B	J	0.32			0.63		
Cadmium	mg/kg	0.21	U	U	0.15	B	J	0.33	B	J	0.16	U	U	0.52			0.46	B	J	0.17	B	J	0.33	B	J
Calcium	mg/kg	727			5470			13800			447			4140			3230			2340			3110		
Chromium	mg/kg	7.8			15.4			17.1			3.9			10.7			15.3			8.7			17.8		
Cobalt	mg/kg	3.1			8.3			18			0.79	B	J	9.5			14.1			3.3			14.1		
Copper	mg/kg	6			19.4			24.9			3.3			18.3			18.1			7.5			24.8		
Iron	mg/kg	8320			18800			22300			7840			17300			17100			12700			26000		
Lead	mg/kg	4.8			10.7			11.8			5.5			29.8			10.3			7.2			12.8		
Magnesium	mg/kg	614			3710			6100			274			1180			2260			1090			3950		
Manganese	mg/kg	30.6			316			721			23.7			188			401			148			230		J
Mercury	mg/kg	0.013	B	J	0.021	B	J	0.019	B	J	0.022	B	J	0.037	B	J	0.076	B	J	0.034	B	J	0.02	B	J

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

	Location Code:	CY1-SB01			CY1-SB01			CY1-SB01			CY1-SB02			CY1-SB02			CY1-SB02			CY1-SB03			CY1-SB03		
	Sample Number:	CY0001			CY0002			CY0003			CY0004			CY0005			CY0006			CY0007			CY0008		
	Sample Date:	20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
	Sample Depth:	0.5 - 1.5 Ft			3 - 5 Ft			8 - 10 Ft			0.3 - 1.3 Ft			3 - 5 Ft			8 - 10 Ft			0.5 - 1.5 Ft			3 - 5 Ft		
	Sample Purpose:	REG			REG			REG			REG			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Nickel	mg/kg	7.8			23.1			36			2.3			13.6			34.1			9.4			37.2		
Potassium	mg/kg	212	B	J	744	B	J	1550			202	B	J	435	B	J	770	B	J	400	B	J	1390		
Selenium	mg/kg	1.1	U	U	2.1	U	U	0.53	B	J	0.82	U	U	1.2	U	U	5.3	U	U	1.2	U	U	1.9	U	U
Silver	mg/kg	0.53	U	U	1	U	U	0.98	U	U	0.41	U	U	0.62	U	U	2.7	U	U	0.6	U	U	0.97	U	U
Sodium	mg/kg	530	U	U	1000	U	U	980	U	U	111	B	J	620	U	U	2700	U	U	111	B	J	970	U	U
Thallium	mg/kg	0.53	U	U	0.52	U	U	0.29	B	J	0.41	U	U	0.62	U	U	0.53	U	U	0.6	U	U	0.41	B	J
Vanadium	mg/kg	15.4			25.2			21.8			8			18.1			18.7			16.6			23.2		
Zinc	mg/kg	21.3			43.9			57.6			9.4			157			163			21.1			57		
General Chemistry																									
% Solids	Percent	83.3			78.7			76.9			83.1			79.7			79.8			82.9			78.2		
Total organic carbon	Percent	0.27			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB03			CY1-SB03			CY1-SB03			CY1-SB04			CY1-SB04			CY1-SB04		
Sample Number:		CY0009			CY0010			CY0011			CY0012			CY0013			CY0014		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		3 - 5 Ft			3 - 5 Ft			8 - 10 Ft			1 - 2 Ft			3 - 5 Ft			8 - 10 Ft		
Sample Purpose:		FD			FS			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Explosives																			
Amino-2,6-dinitrotoluene, 4-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Amino-4,6-dinitrotoluene, 2-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Dinitrobenzene, 1,3-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Dinitrotoluene, 2,4-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Dinitrotoluene, 2,6-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
HMX	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Nitrobenzene	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Nitrotoluene, 2-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Nitrotoluene, 3-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Nitrotoluene, 4-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
RDX	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Tetryl	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Trinitrobenzene, 1,3,5-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Trinitrotoluene, 2,4,6-	mg/kg	0.2	U	U	0.098	U	U	0.16	U	U	0.15	U	U	0.15	U	U	0.19	U	U
Semivolatiles																			
3-Methylphenol and 4-Methylph	mg/kg	0.21	U	U	0.49	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Acenaphthene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Acenaphthylene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
ACETOPHENONE	mg/kg	-	-	-	0.12	U	U	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Atrazine	mg/kg	-	-	-	0.25	U	U	-	-	-	-	-	-	-	-	-	-	-	-
Benzaldehyde	mg/kg	-	-	-	0.12	U	U	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Benzo(a)pyrene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Benzo(b)fluoranthene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Benzo(ghi)perylene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Benzo(k)fluoranthene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Benzoic acid	mg/kg	1.1	U	U	-	-	-	1	U	U	1.1	U	U	1.1	U	U	1	U	U
Benzyl alcohol	mg/kg	0.21	U	U	-	-	-	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
BIBENZENE	mg/kg	-	-	-	0.061	U	U	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.21	U	U	0.12	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Bis(2-chloroethyl)ether	mg/kg	0.21	U	U	0.12	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Bis(2-chloroisopropyl)ether	mg/kg	0.21	U	U	0.12	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Bis(2-ethylhexyl)phthalate	mg/kg	0.43	U	U	0.061	U	U	0.41	U	U	0.46	U	U	0.44	U	U	0.42	U	U
Bromophenyl phenyl ether, 4-	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Butyl benzyl phthalate	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB03			CY1-SB03			CY1-SB03			CY1-SB04			CY1-SB04			CY1-SB04		
Sample Number:		CY0009			CY0010			CY0011			CY0012			CY0013			CY0014		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		3 - 5 Ft			3 - 5 Ft			8 - 10 Ft			1 - 2 Ft			3 - 5 Ft			8 - 10 Ft		
Sample Purpose:		FD			FS			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Caprolactam	mg/kg	-	-	-	0.4	U	U	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Chloro-3-methylphenol, 4-	mg/kg	0.21	U	U	0.18	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Chloroaniline, 4-	mg/kg	0.21	U	U	0.18	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Chloronaphthalene, 2-	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Chlorophenol, 2-	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Chlorophenyl phenyl ether, 4-	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Chrysene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dibenz(a,h)anthracene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dibenzofuran	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dichlorobenzene, 1,2-	mg/kg	0.21	U	U	-	-	-	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dichlorobenzene, 1,3-	mg/kg	0.21	U	U	-	-	-	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dichlorobenzene, 1,4-	mg/kg	0.21	U	U	-	-	-	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dichlorobenzidine, 3,3'-	mg/kg	0.43	U	U	0.12	U	U	0.41	U	U	0.46	U	U	0.44	U	U	0.42	U	U
Dichlorophenol, 2,4-	mg/kg	0.21	U	U	0.18	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Diethyl phthalate	mg/kg	0.43	U	U	0.061	U	U	0.41	U	U	0.46	U	U	0.44	U	U	0.42	U	U
Dimethyl phthalate	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dimethylphenol, 2,4-	mg/kg	0.21	U	U	0.18	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Di-n-butyl phthalate	mg/kg	0.43	U	U	0.061	U	U	0.41	U	U	0.46	U	U	0.44	U	U	0.42	U	U
Dinitro-2-methylphenol, 4,6-	mg/kg	0.43	U	U	0.18	U	U	0.41	U	U	0.46	U	U	0.44	U	U	0.42	U	U
Dinitrophenol, 2,4-	mg/kg	1.1	U	U	0.4	U	U	1	U	U	1.1	U	U	1.1	U	U	1	U	U
Dinitrotoluene, 2,4-	mg/kg	0.21	U	U	0.25	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Dinitrotoluene, 2,6-	mg/kg	0.21	U	U	0.25	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Di-n-octyl phthalate	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Fluoranthene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.0313	J	J	0.22	U	U	0.21	U	U
Fluorene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Hexachlorobenzene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Hexachlorobutadiene	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Hexachlorocyclopentadiene	mg/kg	0.21	U	U	0.4	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Hexachloroethane	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Indeno(1,2,3-cd)pyrene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Isophorone	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Methylnaphthalene, 2-	mg/kg	0.21	U	U	0.025			0.2	U	U	0.0334	J	J	0.22	U	U	0.21	U	U
Methylphenol, 2-	mg/kg	0.21	U	U	0.25	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Naphthalene	mg/kg	0.21	U	U	0.02			0.2	U	U	0.183	J	J	0.22	U	U	0.21	U	U
Nitroaniline, 2-	mg/kg	0.21	U	U	0.25	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Nitroaniline, 3-	mg/kg	0.21	U	U	0.25	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB03			CY1-SB03			CY1-SB03			CY1-SB04			CY1-SB04			CY1-SB04		
Sample Number:		CY0009			CY0010			CY0011			CY0012			CY0013			CY0014		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		3 - 5 Ft			3 - 5 Ft			8 - 10 Ft			1 - 2 Ft			3 - 5 Ft			8 - 10 Ft		
Sample Purpose:		FD			FS			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Nitroaniline, 4-	mg/kg	0.21	U	U	0.25	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Nitrobenzene	mg/kg	0.21	U	U	0.12	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Nitrophenol, 2-	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Nitrophenol, 4-	mg/kg	1.1	U	U	0.4	U	U	1	U	U	1.1	U	U	1.1	U	U	1	U	U
n-Nitroso-di-n-propylamine	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
n-Nitrosodiphenylamine	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Pentachlorophenol	mg/kg	1.1	U	U	0.18	U	U	1	U	U	1.1	U	U	1.1	U	U	1	U	U
Phenanthrene	mg/kg	0.21	U	U	0.009			0.2	U	U	0.0255	J	J	0.22	U	U	0.21	U	U
Phenol	mg/kg	0.21	U	U	0.061	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Pyrene	mg/kg	0.21	U	U	0.0082	U	U	0.2	U	U	0.0309	J	J	0.22	U	U	0.21	U	U
Trichlorobenzene, 1,2,4-	mg/kg	0.21	U	U	-	-	-	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Trichlorophenol, 2,4,5-	mg/kg	0.21	U	U	0.18	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Trichlorophenol, 2,4,6-	mg/kg	0.21	U	U	0.18	U	U	0.2	U	U	0.23	U	U	0.22	U	U	0.21	U	U
Pesticides/PCBs																			
Aroclor 1016	mg/kg	0.021	U	U	0.08	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Aroclor 1221	mg/kg	0.021	U	U	0.062	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Aroclor 1232	mg/kg	0.021	U	U	0.056	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Aroclor 1242	mg/kg	0.021	U	U	0.049	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Aroclor 1248	mg/kg	0.021	U	U	0.068	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Aroclor 1254	mg/kg	0.021	U	U	0.068	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Aroclor 1260	mg/kg	0.021	U	U	0.068	U	U	-	-	-	0.022	U	U	0.021	U	U	-	-	-
Metals - Unfiltered																			
Aluminum	mg/kg	13100			10000			6900			5480			8830		J	8400		
Antimony	mg/kg	2.3	U	U	1.4	J	J	3.8	U	U	0.17	B	J	0.13	B	J	0.16	B	J
Arsenic	mg/kg	10.1			19			5.9			24.6			8.4		J	8.3		
Barium	mg/kg	79.8			100			53.6			46.5			55.1		J	42.5		
Beryllium	mg/kg	0.67			0.51			0.36			0.26	B	J	0.44		J	0.41		
Cadmium	mg/kg	0.38	B	J	0.51	U	U	0.76	U	U	0.8			0.57		J	0.65		
Calcium	mg/kg	2910			2600			50000			1080			19800		J	26500		
Chromium	mg/kg	20.1			18			14.5			13			13		J	12.1		
Cobalt	mg/kg	15.7			11			6.4			3.3	B	J	9.7		J	6.5		
Copper	mg/kg	26.7			30			17.6			12			19.9		J	19		
Iron	mg/kg	20700			43000			13200			31700			19100		J	15200		
Lead	mg/kg	10.6			14			12.5			7.6			11.4			12.1		
Magnesium	mg/kg	3710			3100	B		12500			748			8220		J	6880		
Manganese	mg/kg	461		J	290			249			93.6			279		J	217		
Mercury	mg/kg	0.031	B	J	0.022	J	J	0.015	B	J	0.049	B	J	0.018	B	J	0.015	B	J

Appendix F

Ash Pit 1 Coal Yard
Chemical Analytical Data Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location Code:		CY1-SB03			CY1-SB03			CY1-SB03			CY1-SB04			CY1-SB04			CY1-SB04		
Sample Number:		CY0009			CY0010			CY0011			CY0012			CY0013			CY0014		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		3 - 5 Ft			3 - 5 Ft			8 - 10 Ft			1 - 2 Ft			3 - 5 Ft			8 - 10 Ft		
Sample Purpose:		FD			FS			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Nickel	mg/kg	39			36			17.5			9.8			24.7		J	19.9		
Potassium	mg/kg	1210			1000			1220			716			1280		J	1470		
Selenium	mg/kg	2.3	U	U	2	U	U	3.8	U	U	1.4	U	U	1.1	U	UJ	1	U	U
Silver	mg/kg	1.2	U	U	0.51	U	U	0.47	U	U	0.074	B	J	0.57	U	UJ	0.5	U	U
Sodium	mg/kg	1200	U	U	510	U	U	115	B	J	89.5	B	J	92.3	B	J	96.7	B	J
Thallium	mg/kg	0.58	U	U	1.5	J	J	1.9	U	U	0.64	B	J	0.38	B	J	0.5	U	U
Vanadium	mg/kg	28.9			30			14.7			22.8			17.1		J	14.3		
Zinc	mg/kg	62.9			74			50.5			27.9			44.7		J	37.5		
General Chemistry																			
% Solids	Percent	78.9			-	-	-	80.5			74			76.5			79.1		
Total organic carbon	Percent	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Laboratory and data validation qualifier definitions are presented in Table 5 of Appendix H.
"-" = Not Analyzed
LQ - Laboratory qualifier. REG = Regular field Sample
mg/kg - Milligrams per kilogram. FS = Field Split
VQ - Validation qualifier. FD = Field Duplicate
The laboratory LOQ is presented for all non-detect constituents.

APPENDIX G

DETECTED HITS SUMMARY

Appendix G

Ash Pit 1 Coal Yard
Detected Hits Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location:		CY1-SB01			CY1-SB01			CY1-SB01			CY1-SB02			CY1-SB02			CY1-SB02			CY1-SB03			CY1-SB03			CY1-SB03		
Sample Number:		CY0001			CY0002			CY0003			CY0004			CY0005			CY0006			CY0007			CY0008			CY0009		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		.5 - 1.5 Ft			3 - 5 Ft			8 - 10 Ft			.3 - 1.3 Ft			3 - 5 Ft			8 - 10 Ft			.5 - 1.5 Ft			3 - 5 Ft			3 - 5 Ft		
Sample Purpose:		REG			REG			REG			REG			REG			REG			REG			REG			FD		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Semivolatiles																												
Dibenzofuran	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	0.103	J	J	U	U	U	U	U	U	U	U	U	U	U	U
Fluoranthene	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	0.138	J	J	U	U	U	U	U	U	U	U	U	U	U	U
Fluorene	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	0.105	J	J	U	U	U	U	U	U	U	U	U	U	U	U
Methylnaphthalene, 2-	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.0264	J	J	U	U	U	U	U	U
Naphthalene	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Phenanthrene	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Pyrene	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	0.124	J	J	U	U	U	U	U	U	U	U	U	U	U	U
Metals - Unfiltered																												
Aluminum	mg/kg	4660			10100			11000			2030			6020			9910			5020			11400			13100		
Antimony	mg/kg	0.12	B	J	U	U	U	U	U	U	0.14	B	J	0.23	B	J	U	U	U	U	U	U	U	U	U	U	U	U
Arsenic	mg/kg	3.1			7.9			8.4			34.6			3.8			7			9			12.5			10.1		
Barium	mg/kg	18.5			73.8			79.7			23.9			44			62.7			31.6			84.6			79.8		
Beryllium	mg/kg	0.24	B	J	0.52			0.58			0.061	B	J	0.5			0.62	B	J	0.32			0.63			0.67		
Cadmium	mg/kg	U	U	U	0.15	B	J	0.33	B	J	U	U	U	0.52			0.46	B	J	0.17	B	J	0.33	B	J	0.38	B	J
Calcium	mg/kg	727			5470			13800			447			4140			3230			2340			3110			2910		
Chromium	mg/kg	7.8			15.4			17.1			3.9			10.7			15.3			8.7			17.8			20.1		
Cobalt	mg/kg	3.1			8.3			18			0.79	B	J	9.5			14.1			3.3			14.1			15.7		
Copper	mg/kg	6			19.4			24.9			3.3			18.3			18.1			7.5			24.8			26.7		
Iron	mg/kg	8320			18800			22300			7840			17300			17100			12700			26000			20700		
Lead	mg/kg	4.8			10.7			11.8			5.5			29.8			10.3			7.2			12.8			10.6		
Magnesium	mg/kg	614			3710			6100			274			1180			2260			1090			3950			3710		
Manganese	mg/kg	30.6			316			721			23.7			188			401			148			230		J	461		J
Mercury	mg/kg	0.013	B	J	0.021	B	J	0.019	B	J	0.022	B	J	0.037	B	J	0.076	B	J	0.034	B	J	0.02	B	J	0.031	B	J
Nickel	mg/kg	7.8			23.1			36			2.3			13.6			34.1			9.4			37.2			39		
Potassium	mg/kg	212	B	J	744	B	J	1550			202	B	J	435	B	J	770	B	J	400	B	J	1390			1210		
Selenium	mg/kg	U	U	U	U	U	U	0.53	B	J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Silver	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Sodium	mg/kg	U	U	U	U	U	U	U	U	U	111	B	J	U	U	U	U	U	U	111	B	J	U	U	U	U	U	U
Thallium	mg/kg	U	U	U	U	U	U	0.29	B	J	U	U	U	U	U	U	U	U	U	U	U	U	0.41	B	J	U	U	U
Vanadium	mg/kg	15.4			25.2			21.8			8			18.1			18.7			16.6			23.2			28.9		
Zinc	mg/kg	21.3			43.9			57.6			9.4			157			163			21.1			57			62.9		
Water Quality Parameters																												
% Solids	Percent	83.3			78.7			76.9			83.1			79.7			79.8			82.9			78.2			78.9		

Appendix G

Ash Pit 1 Coal Yard
Detected Hits Summary
Former Plum Brook Ordnance Works
Sandusky, Ohio

Location:		CY1-SB03			CY1-SB03			CY1-SB04			CY1-SB04			CY1-SB04		
Sample Number:		CY0010			CY0011			CY0012			CY0013			CY0014		
Sample Date:		20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11			20-Dec-11		
Sample Depth:		3 - 5 Ft			8 - 10 Ft			1 - 2 Ft			3 - 5 Ft			8 - 10 Ft		
Sample Purpose:		FS			REG			REG			REG			REG		
Parameter	Units	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ	Result	LQ	VQ
Semivolatiles																
Dibenzofuran	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Fluoranthene	mg/kg	U	U	U	U	U	U	0.0313	J	J	U	U	U	U	U	U
Fluorene	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Methylnaphthalene, 2-	mg/kg	0.025			U	U	U	0.0334	J	J	U	U	U	U	U	U
Naphthalene	mg/kg	0.02			U	U	U	0.183	J	J	U	U	U	U	U	U
Phenanthrene	mg/kg	0.009			U	U	U	0.0255	J	J	U	U	U	U	U	U
Pyrene	mg/kg	U	U	U	U	U	U	0.0309	J	J	U	U	U	U	U	U
Metals - Unfiltered																
Aluminum	mg/kg	10000			6900			5480			8830		J	8400		
Antimony	mg/kg	1.4	J	J	U	U	U	0.17	B	J	0.13	B	J	0.16	B	J
Arsenic	mg/kg	19			5.9			24.6			8.4		J	8.3		
Barium	mg/kg	100			53.6			46.5			55.1		J	42.5		
Beryllium	mg/kg	0.51			0.36			0.26	B	J	0.44		J	0.41		
Cadmium	mg/kg	U	U	U	U	U	U	0.8			0.57		J	0.65		
Calcium	mg/kg	2600			50000			1080			19800		J	26500		
Chromium	mg/kg	18			14.5			13			13		J	12.1		
Cobalt	mg/kg	11			6.4			3.3	B	J	9.7		J	6.5		
Copper	mg/kg	30			17.6			12			19.9		J	19		
Iron	mg/kg	43000			13200			31700			19100		J	15200		
Lead	mg/kg	14			12.5			7.6			11.4			12.1		
Magnesium	mg/kg	3100	B		12500			748			8220		J	6880		
Manganese	mg/kg	290			249			93.6			279		J	217		
Mercury	mg/kg	0.022	J	J	0.015	B	J	0.049	B	J	0.018	B	J	0.015	B	J
Nickel	mg/kg	36			17.5			9.8			24.7		J	19.9		
Potassium	mg/kg	1000			1220			716			1280		J	1470		
Selenium	mg/kg	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Silver	mg/kg	U	U	U	U	U	U	0.074	B	J	U	U	U	U	U	U
Sodium	mg/kg	U	U	U	115	B	J	89.5	B	J	92.3	B	J	96.7	B	J
Thallium	mg/kg	1.5	J	J	U	U	U	0.64	B	J	0.38	B	J	U	U	U
Vanadium	mg/kg	30			14.7			22.8			17.1		J	14.3		
Zinc	mg/kg	74			50.5			27.9			44.7		J	37.5		
Water Quality Parameters																
% Solids	Percent	-	-	-	80.5			74			76.5			79.1		

Laboratory and data validation qualifier definitions are presented in Table 5 of Appendix H.

"-" = Not Analyzed
"U" = Not Detected
LQ - Laboratory qualifier.
REG = Regular field Sample
mg/kg - Milligrams per kilogram.
FS = Field Split
VQ - Validation qualifier.
FD = Field Duplicate
The laboratory LOQ is presented for all non-detect constituents.

APPENDIX H

DATA QUALITY EVALUATIONS

DATA QUALITY EVALUATION

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List of Acronyms

CCAL	continuing calibration
DQO	data quality objectives
EPA	U.S. Environmental Protection Agency
ICAL	initial calibration
ICP	inductively coupled plasma
ICS	interference check sample
LCS	laboratory control sample
MDL	method detection limit
MQL	method quantitation limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
PBOW	Plum Brook Ordnance Works
PQL	practical quanitation limit
QA	quality assurance
QC	quality control
SAP	sampling and analysis plan
Shaw	Shaw Environmental, Inc.
RPD	relative percent difference

1.0 Introduction

This appendix presents results of the quality assurance (QA)/quality control (QC) measures implemented for the sampling and analysis activities at Plum Brook Ordnance Works (PBOW), Sandusky, Ohio. The quality indicators from every aspect of the data collection were reviewed, and an assessment of the data with regard to project-specific objectives is presented. Successful execution of project-specific objectives and procedures provides strong support for the acceptance of the data generated as adequate for the purpose of evaluating the analytical results from this assessment at PBOW.

Shaw Environmental, Inc. (Shaw) conducted investigative work at the Coal Yard 1 area; sampling was performed in December 2011. Primary and field duplicate project samples were analyzed by Accutest Laboratories, of Orlando, Florida. Field split samples were submitted to Test America Laboratories, Inc. of North Canton, Ohio, for analysis. All data analyzed were reviewed for accuracy and completeness. One hundred percent of the data analyzed were subjected to data validation following the guidelines in the U.S. Environmental Protection Agency (EPA) Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review (June 2008) the QA project plan, and EPA Region 3 Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (April 1993). Since these documents specify procedures for Contract Laboratory Program data, they are used as guidelines only. Method and laboratory QA and QC requirements supersede these guidelines, where applicable. Data were evaluated against specific criteria to verify the achievement of precision, accuracy, representativeness, completeness and comparability goals established to meet the project data quality objectives (DQO). To verify that these DQOs were met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and all nonconformances and discrepancies in the data were examined to determine compliance with the appropriate and applicable procedures defined in the sampling and analysis plan (SAP). The results of this review are presented in the following sections, with all analytical outliers or nonconformances discussed where they occurred.

This report is divided into three sections. Section 2.0 discusses the field investigation and QC procedures used during the sampling effort. Section 3.0 outlines the analytical program and the associated QC activities performed. The final part of this document, Section 4.0, summarizes the data findings and their overall impact on the usability of the analytical data.

2.0 Field Sampling and Quality Control Activities

Shaw was retained by the U. S. Army Corps of Engineers Nashville District to conduct investigative and sampling activities at PBOW. Field activities at this site included collection of soil samples. The collection of these samples and their associated QC samples are discussed in this section of the data quality evaluation. Thirteen project samples and one field duplicate soil sample were submitted to Accutest for analysis. Sample shipments from the field were performed under custody and documented using standard Shaw analysis request/chain-of-custody forms. These forms provided project-specific analytical specifications and QC instructions to the laboratory. A formal chain-of-custody transfer record was prepared and included with these forms to document custody during sample transportation, storage, and disposition by the laboratory. Table 1 summarizes the field sample number, location, sample type, date of collection, lot number, and laboratory for each sample collected.

2.1 Equipment Rinsates

Equipment rinsates are used to assess the effectiveness of the decontamination procedures used by the sampling team on reusable sampling equipment. No equipment rinsate samples were collected during this sampling event.

2.2 Field Duplicates

Field duplicate samples are collected and submitted to the laboratory for analysis along with their corresponding original sample. The data generated from the analysis of field duplicate samples are used to evaluate the precision of the sample collection and analysis procedures. It is difficult to collect and analyze soil samples in duplicate due to the heterogeneous nature of soil. High relative percent difference (RPD) between an original sample and its field duplicate may indicate a difference in sample matrix or sample collection rather than true problems with precision of sample analysis. Also, when estimated (“J”) or nondetected (“U”) results are reported, there is a potential for increased variability between the primary and duplicate sample results.

Field duplicate samples were collected at a frequency of 1 for every 10 samples (10 percent). One field duplicate soil sample was collected during this sampling event. Table 2 compares the original and field duplicate results and shows the RPDs calculated for those detected compounds. Compounds not presented in the table were not detected in either the original or field duplicate samples. Sample sets with no detections are not presented in the table. In cases where duplicates were performed and one result is less than the reporting limit but greater than the method

detection limit, the RPD is reported but is of limited value. Only samples with detections in both the regular and the duplicate were qualified for high RPDs.

The acceptance criterion of 30 percent RPD for waters and 50 percent RPD for soils was used to evaluate these sample results. The RPD value for manganese in sample/duplicate pair CY0008/CY0009 exceeded the acceptance criteria resulting in the qualification of data. Overall, the data compared well when detected concentrations were greater than the reporting limit. RPD is calculated by using the following formula:

$$RPD = \left| \frac{A - B}{(A + B)/2} \right| \quad x \quad 100$$

where:

RPD	=	relative percent difference
A	=	original result
B	=	field duplicate result.

2.3 Field Split Samples

Split samples were collected in conjunction with field duplicate samples and sent to Test America Laboratories, Inc. of North Canton. The split samples were submitted to the laboratory for the same analyses as their corresponding field duplicates and original field samples. The split samples are used to determine if data results are reproducible when analyzed by two different laboratories. Results are also evaluated to determine if a contracted laboratory's preparation and analysis procedures are in control and meet the approved method criteria.

Field split samples were collected at a frequency of approximately 1 for every 10 regular samples. One soil field split sample was collected during this sampling event. Table 2 compares the original and field split results and shows the RPDs calculated for those detected compounds. Compounds not presented in the table were not detected in either the original or field split samples. Samples with no detections are not presented in the table. Field split samples were not qualified for RPD criterion.

3.0 Analytical Program and Quality Control Activities

The project QA/QC program described in the SAP was followed for the collection and laboratory analysis of samples. Each of the analytical methods used require that method-specific QA/QC

protocols be followed during sample analysis. These protocols are a critical part of the methods employed and were followed by the laboratory during sample analysis. Specific measures included detailed record-keeping procedures, instrument calibrations, and analysis of method blanks, blank spikes, matrix spike (MS)/matrix spike duplicate (MSD), surrogates, and internal standards. The following SW-846 and EPA methods were used to analyze PBOW samples:

Analysis	Method
Semivolatiles	SW-846 3550C/8270D
Nitroaromatics	SW-846 8330A
Metals	SW-846 3050B/6010C/7471B
Polychlorinated Biphenyls	SW-846 3550C/8082A
Wet Chemistry	Total Organic Carbon by Walkley Black

The validator used the QA/QC criteria defined in the SAP, laboratory-derived acceptance criteria, and analytical method criteria to qualify data. Any qualifiers added to these data by the data validator are included in the data summary report.

3.1 Laboratory Quality Assurance/Quality Control Procedures

The following sections discuss specific QA/QC protocols required and performed by the laboratory during this investigation.

3.1.1 Calibration

The calibration of instruments is required to ensure that the instruments are operating properly. Calibration is achieved when instrument response can be related to the concentration of an analyte. All analytes met QC criteria for initial calibration (ICAL) percent relative standard deviation and/or continuing calibration (CCAL) percent difference. The following criteria are used to evaluate the data: individual ICAL percent relative standard deviation +/- 30 percent and/or CCAL percent difference +/- 20 percent (volatile and semivolatile organics); +/-15 percent (explosives); for metals, individual ICAL/CCAL percent relative standard deviation +/- 10 percent; and for mercury, individual ICAL/CCAL percent relative standard deviation +/- 20 percent. No sample qualification was required.

3.1.2 Method/Calibration Blanks

Method blanks are analyzed with each analytical "batch" processed on a per matrix (i.e., soil and water) basis. Method blanks are carried step-wise through the same analytical procedure as their associated field samples including the addition of solvents, surrogate and standard spikes, and reagents as required in the analysis process. The purpose of a method blank is to identify any

contaminants that may be introduced to the sample as a result of the analytical process. The method blank is considered acceptable by the laboratory if the concentration of any target analyte is less than ½ the reporting limit and less than 1/10 the amount measure in any sample or regulatory limit (whichever is greater). The data validator evaluated all blank data associated with each sample. The data validators evaluated all blank data associated with each sample. The third party data validation evaluation criteria for method blanks are as follows:

- If a parameter is found in a blank but not detected in the sample, no action is taken.
- For organics, if the sample result is less than 5 times (most analytes) or 10 times (common laboratory contaminants) that of the blank result, the sample result is qualified “B.”
- For inorganics, if the sample result is greater than the instrument detection limit but less than 5 times the blank result, the sample result is qualified "B."

If the sample result is greater than 5 times (most analytes) or 10 times (common laboratory contaminants) the blank result, no action is taken. All method blanks were found to be acceptable.

3.1.3 Surrogate Recoveries

Surrogate standards are defined as non-target compounds added to standards, blanks, and samples prior to extraction or purging. They are used in organic analyses to monitor the percent recovery efficiencies of the sample preparation and analytical procedures. Surrogate recoveries for the project samples all fell within acceptable QC criteria.

The surrogate control limits for this project can be found in Attachment A of Appendix E. The surrogate control limits used for evaluation are the laboratory established in-house surrogate criteria.

3.1.4 Matrix Spikes and Laboratory Control Spikes

Two types of spikes were performed for all analyses: MSs and laboratory control samples (LCS). MS compounds are spiked into an aliquot of a field sample. LCS compounds are spiked into a blank matrix. The spiked compounds are representative compounds that are quantified during performance of the method. Recovery of the spiked compound is used as an assessment of analytical accuracy for the sample matrix analyzed. These results are useful in distinguishing sample matrix interferences from analysis interferences through a comparison of MS and LCS recovery data. Often, spikes are performed in duplicate as an MSD or LCS duplicate. In this

manner, the precision of the assessment can be quantified as the RPD of the original and duplicate spike.

MSs were assigned at a frequency of at least 1 for every 20 field samples collected. One MS/MSD pair, CY0013-MS/MSD, was assigned to samples. Additional sample volume was provided to the laboratory for the MS/MSD analyses. This sampling frequency meets the collection criteria for this program as specified in the SAP. In addition to the overall collection frequency, the analytical method requires that the laboratory analyze one set of spikes per analytical batch. To comply with this method requirement, the laboratory may analyze additional MS/MSD pairs. The validator evaluated all batch QC. The laboratory's statistically determined target acceptance limits were used to assess the spike recovery and RPD.

The following MS/MSD recoveries are outside of established QC criteria:

Sample Delivery Group	Samples Affected	Analyte(s)	Validation Qualifier
F88938	CY0013	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Nickel, Potassium, Selenium, Silver, Sodium, Vanadium, Zinc	J/UJ

LCS results are used to evaluate laboratory method performance in the same manner as the MS/MSD results, except the LCS is not performed on an actual field sample matrix. The LCS is prepared for each analytical batch and for each parameter and matrix analyzed. All LCS recoveries met QC criteria.

The LCS and MS/MSD control limits for this project can be found in Attachment A of Appendix E. The LCS and MS/MSD control used for evaluation are the laboratory established in-house control limits. Detected constituents with associated MS/MSD recoveries above or below the QC limits were qualified as estimated “J”. Sample results with associated MS/MSD or LCS recoveries below the QC limits were qualified as estimated non-detects “UJ”.

3.1.5 Laboratory Duplicate Sample Analysis

Laboratory duplicate determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate sample analyses are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices. Laboratory duplicates are not required for nitoraromatic analysis. All laboratory duplicate sample analysis met QC criteria with the following exception:

Sample Delivery Group	Samples Affected	Analyte(s)	Validation Qualifier
F88938	CY0013	Barium	J

3.1.6 Column Agreement

For high-performance liquid chromatography analyses, sample results are confirmed using two dissimilar columns. In order for an analyte to be reported, it must be detected on both columns. Results differing by greater than 40 percent are qualified estimated (J); however, for this sampling event, all detections were in agreement.

3.1.7 Interference Check Sample and Post Digestion Spike

The ICP Interference Check Sample (ICS) verifies the contract laboratory's interelement and background correction factors. The ICS consists of two solutions: Solution A and Solution AB. Solution A consists of the interferents, and solution AB consists of the analytes mixed with the interferents. An ICS analysis consists of analyzing both solutions consecutively, starting with solution A, for all wavelengths used for each analyte reported by ICP. Results for the ICP analysis of the ICS solution AB must fall within the control limits of $\pm$ 20% of the true value for the analytes included in the solution. All Interference Check Sample (ICS) percent recoveries were acceptable.

Post Digestion spikes are elements added to a portion of a prepared sample to verify the absence or presence of matrix effects for ICP and ICP/MS analysis. To verify the absence of interference, the spike recovery must be between 75% and 125%. Results outside the acceptance limits require a method of standard additions (MSA) for all samples within the batch. All post digestion spike recoveries were found to be acceptable.

3.1.8 Inductively Coupled Plasma Serial Dilutions

The ICP serial dilution analysis is performed to determine whether or not significant physical or chemical interferences exist due to sample matrix. All QC criteria were met for the serial dilutions associated with the project samples, with the following exceptions:

Sample Delivery Group	Sample(s) Affected	Analyte(s)	Validation Qualifier
F88938	CY0013	Aluminum, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Magnesium, Manganese, Nickel, Potassium, Vanadium, Zinc	J

3.2 Reporting Limits

Limits have been established to describe project sensitivity requirements. Each laboratory is required to demonstrate method performance through method detection limit (MDL) studies for every method employed. These studies are required to be laboratory-specific so that individual laboratory variables such as equipment brands, reagent suppliers, and chemist technique are factored into the performance study. MDLs are established using controlled matrices (i.e., deionized water). Practical quantitation limits (PQL) or method quantitation limits (MQL) used for this project are those statistically determined by the laboratories. The analytical program executed for this project required the use of SW-846 methods, which specify the procedure for calculating the MDLs. The PQL/MQL calculation adjusts the limit by a predetermined mathematical factor for the analysis of actual environmental sample matrices (i.e., soil, groundwater, etc.). Method reporting limits (MRL) are based on the project action or decision levels.

These limits are generally defined as follows:

- ***MDL.*** The minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the concentration is greater than zero.
- ***MQL/PQL.*** The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. It is set at the lowest standard used for the calibration curve.
- ***MRL.*** A threshold value below which the laboratory reports a result as nondetected. Ideally, the MRL will be established anywhere between the MDL and 1/2 the project action levels.

An MDL is the lower limit at which the laboratory can differentiate a measurement from background. The MDL is determined in accordance with the procedures in 40 Code of Federal Regulations Part 136. If project action levels are near or below the MDL, it is unlikely the sensitivity of the method will be achievable. A compromise must be reached. The PQL/MQL is the lower limit at which a measurement becomes meaningful. This measurement (the PQL or the reporting limit) is generally a multiple of three to five times the MDL.
Most samples were handled and analyzed as expected without significant changes to the anticipated project MQLs.

3.3 Holding Times/Preservation

All laboratory results submitted for this investigation have been reviewed with respect to laboratory adherence to extraction and analysis holding times. All hold times and preservation requirements were met. No qualification was required.

4.0 Data Evaluation and Usability

The analytical data review process identified a few analytical nonconformance issues that were noted during this analytical program. These anomalies have been discussed in the previous sections of this appendix. Table 3 summarizes all compounds requiring qualifier application due to anomalies discovered during data validation. Table 4 defines the reason codes for qualification, and Table 5 defines the data validation qualifiers.

The following definitions are used for defining precision, accuracy, representativeness, completeness, and comparability as they have been applied to this evaluation.

Precision. Precision is a measurement of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision data were obtained through the analysis and evaluation of duplicate QA samples. Accuracy was determined through the analysis and evaluation of method blanks, LCSs, trip blanks, equipment rinsates, and MS samples.

Accuracy. Accuracy is a measurement of bias in a system and is expressed as a percent recovery. These QA samples were collected and/or analyzed at the frequency established in the SAP, verifying the completeness element of the DQOs along with the evaluation of holding times and reporting limits. Percent recovery is calculated as follows:

$$Percent\ Recovery = \left(\frac{(x - s)}{T} \right) * 100$$

Where:

X = the laboratory determined concentration of a spiked sample
S = the sample native concentration prior to spike
T = the true concentration of the spike.

RPD is calculated as follows:

$$Relative\ Percent\ Difference = \left[\frac{|D1 - D2|}{\frac{D1 + D2}{2}} \right] * 100$$

Where:

D1 and D2 = the results of duplicate measurements.

Representativeness. Representativeness is a qualitative parameter that expresses the degree to which sample data actually represent the matrix and site conditions. For example, in conducting groundwater monitoring, representativeness requires proper location of wells and the collection of samples under consistent, documented procedures. Wells are located based upon the results of the hydrological study in progress and are designed to provide maximum coverage of the flow conditions. Requirements and procedures for sample collection and handling are designed to maximize sample representativeness. Representativeness also can be monitored by reviewing field documentation and by performing field audits.

The samples were collected using Shaw standard operating procedures (SOP) and were fully documented through the use of standard Shaw field forms. Samples are representative of the matrix and site sampled.

Completeness. Completeness is a measure of the amount of valid data that are obtained during a sampling event as compared to the amount of data planned to be collected under optimum conditions. Some data for this project were qualified as estimated in the validation process because of the outliers noted in the MS recoveries, duplicate results for certain elements, and various other calibration and column confirmation percent difference results. Completeness is calculated as follows:

$$Completeness\ \% = \left(\frac{D_r}{D_c} \right) X\ 100$$

Where:

D_r = the number of data points for which valid results are reported
D_c = the number of valid samples/data points that are collected and reach the laboratory for analysis.

During this task, 13 regular project samples, 1 field duplicate, and 1 field split sample were collected, resulting in approximately 1,525 targeted analytical records. No results were rejected. Using the above calculation, 100 percent completeness was achieved for the task.

Comparability. Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability ensures that results for the sampling event can be compared with data from other past and/or future sampling programs. Comparability for this sampling event was achieved through the use of established and recognized techniques and accepted standard EPA methods. All samples collected and analyzed were subjected to the same sampling, handling, preparation, analysis, reporting, and validation criteria for the purpose of achieving comparability goals within the data set.

Statement of Data Usability. The overall results of the analyses, as discussed in this evaluation, suggest that representative samples were collected and analyzed, and the results are indicative of the media analyzed, with the exception of the few anomalies noted. The data do reflect expected site conditions and are usable for their intended purpose.

Tables 1, 2, 3, 4 and 5 summarize the analytical program and the results for the data validation effort for all samples collected by Shaw at PBOW Coal Yard 1 area.

TABLES

Table 1

Sample Cross Reference
Former Plum Brook Ordnance Works
Sandusky, Ohio

Sample Type	Sample Location	Sample Number	Sample Date	Sample Purpose	SDG Number	Laboratory
SS	CY1-SB01	CY0001	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB01	CY0002	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB01	CY0003	20-Dec-11	REG	F88938	Accutest
SS	CY1-SB02	CY0004	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB02	CY0005	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB02	CY0006	20-Dec-11	REG	F88938	Accutest
SS	CY1-SB03	CY0007	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB03	CY0008	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB03	CY0009	20-Dec-11	FD	F88938	Accutest
DS	CY1-SB03	CY0010	20-Dec-11	FS	240-7168-1	Test America
DS	CY1-SB03	CY0011	20-Dec-11	REG	F88938	Accutest
SS	CY1-SB04	CY0012	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB04	CY0013	20-Dec-11	REG	F88938	Accutest
DS	CY1-SB04	CY0014	20-Dec-11	REG	F88938	Accutest

SDG - Sample delivery group.

Table 2

Summary of Original, Field Duplicate, and Field Split Hits with Relative Percent Difference Calculations
Former Plum Brook Ordnance Works
Sandusky, Ohio

		Location:	CY1-SB03		CY1-SB03		CY1-SB03		Relative	Relative
		Sample Number:	CY0008		CY0009		CY0010		Percent	Percent
		Sample Date:	20-Dec-11		20-Dec-11		20-Dec-11		Difference	Difference
		Sample Depth:	3 - 5 Ft		3 - 5 Ft		3 - 5 Ft		REG and FD	REG and FS
		Sample Purpose:	REG		FD		FS			
Parameter	Filtered	Units	Result	ValQual	Result	ValQual	Result	ValQual		
Aluminum	N	mg/kg	11400		13100		10000		13.88	13.08
Antimony	N	mg/kg	1.9	U	1.9	U	1.4	J	-	-
Arsenic	N	mg/kg	12.5		10.1		19		21.24	159.71
Barium	N	mg/kg	84.6		79.8		100		5.84	16.68
Beryllium	N	mg/kg	0.63		0.67		0.51		6.15	21.05
Cadmium	N	mg/kg	0.33	J	0.38	J	0.3	U	14.08	-
Calcium	N	mg/kg	3110		2910		2600		6.64	-
Chromium	N	mg/kg	17.8		20.1		18		12.14	1.12
Cobalt	N	mg/kg	14.1		15.7		11		10.74	24.70
Copper	N	mg/kg	24.8		26.7		30		7.38	18.98
Iron	N	mg/kg	26000		20700		43000		22.70	49.28
Lead	N	mg/kg	12.8		10.6		14		18.80	8.96
Magnesium	N	mg/kg	3950		3710		3100		6.27	24.11
Manganese	N	mg/kg	230	J	461	J	290		**66.86**	23.08
Mercury	N	mg/kg	0.02	J	0.031	J	0.022	J	43.14	9.52
Nickel	N	mg/kg	37.2		39		36		4.72	3.28
Potassium	N	mg/kg	1390		1210		1000		13.85	32.64
Thallium	N	mg/kg	0.41	J	0.058	U	1.5	J	-	114.14
Vanadium	N	mg/kg	23.2		28.9		30		21.88	25.56
Zinc	N	mg/kg	57		62.9		74		9.84	25.95

FD - Field duplicate.
FS - Field split.
mg/kg - Milligrams per kilogram.
REG - Regular field sample.
"-" = Not Calculated

Table 3

Summary of Data Validation Reason Codes
Former Plum Brook Ordnance Works
Sandusky, Ohio

Reason Code	Description
01	Sample received outside of 4+/-2 degrees Celsius
01A	Improper sample preservation
02	Holding Time Exceeded
02A	Extraction
02B	Analysis
03	Instrument Performance - Outside Criteria
03A	BFB
03B	DFTPP
03C	DDT and/or Endrin % breakdown exceeds criteria
03D	retention time windows
03E	Resolution
04	Initial Calibration results outside specified criteria
04A	Compound mean RRF<0.05
04B	Compound %RSD>30
04C	Correlation Coefficient<0.995
05	Continuing Calibration results outside specified criteria
05A	Compound mean RRF<0.05
05B	Compound %D>25
06	Result qualified as a result of the 5x/10x blank correction
06A	Method or Preparation Blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate Recoveries outside control limits
07A	Sample
07B	Associated method blank or LCS
08	MS/MSD/Duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	%RPD outside acceptance criteria (precision)
09	Post Digestion Spike outside criteria (GFAA)
10	Internal Standards outside specified control limits
10A	Recovery
10B	Retention Time
11	Laboratory Control Sample recoveries outside specified control limits
11A	Recovery
11B	%RPD (if run in duplicate)
12	Interference Check Standard
13	Serial Dilution
14	Tentatively Identified Compounds
15	Quantitation
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria exceeded
18	Percent difference between original and second column > 25%
19	Professional judgement was used to qualify the data
20	Pesticide clean-up checks
21	Target compound identification
22	Radiological calibration
23	Radiological quantitation
24	Reported result and/or lab qualifier revised to reflect validation findings
999	See hard copy for details.

Table 4

Summary of Data Validation Qualifiers Assigned and Reason Codes for Qualification
Former Plum Brook Ordnance Works
Sandusky, Ohio

Work Order	Sample Number	Analysis	Parameter	Reason Codes				
				VQ	R1	R2	R3	R4
F88938	CY0001	METALS3	Potassium	J	15			
F88938	CY0001	METALS3	Antimony	J	15			
F88938	CY0001	METALS3	Beryllium	J	15			
F88938	CY0001	METALS3	Mercury	J	15			
F88938	CY0002	METALS3	Potassium	J	15			
F88938	CY0002	METALS3	Cadmium	J	15			
F88938	CY0002	METALS3	Mercury	J	15			
F88938	CY0003	METALS3	Thallium	J	15			
F88938	CY0003	METALS3	Cadmium	J	15			
F88938	CY0003	METALS3	Selenium	J	15			
F88938	CY0003	METALS3	Mercury	J	15			
F88938	CY0004	METALS3	Potassium	J	15			
F88938	CY0004	METALS3	Sodium	J	15			
F88938	CY0004	METALS3	Antimony	J	15			
F88938	CY0004	METALS3	Beryllium	J	15			
F88938	CY0004	METALS3	Cobalt	J	15			
F88938	CY0004	METALS3	Mercury	J	15			
F88938	CY0005	METALS3	Potassium	J	15			
F88938	CY0005	METALS3	Antimony	J	15			
F88938	CY0005	METALS3	Mercury	J	15			
F88938	CY0005	SEMIVOLATILES3	Pyrene	J	15			
F88938	CY0005	SEMIVOLATILES3	Dibenzofuran	J	15			
F88938	CY0005	SEMIVOLATILES3	Fluoranthene	J	15			
F88938	CY0005	SEMIVOLATILES3	Fluorene	J	15			
F88938	CY0006	METALS3	Potassium	J	15			
F88938	CY0006	METALS3	Beryllium	J	15			
F88938	CY0006	METALS3	Cadmium	J	15			
F88938	CY0006	METALS3	Mercury	J	15			
F88938	CY0007	METALS3	Potassium	J	15			
F88938	CY0007	METALS3	Sodium	J	15			
F88938	CY0007	METALS3	Cadmium	J	15			
F88938	CY0007	METALS3	Mercury	J	15			
F88938	CY0007	SEMIVOLATILES3	Methylnaphthalene, 2-	J	15			
F88938	CY0008	METALS3	Manganese	J	17			
F88938	CY0008	METALS3	Thallium	J	15			
F88938	CY0008	METALS3	Cadmium	J	15			
F88938	CY0008	METALS3	Mercury	J	15			
F88938	CY0009	METALS3	Manganese	J	17			
F88938	CY0009	METALS3	Cadmium	J	15			
F88938	CY0009	METALS3	Mercury	J	15			
240-7168-1	CY0010	METALS3	Thallium	J	15			
240-7168-1	CY0010	METALS3	Antimony	J	15			
240-7168-1	CY0010	METALS3	Mercury	J	15			
F88938	CY0011	METALS3	Sodium	J	15			
F88938	CY0011	METALS3	Mercury	J	15			
F88938	CY0012	METALS3	Silver	J	15			
F88938	CY0012	METALS3	Sodium	J	15			
F88938	CY0012	METALS3	Thallium	J	15			
F88938	CY0012	METALS3	Antimony	J	15			
F88938	CY0012	METALS3	Beryllium	J	15			

Table 4

Summary of Data Validation Qualifiers Assigned and Reason Codes for Qualification
Former Plum Brook Ordnance Works
Sandusky, Ohio

Work	Sample			Reason Codes				
F88938	CY0012	METALS3	Cobalt	J	15			
F88938	CY0012	METALS3	Mercury	J	15			
F88938	CY0012	SEMIVOLATILES3	Pyrene	J	15			
F88938	CY0012	SEMIVOLATILES3	Fluoranthene	J	15			
F88938	CY0012	SEMIVOLATILES3	Phenanthrene	J	15			
F88938	CY0012	SEMIVOLATILES3	Naphthalene	J	15			
F88938	CY0012	SEMIVOLATILES3	Methylnaphthalene, 2-	J	15			
F88938	CY0013	METALS3	Aluminum	J	13			
F88938	CY0013	METALS3	Iron	J	13			
F88938	CY0013	METALS3	Magnesium	J	13			
F88938	CY0013	METALS3	Manganese	J	13			
F88938	CY0013	METALS3	Nickel	J	08A	13		
F88938	CY0013	METALS3	Potassium	J	08A	13		
F88938	CY0013	METALS3	Silver	UJ	08A			
F88938	CY0013	METALS3	Sodium	J	08A		15	
F88938	CY0013	METALS3	Thallium	J	15			
F88938	CY0013	METALS3	Antimony	J	08A	15		
F88938	CY0013	METALS3	Arsenic	J	08A	13		
F88938	CY0013	METALS3	Barium	J	08A	08B	13	
F88938	CY0013	METALS3	Beryllium	J	08A	13		
F88938	CY0013	METALS3	Cadmium	J	08A	13		
F88938	CY0013	METALS3	Chromium	J	08A	13		
F88938	CY0013	METALS3	Cobalt	J	08A	13		
F88938	CY0013	METALS3	Copper	J	08A	13		
F88938	CY0013	METALS3	Vanadium	J	08A	13		
F88938	CY0013	METALS3	Zinc	J	08A	13		
F88938	CY0013	METALS3	Calcium	J	13			
F88938	CY0013	METALS3	Selenium	UJ	08A			
F88938	CY0013	METALS3	Mercury	J	15			
F88938	CY0014	METALS3	Sodium	J	15			
F88938	CY0014	METALS3	Antimony	J	15			
F88938	CY0014	METALS3	Mercury	J	15			

Table 5

Laboratory and Validation Qualifier Definitions
Former Plum Brook Ordnance Works
Sandusky, Ohio

Qualifier	Definition
Laboratory	
B	Indicates the analyte is found in associated method blank.
J	Indicates the analyte result is an estimated value.
ND	Not detected. The compound was analyzed for, but not detected above the associated reporting limit.
MDL	Method detection limit.
RL	Reporting limit.
E	Indicates the value exceeds the calibration range.
ND	Indicates presumptive evidence of a compound
Validation	
B	The compound/analyte was detected in a lab or field blank.
J	The compound/analyte was positively identified; the reported value is an estimated concentration.
U	Not detected. The compound/analyte was analyzed for, but not detected above the associated reporting limit.
UJ	The analyte is not detected; the result is an estimated value.
R	Analyte is rejected.

APPENDIX I

CHAINS OF CUSTODY

F88938

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB 122 11ACCT

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mike Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8768-6974-9869

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884
Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

	Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
1	CY0001	SOIL	12-20-11 / 1100	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082, TOC by Walkley-Black		
2	CY0002	SOIL	12-20-11 / 1115	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
3	CY0004	SOIL	12-20-11 / 1000	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
4	CY0005	SOIL	12-20-11 / 1015	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
5	CY0007	SOIL	12-20-11 / 1155	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
6	CY0008	SOIL	12-20-11 / 1205	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
7	CY0009	SOIL	12-20-11 / 1205	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
8	CY0012	SOIL	12-20-11 / 1242	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
9	CY0013	SOIL	12-20-11 / 1250	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		

Special Instructions:

Possible Hazard Identification:
Non-haz: ___ Flammable: ___ Poison B: ___ Unknown: X

Sample Disposal:
Return to Client: ___ Disposal by Lab: X Archive: ___

Turnaround Time:
Normal: X Rush: ___

Level of QC Required:
Definitive: X Project Specific: ___

1. Relinquished by: E. W. Weaver — Date: 12-21-11 Time: 1600
2. Relinquished by: FX — Date: 12/22/11 Time: 7:30
3. Relinquished by: — Date: Time:

1. Received by: FX — Date: Time:
2. Received by: [signature] ALSE — Date: 12/22/11 Time: 7:30
2. Received by: — Date: Time:

Comments:

3.4c

F 88938

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB[illegible]1221 11ACCT

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mike Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8768-6974-9869

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
9 CY0013 MS	SOIL	12-20-11/1250	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
9 CY0013 MSD	SOIL	12-20-11/1250	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
	SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		

Special Instructions:

Possible Hazard Identification:
Non-haz: ___ Flammable: ___ Poison B: ___ Unknown: X

Sample Disposal:
Return to Client: ___ Disposal by Lab: X Archive: ___

Turnaround Time:
Normal: X Rush: ___

Level of QC Required:
Definitive: X
Project Specific: ___

1. Relinquished by: E. W. Weaver Date: 12-21-11 Time: 1600
2. Relinquished by: Date: Time:
3. Relinquished by: Date: Time:

1. Received by: FX Date: Time:
2. Received by: Fred Jones ALSE Date: 12 22 11 Time: 730
2. Received by: Date: Time:

Comments:

3.4c

F 88938

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB 1221 11ACCT

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mike Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8768-6974-9869

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

	Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
10	CY0003	SOIL	12-20-11/1145	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
11	CY0006	SOIL	12-20-11/1042	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
12	CY0011	SOIL	12-20-11/1225	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
13	CY0014	SOIL	12-20-11/1340	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		

Special Instructions:

Possible Hazard Identification:
Non-haz: ____ Flammable: ____ Poison B: ____ Unknown: X

Sample Disposal:
Return to Client: ____ Disposal by Lab: X Archive: ____

Turnaround Time:
Normal: X Rush: ____

Level of QC Required:
Definitive: X
Project Specific: ____

1. Relinquished by: Eric W. Weaver Date: 12-21-11 Time: 1600
2. Relinquished by: Date: Time:
3. Relinquished by: Date: Time:

1. Received by: FX Date: Time:
2. Received by: Zl Jones ALSE Date: 12/22/11 Time: 730
2. Received by: Date: Time:

Comments:

3.4c

F 88938

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PBOW 1221 11ACCT

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mike Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8768-6974-9869

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

	Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
14	CY0035	SOIL	12-19-11 / 1140	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
15	CY0038	SOIL	12-19-11 / 1330	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
16	CY0041	SOIL	12-19-11 / 1555	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
17	CY0044	SOIL	12-19-11 / 1630	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471		

Special Instructions:

Possible Hazard Identification:
Non-haz: ___ Flammable: ___ Poison B: ___ Unknown: X

Sample Disposal:
Return to Client: ___ Disposal by Lab: X Archive: ___

Turnaround Time:
Normal: X Rush: ___

Level of QC Required:
Definitive: X
Project Specific: ___

1. Relinquished by: E. W. Weaver Date: 12-21-11 Time: 1600
2. Relinquished by: Date: Time:
3. Relinquished by: Date: Time:

1. Received by: FX Date: Time:
2. Received by: [illegible] ALSE Date: 12/22/11 Time: 730
2. Received by: Date: Time:

Comments:

3.4c

F88938

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB[illegible]/1221 11ACCT

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mike Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8768-6974-9869

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

	Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
18	CY0042	SOIL	12-19-11/1600	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
19	CY0043	SOIL	12-19-11/1610	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
		SOIL		2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		

EW

Special Instructions:

Possible Hazard Identification:
Non-haz: ___ Flammable: ___ Poison B: ___ Unknown: X

Sample Disposal:
Return to Client: ___ Disposal by Lab: X Archive: ___

Turnaround Time:
Normal: X Rush: ___

Level of QC Required:
Definitive: X Project Specific: ___

1. Relinquished by: E. W. Weaver Date: 12-21-11 Time: 1600
2. Relinquished by: Date: Time:
3. Relinquished by: Date: Time:

1. Received by: FX Date: Time:
2. Received by: T. L. Torres ALSE Date: 12/22/11 Time: 730
2. Received by: Date: Time:

Comments:

3.4c

F 88938

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB 1221 11ACCT

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mike Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Accutest
Laboratory Contact: Sue Bell
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8768-6974-9869

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

	Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
20	CY0031	SOIL	12-19-11 / 1105	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082, TOC by Walkley-Black		
21	CY0032	SOIL	12-19-11 / 1119	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
22	CY0033	SOIL	12-19-11 / 1119	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
23	CY0036	SOIL	12-19-11 / 1250	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
24	CY0037	SOIL	12-19-11 / 1310	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
25	CY0039	SOIL	12-19-11 / 1540	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
26	CY0040	SOIL	12-19-11 / 1545	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
26	CY0040MS	SOIL	12-19-11 / 1545	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
26	CY0040MSD	SOIL	12-19-11 / 1545	2-Wide Mouth Glass Jar	8 oz	Cool	Explosives by 8330, SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		

Special Instructions:

Possible Hazard Identification:
Non-haz: ____ Flammable: ____ Poison B: ____ Unknown: X

Sample Disposal:
Return to Client: ____ Disposal by Lab: X Archive: ____

Turnaround Time:
Normal: X Rush: ____

Level of QC Required:
Definitive: X
Project Specific: ____

1. Relinquished by: Eddie W. Weaver — Date: 12-21-11 Time: 1600
2. Relinquished by: — Date: Time:
3. Relinquished by: — Date: Time:

1. Received by: FX — Date: Time:
2. Received by: [signature] — Date: 12/22/11 Time: 930
2. Received by: — Date: Time:

Comments:

3.4c

ACCUTEST LABORATORIES SAMPLE RECEIPT CONFIRMATION

ACCUTEST'S JOB NUMBER: F 88938 CLIENT: Shaw PROJECT: PBOW

DATE/TIME RECEIVED: 12/22/11 730 {MM/DD/YY 24:00} NIMBER OF COOLERS RECEIVED: 1

METHOD OF DELIVERY: (FEDEX) UPS ACCUTEST COURIER GREYHOUND DELIVERY OTHER

AIRBILL NUMBERS: 8768 6974 9869

COOLER INFORMATION

- [ ] CUSTODY SEAL NOT PRESENT OR NOT INTACT
- [ ] CHAIN OF CUSTODY NOT RECEIVED (COC)
- [ ] ANALYSIS REQUESTED IS UNCLEAR OR MISSING
- [ ] SAMPLE DATES OR TIMES UNCLEAR OR MISSING
- [ ] TEMPERATURE CRITERIA NOT MET
- [ ] WET ICE PRESENT

TRIP BLANK INFORMATION

- [ ] TRIP BLANK PROVIDED
- [x] TRIP BLANK NOT PROVIDED
- [x] TRIP BLANK NOT ON COC
- [ ] TRIP BLANK INTACT
- [ ] TRIP BLANK NOT INTACT
- [ ] RECEIVED WATER TRIP BLANK
- [ ] RECEIVED SOIL TRIP BLANK

MISC. INFORMATION

NUMBER OF ENCORES ? 25-GRAM_____ 5-GRAM_____

NUMBER OF 5035 FIELD KITS ? _____

NUMBER OF LAB FILTERED METALS ? _____

TEMPERATURE INFORMATION

- [ ] IR THERM ID 1 CORR. FACTOR +0.2
- [ ] OBSERVED TEMPS: 3.2
- [ ] CORRECTED TEMPS: 3.4

SAMPLE INFORMATION

- [ ] SAMPLE LABELS PRESENT ON ALL BOTTLES
- [ ] INCORRECT NUMBER OF CONTAINERS USED
- [ ] SAMPLE RECEIVED IMPROPERLY PRESERVED
- [ ] INSUFFICIENT VOLUME FOR ANALYSIS
- [ ] DATES/TIMES ON COC DO NOT MATCH SAMPLE LABEL
- [ ] ID'S ON COC DO NOT MATCH LABEL
- [ ] VOC VIALS HAVE HEADSPACE (MACRO BUBBLES)
- [ ] BOTTLES RECEIVED BUT ANALYSIS NOT REQUESTED
- [ ] NO BOTTLES RECEIVED FOR ANALYSIS REQUESTED
- [ ] UNCLEAR FILTERING OR COMPOSITING INSTRUCTIONS
- [ ] SAMPLE CONTAINER(S) RECEIVED BROKEN
- [ ] % SOLIDS JAR NOT RECEIVED
- [ ] 5035 FIELD KIT FROZEN WITHIN 48 HOUR'S
- [ ] RESIDUAL CHLORINE PRESENT

{APPICABLE TO EPA 600 SERIES OR NORTH CAROLINA ORGANICS}

SUMMARY OF COMMENTS:

TECHNICIAN SIGNATURE/DATE [signature] 12/22/11 REVIEWER SIGNATURE/DATE [signature] 12-22-11

NF 12/10

Shaw
Shaw E & I, Inc.

ANALYSIS REQUEST AND CHAIN-OF-CUSTODY RECORD

REFERENCE COC NO.: PB EW 1221 11TA

PAGE 1 OF 1

Project Name/No: PBOW
Sample Team Member: Mke Gunderson
Profit Center: Knoxville
Project Manager: Steve Downey
Project No.: 132457 Coal Yards
Required Report Date: 21 DAYS

Sample Shipment Date: 12-21-11
Laboratory Destination: Test America
Laboratory Contact: Denise Pohl
Project Contact/Phone: Eddie Weaver/865-690-3211
Carrier Waybill No.: 8989-5317-7768

Bill To: Attn: Accounts Payable Dept.
Shaw Environmental
P.O. Box 98519
Baton Rouge, LA 70884

Report To: Eddie Weaver
Shaw E & I
312 Directors Drive
Knoxville, TN 37923

Sample Number	Sample Type/ Description	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Testing Program	Condition on Receipt	Disposal Record
CY0034	Soil	12-19-11 / 1119	Wide Mouth Glass Jar	1 8 ~~2~~ X ~~4~~ oz EW	Cool	SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
				~~8~~ oz	Cool	Explosives by 8330A		
CY0010	Soil	12-20-11 / 1205	Wide Mouth Glass Jar	1 8 ~~2~~ X ~~4~~ oz EW	Cool	SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
				~~8~~ oz	Cool	Explosives by 8330A		
	Soil		Wide Mouth Glass Jar	2 X 4 oz	Cool	SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
				4 oz	Cool	Explosives by 8330A		
	Soil		Wide Mouth Glass Jar	2 X 4 oz	Cool	SVOC by 8270, TAL Metals by 6010/7471, PCBs by 8082		
				4 oz	Cool	Explosives by 8330A		

EW

Special Instructions:

Possible Hazard Identification:
Non-haz: ____ Flammable: ____ Poison B: ____ Unknown: X

Sample Disposal:
Return to Client: ____ Disposal by Lab: X Archive: ____

Turnaround Time:
Normal: X Rush: ____

Level of QC Required:
Definitive: X Project Specific: ____

1. Relinquished by: E. W. Weaver	Date: 12-21-11 Time: 1600	1. Received by: Mike Gunderson	Date: 12/22/11 Time: 8:30
2. Relinquished by:	Date: Time:	2. Received by:	Date: Time:
3. Relinquished by:	Date: Time:	2. Received by:	Date: Time:

Comments:

APPENDIX J

RESPONSE TO COMMENTS

Response to Comments - OEPA
Draft Ash Pit 1 and Ash Pit 3
Site Characterization Report Addendum for Coal Yard No. 1
Former Plum Brook Ordnance Works, Sandusky, Ohio
(Report dated June 2012)

Reference: Comments from Dr. Janusz Z. Byczkowski, DERR, CO, email dated July 6, 2012.

Comment 1: **Section 1.4, Page 1-3, Line #21; This document states: "…*NASA's inactive reactor, which is presently in the process of being decommissioned*…". This statement does not reflect the up to date accomplishments (as of June 2012). The term "*presently*" should correspond to the date of the document.**

Please update statements regarding condition of the Site, to correspond to the date of the document.

Response 1: Information of the present status, as of August 2012, of the nuclear reactor decommissioning will be included at the end of the referenced paragraph.

Comment 2: **Section 4.2.2, Page 4-4, Line #7; This document states: "…*Each BSC is the calculated 95th percent upper tolerance limit or the maximum detected concentration of the background data set, whichever value is lower, for each relevant analyte (IT Corporation, 1998)*…". The described method of background level (BSC) calculation is currently not recommended by OEPA-DERR (2009). Actually, the Table 5-1 may illustrate inadequacy of BSCs to this area of concern (in many cases BSCs area more than an order of magnitude higher than the respective maximum concentrations detected in this AOC). The use of methodology not recommended by OEPA-DERR should be emphasized and justified.**

Reference: OEPA-DERR (2009) **Use of Background for Remedial Response Sites. On-line:** **http://www.epa.ohio.gov/portals/30/rules/Use%20of20Background%20for%20RR%20Sites.pdf .**

Please emphasize a different background screening approach than that currently recommended by OEPA-DERR and provide justification.

Response 2: Text consistent with the following will be added to this text: *"It is noted that the method agreed upon for the development of BSCs by OEPA and USACE, as recorded in the September 11, 2002 PBOW team meeting minutes, differs from that shown in current OEPA (2009) guidance. This PBOW team agreement, which has been used for all PBOW risk assessments to date, takes precedence over the subsequent OEPA (2009) guidance.*" We note that the concentrations of inorganics in Coal Yard No. 2 soil are low relative to other PBOW sites.

Reference used in the Response:

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