

**Record of Decision  
Site 2 - Antenna Field Landfill**

**Operable Unit 5, Soil and  
Operable Unit 9, Groundwater**

**Naval Air Station  
Joint Reserve Base  
Willow Grove, Pennsylvania**



**Naval Facilities Engineering Command  
Mid-Atlantic**

**Contract Number N62470-08-D-1001  
Contract Task Order WE05**

**February 2010**



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## ACRONYMS

AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
ARS	Air Reserve Station
bgs	Below Ground Surface
BTAG	Biological Technical Assistance Group
BRAC	Base Realignment and Closure
B&R Environmental	Brown and Root Environmental, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COPCs	Constituents of Potential Concern
CTE	Central Tendency Exposure
DoD	Department of Defense
EA	EA Engineering, Science and Technology, Inc.
Eco-SSL	Ecological Soil Screening Level
EM	Electromagnetic
EPA	United States Environmental Protection Agency
EPIC	Environmental Photographic Interpretation Center
ERA	Ecological Risk Assessment
ESV	Ecological Risk Screening Value
FFA	Federal Facility Agreement
FS	Feasibility Study
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
ILCR	Incremental Lifetime Cancer Risk
IRP	Installation Restoration Program
LUC	Land Use Control
MCL	Maximum Contaminant Level
NAS JRB	Naval Air Station Joint Reserve Base
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NPL	National Priorities List
OU	Operable Unit

## ACRONYMS (Continued)

PA	Preliminary Assessment
PADEP	Pennsylvania Department of Environmental Protection
PAH	Polynuclear Aromatic Hydrocarbon
RAB	Restoration Advisory Board
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RSL	Regional Screening Level
SDWA	Safe Drinking Water Act
SI	Site Inspection
SARA	Superfund Amendments and Reauthorization Act
SLERA	Screening Level Ecological Risk Assessment
SSA	Site Screening Area
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TEF	Toxicity Equivalency Factor
Tetra Tech	Tetra Tech NUS, Inc.
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
USGS	United States Geological Survey
VOC	Volatile Organic Compound

**RECORD OF DECISION  
NAVAL AIR STATION JOINT RESERVE BASE WILLOW GROVE  
SITE 2 - ANTENNA FIELD LANDFILL  
OPERABLE UNIT 5 AND OPERABLE UNIT 9**

**PART I — DECLARATION**

**I. SITE NAME AND LOCATION**

Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove  
Site 2 - Antenna Field Landfill  
Operable Unit (OU) 5, Soil and OU 9, Groundwater  
Horsham Township, Montgomery County  
Pennsylvania  
ID Number: PAD987277837

**II. STATEMENT OF BASIS AND PURPOSE**

This Record of Decision (ROD) presents the selected remedy (No Remedial Action) for OU 5, soil and OU 9, groundwater at Site 2, the Antenna Field Landfill, at NAS JRB Willow Grove, located in Horsham Township, Montgomery County, Pennsylvania.

This remedial action decision was made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal bases for selecting the remedy and is based on the Administrative Record for OU 5 and OU 9. Reports and other information used in the remedy selection process are part of the Administrative Record (AR) file for OU 5 and OU 9. Copies of these reports are available in the information repository at the Horsham Township Library, 435 Babylon Road, Horsham, Pennsylvania.

This decision has been selected by the United States Navy (Navy) and the United States Environmental Protection Agency (EPA). The Commonwealth of Pennsylvania Department of Environmental Protection (PADEP) has commented on the selected remedy, their comments have been incorporated into this ROD, and PADEP concurs with the decision for no action at Site 2. A review of the public response to the OU 5 and OU 9 Proposed Plan is included in the Responsiveness Summary (Part III) of this decision document.

**III. DESCRIPTION OF THE SELECTED REMEDY**

No action is necessary to protect public health or welfare, or the environment, because the site does not pose any unacceptable risks to human health or the environment under current or potential future land use and associated exposure scenarios. No remedial action is required for Site 2 to allow unrestricted current and future land use.

**IV. STATUTORY DETERMINATIONS**

The selected remedy for Site 2 soil (OU 5) and groundwater (OU 9) is protective of human health and the environment, is cost effective and will not result in hazardous substances, pollutants or contaminants remaining at the site in excess of levels that allow for unlimited use and unrestricted exposure. Since no remedial action is needed or proposed for Site 2 soil and groundwater, no federal or state applicable or relevant and appropriate requirements (ARARs) apply.

**Authorizing Signatures**

Lead Agency:



Robert F. Lewandowski  
BRAC Environmental Coordinator  
Naval Air Station Joint Reserve Base, Willow Grove  
BRAC Program Management Office, Northeast

30 March 2010

Date

Environmental Protection Agency:



Henry J. Sokolowski, Associate Director  
Office of Federal Facility Remediation and Site Assessment  
U.S. EPA Region III

June 17, 2010

Date

**RECORD OF DECISION**  
**Naval Air Station Joint Reserve Base Willow Grove**  
**Site 2 - Antenna Field Landfill**  
**Operable Unit 5 and Operable Unit 9**

**PART II - DECISION SUMMARY**

**I. SITE NAME, LOCATION, AND DESCRIPTION**

NAS JRB Willow Grove, Pennsylvania is located in Horsham Township, Montgomery County in southeastern Pennsylvania, approximately 20 miles north of the city of Philadelphia. NAS JRB Willow Grove occupies approximately 900 acres of flat to slightly rolling terrain and is generally bounded by State Route 611 to the east, Horsham Road to the southwest, and Keith Valley Road to the north (Figures 1 and 2).

The Antenna Field Landfill is located in the southern portion of the Air Station southwest of the runway in a relatively undeveloped section of the Naval Air Station (Figure 2). The area of the former landfill is generally flat, approximately 4 acres in size, with grassy surfaces sloping toward the south and west. Major earth moving activities evident in the 1958 aerial photograph seem to coincide with the installation of an antenna array consisting of five antennae. In the mid 1990s, a new antenna array consisting of five antennae was constructed on the site to replace the preexisting antenna array constructed earlier. Currently, the entire site is covered by vegetation, including grass, brush and small trees. Storm water runoff from Site 2 enters a drainage swale, passes under Route 463 toward the southwest, and is directed toward Pennypack Creek, approximately 3000 feet south of the Air Station.

**II. SITE HISTORY AND ENFORCEMENT ACTIVITY**

The Antenna Field Landfill area was reportedly used between 1948 and 1960 as the principal disposal area for solid waste generated by the Air Station. Landfill activities reportedly consisted of trench excavation with subsequent burning and burial of waste material disposed within the trenches. Upon cessation of disposal operations, the landfill was regraded with a soil cover and vegetated with grass that is kept mowed by Air Station groundskeepers.

Work undertaken pursuant to CERCLA at NAS JRB Willow Grove Site 2 includes the Initial Assessment Study (IAS), the Site Investigation (SI), a Phase I and Phase II (Remedial Investigation) RI, and a post-RI Groundwater Confirmation study. The IAS (also known as the Preliminary Assessment (PA)) was a Base-wide preliminary study that assessed 17 sites from 1984 through 1988. Based on IAS findings, SI work was performed on 12 of the 17 sites, including Site 2 in 1989. Remedial Investigation/Feasibility Study (RI/FS)

activities have subsequently been completed or are underway at eight sites, of which four are on Air Force property and four are on Navy property, including Site 2. The Phase I RI, performed in 1991, characterized the physical and chemical nature of the four Navy sites and identified data gaps requiring further study. Recommendations for further investigation led to the Phase II RI activities at Site 2 that began in 1996. The April 1998 draft Phase II RI Report (B&R Environmental, 1998) addressed Site 2 along with three other IRP sites at NAS JRB Willow Grove and included a human health risk assessment (HHRA) completed in 1997 for each site. After the draft Phase II RI Report was submitted in April 1998, the Navy in agreement with EPA and PADEP, delinked the RI reporting process to allow each of the four Navy IRP sites, including Site 2, to progress independently. In December 2008, a fifth site, Site 12-South Landfill, was added to the Navy program for full RI/FS activities. Site 12 is in an early stage of investigation.

In April 1999, EPA provided the Navy with a review of Environmental Photographic Interpretation Center (EPIC) historical aerial photographs showing unidentified anomalies near the northeastern portion of Site 2 that turned out to be discarded drums and debris. In 2003, the Navy performed a field inspection, housekeeping cleanup (debris removal) and confirmation sampling effort in the area of the EPIC anomalies/discarded debris. A new Site Screening Area (SSA 12) was defined at that time as the portion of Site 2 northeast of the usually dry drainage ditch running through Site 2, roughly cutting Site 2 in half. In August 2008, the Navy submitted the draft Site 2 RI Report that was accepted as final by Navy, EPA, and PADEP in March 2009 (Tetra Tech, 2009a). The March 2009 final RI Report included as Appendix K, a Technical Memorandum of Risk Assessment Evaluation for Site 2 (Tech Memo) finalized in July 2006. The July 2006 Tech Memo supported the 1997 HHRA conclusion indicating that no action is required at Site 2.

In 2005, NAS JRB Willow Grove was designated for closure under the authority of the Defense Base Realignment and Closure Act (BRAC) of 1990, Public Law 101-510 as amended. BRAC legislation requires that the base closure be in full compliance with CERCLA. Section 2 (Definitions) of the Federal Facility Agreement (FFA) identifies Navy Engineering Field Activity Northeast (EFANE) as the primary Navy local contact entity. The EFANE office was designated for closure under the 2005 round of BRAC. CERCLA cleanup responsibilities were assigned to the BRAC Program Management Office Northeast, located at the former Philadelphia Navy Shipyard, as the primary local Navy contact office.

In May 2007, Special Legislation was enacted that said, "The Secretary of the Navy shall, notwithstanding any other provision of law, transfer to the Secretary of the Air Force, at no cost, all lands, easements, Air Installation Compatible Use Zones, and facilities at NAS JRB Willow Grove designated for operation as a Joint Interagency Installation (JII) for use by the Pennsylvania National Guard and other Department of Defense components, government agencies, and associated users to perform national defense,

homeland security, and emergency preparedness missions." Site cleanup under the FFA is expected to continue unabated by the May 2007 Special Legislation.

Further study at SSA 12 in 2007 and 2008 included visual observations of a "hummocky" appearance, extensive brush clearing, and performance of an electromagnetic (EM) geophysical survey of subsurface conditions. The EM geophysical survey (Tetra Tech, 2009a) indicated potential subsurface burial of waste on the northeast side of the drainage ditch bisecting Site 2. In December 2008 the Navy, in agreement with EPA and PADEP, decided to initiate a separate RI/FS and CERCLA decision process for the northeastern portion of Site 2, in the area now designated as Site 12 - South Landfill (Figure 3).

Based on the reduced exposure area of the smaller revised Site 2 boundaries shown on Figure 3 and the time since re-evaluation of the 1997 HHRA (Tech Memo) (Tetra Tech, 2006), the Navy prepared an RI Report Addendum for Site 2 - Antenna Field Landfill in June 2009 (Tetra Tech, 2009b). The June 2009 RI Report Addendum included an updated evaluation of Site 2 risk, incorporating the revised data set corresponding to the reduced size of the exposure unit for Site 2, and updated the risk calculations to comply with EPA HHRA guidelines current in May 2009. The June 2009 RI Report Addendum supported the 1997 HHRA conclusion that no action is required at Site 2.

Post-RI groundwater confirmation sampling analysis and reporting for Site 2, completed in June 2009 (Tetra Tech, June 2009c), confirmed groundwater results obtained in 1997 and also supported the HHRA conclusion indicating that no action is required at Site 2.

There have been no cited violations under federal or state environmental law or any past or pending enforcement actions pertaining to Site 2.

### **III. COMMUNITY PARTICIPATION**

Community participation at NAS JRB Willow Grove is facilitated by a Restoration Advisory Board (RAB), public meetings, a public Information Repository, and public notices of significant environmental events. The NAS JRB Willow Grove RAB is comprised of community leaders, government agency representatives, and local citizens who gather quarterly to discuss the progress of environmental programs at NAS JRB Willow Grove. RAB meetings are held to provide an information exchange among community members, the EPA, the Commonwealth of Pennsylvania, and the Navy. A community involvement program is sustained through the RAB and public meeting process. Public input to NAS JRB Willow Grove environmental programs is a key element in the decision-making process.

Based on the Site 2 - Antenna Field Landfill Remedial Investigation Report (Tetra Tech, 2009a) and Site 2 RI Report Addendum (Tetra Tech, 2009b), the Navy prepared the Site 2 Proposed Plan for no action (Tetra

Tech, 2009d). On July 29, 2009, a newspaper notification inviting public comment on the Proposed Plan appeared in *The Intelligencer* newspaper. The newspaper public notice identified the time and location of the public meeting to learn about the Navy's Proposed Plan. A public meeting was held on August 5, 2009 at 6:00 PM in the Community Meeting Room at the Horsham Township Public Library, 435 Babylon Road, Willow Grove, Pennsylvania to present the Site 2 Proposed Plan to the public. Copies of the Site 2 Proposed Plan were distributed to interested community and RAB members, and it was also made available for public review at the public meeting. A copy of the Proposed Plan and a copy of the Administrative Record file are located in the information repository for NAS JRB, at the Horsham Township Public Library. In accordance with CERCLA Sections 113(k) and 117(a), a public comment period for the Proposed Plan was held from July 29 through September 11, 2009. More details about the community involvement in this ROD are described in the Responsiveness Summary, which is Part III of this ROD.

#### **IV. SCOPE AND ROLE OF SITE 2 SOIL (OU 5) AND GROUNDWATER (OU 9)**

During the early stages of investigation of NAS JRB Willow Grove sites, the Navy and EPA, with agreement from PADEP, organized the response at all sites into operable units. Site 2 was organized into two operable units:

- Operable Unit 5: Site 2 soils
- Operable Unit 9: Site 2 groundwater

This ROD addresses the proposed action for Site 2 soil (OU 5) and groundwater (OU 9). Based on the results of Site 2 investigations, the Navy, EPA, and PADEP concur that OU 5 and OU 9 do not pose any unacceptable risks to human health or the environment under current and potential future land use and associated exposure scenarios. No remedial action is required for OU 5 or OU 9 to allow unrestricted land use at Site 2.

Site 2 is one of the sites identified in the FFA for NAS JRB Willow Grove. A list and description of all IR Program sites is presented in the NAS JRB Willow Grove Site Management Plan. Other sites at NAS JRB Willow Grove identified as part of the National Priorities List (NPL) include:

- Site 1 - Privet Road Compound (OU 1 - Site 1 soil; OU 3 - Site 1 groundwater)
- Site 3 - Ninth Street Landfill (OU 6 - Site 3 soil; OU 10 - Site 3 groundwater)
- Site 5 - Fire Training Area (OU 2 - Site 5 groundwater; OU 4 - Site 5 soil)
- Site 12 - South Landfill (has not yet been assigned an OU designation)

Sites 3, 5, and 12 are in the RI/FS phase of the CERCLA process. At Site 1 a soil removal action was completed in 1999. The Site 1 Soil (OU 1) ROD, specifying no further action for Site 1 soil, was accepted

by PADEP and signed by the Navy and EPA in September 2006. At Site 5, a soil removal action was conducted in 2006, and the ROD for Site 5 Soil (OU 4) was signed in September 2007, documenting that no further action is required for Site 5 soil. An Interim ROD for Site 1 groundwater (OU 3) was signed by the Navy and EPA in September 2008. The selected interim remedy for OU 3 consists of land use controls (LUCs), periodic groundwater monitoring, and five-year reviews.

## **V. SITE CHARACTERISTICS**

Site 2 is approximately four acres of gently southwest-sloping grass-covered land that is level with the surrounding land to the north and east, but with relatively steep embankments at the south and southwest boundaries. There is a normally dry drainage ditch along the eastern boundary of Site 2 that joins a small perennial tributary that forms the southern boundary of the site. The most conspicuous features of Site 2 are the antenna array situated upon it and the raised (plateau-like) appearance of the site as it is approached from the south or southwest.

### **A. Hydrology**

The ground surface at the Antenna Field Landfill generally slopes toward the southwest at a grade of less than two percent. The ground surface is covered throughout most of the area with grassy or woody vegetation that, coupled with the relatively flat topography, tends to enhance infiltration of most precipitation.

A small ephemeral drainage swale traverses the area immediately southwest of Site 2. The ephemeral drainage flows into an unnamed creek, which then flows off Base approximately 300 feet from the landfill area and enters Pennypack Creek approximately 3,000 feet from the Base boundary.

### **B. Geology**

Most of the soil within the boundaries of the Air Station has been disturbed. In addition, large areas have been filled with shale and sandstone mixed earth materials. These soils, known as made land, vary widely in depth and drainage potential and are consistent with much of the soil found at Site 2.

NAS JRB Willow Grove is located within the Triassic Basin of southeastern Pennsylvania. Bedrock underlying NAS JRB Willow Grove consists of the middle arkose (feldspar-rich) sandstone member of the Late Triassic Stockton Formation. The Stockton Formation locally is about 5,000 feet thick and is unconformably underlain by Ordovician to Pre-Cambrian basement rocks. Boreholes and test pits completed at Site 2 indicate that the overburden thickness at Site 2 ranged from approximately 4 feet to 21 feet.

Site 2 test pits encountered disturbed earth materials and waste debris from the ground surface to either the maximum reach of the backhoe (13.5 feet) or to bucket refusal on large boulders or bedrock. Most of the landfill material consisted of remixed clayey silt and silty clay with sandstone and siltstone fragments. Waste debris, consisting primarily of wood stumps and rock cobbles, with lesser amounts of glass, metal pipe, wire, and paper was also noted. Very little waste material was found buried in the test pits.

### **C. Hydrogeology**

The sandstones, shales, and conglomerates of the Triassic Basin generally yield abundant supplies to wells. The groundwater ranges from soft to hard, and the average hardness is greater than that of most other formations in southeastern Pennsylvania. The major source of groundwater in the vicinity of NAS JRB Willow Grove is the fractured bedrock of the Stockton Formation. These rocks form a multi-aquifer system of relatively discrete water-bearing zones separated by less permeable zones. Transmissivity and groundwater movement within water-bearing zones are greater parallel to bedding than across bedding. Groundwater can generally be found between 5 and 25 feet below ground surface (bgs).

Groundwater flow directions calculated for Site 2 indicate that the groundwater within both the shallow and intermediate bedrock zones flows towards the southwest. Analyses of monitoring well drilling logs, borehole videotape, and borehole geophysical logs reveal that discrete water-entry zones were either bedding-plane partings at lithologic contacts or fractures within a relatively homogeneous lithologic unit. Typically, both types of water-entry zones were present in most boreholes. The primary porosity of the various lithologic units (particularly sandstones) most likely contributed groundwater to each borehole, but the volume or yield could not be quantified due to the low volume of groundwater entering through primary pore spaces (lithologic unit) relative to the volume entering through secondary openings (bedding-plane partings at lithologic contacts and/or fractures).

The United States Geological Survey (USGS) (USGS, 2002) performed a regional water level study that found a direct relationship between the pumping of off-Base Horsham Township production well number 26 and fluctuations in hydraulic head recorded in 02MW011, located in the southern portion of Site 2 (Figure 3).

### **D. Nature and Extent of Contamination**

The June 2009 RI concluded that the Site 2 Antenna Field Landfill is a probable source of metals and polynuclear aromatic hydrocarbons (PAHs). PAHs, pesticides, and metals were detected in soils at Site 2. Iron was found in one surface soil sample at a concentration of 63,200 mg/kg, which was above the maximum corresponding background concentration of 17,600 mg/kg. Arsenic up to 12.6 mg/kg and beryllium up to 2.3 mg/kg were found in soil at concentrations above background. Benzo(a)anthracene up to 9,300 mg/kg, benzo(a)pyrene up to 7,400J (estimated) mg/kg, and dibenz(a,h)anthracene up to 1,300J

mg/kg were detected mostly in one test pit sample. Dieldrin was detected in two soil samples at concentrations up to 447 ug/kg. Contaminants adsorbed to soil particles can be transported through erosion and runoff to the sediments and surface waters of the intermittent stream.

Surface water and seep samples have shown impacts, particularly in the eastern segment of the tributary near the southern side of the site at concentrations potentially of concern for ecological impacts.

## **VI. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES**

The Antenna Field Landfill is located in a relatively undeveloped section of the Naval Air Station. The entire site is covered by vegetation including grass, brush, and small trees. Current use is limited by a passive antenna array that has dominated the surface of Site 2 since the original array was constructed approximately in the early 1960s or earlier. The original antenna array was replaced by the current antenna array constructed in the mid 1990s. The antenna array historically has required very little human activity, limited to infrequent minor maintenance of the structures. Only Air Station maintenance personnel occasionally enter the Site 2 area to cut grass and limit the height of brush in the area adjacent to flight operations. There is no current use of Site 2 groundwater.

Specific reuse plans for Site 2 after Base Closure are not known at this time. However BRAC law allows for the establishment of an enclave for the Air National Guard. Additionally, it authorized the establishment of an Armed Forces Reserve Center for Army Reserve Units relocated to NAS JRB Willow Grove by other BRAC recommendations. Subsequent legislation authorized the transfer of NAS JRB Willow Grove property to the Air Force for the establishment of a Joint Interagency Installation for use by the Pennsylvania National Guard and other DoD components and government agencies.

## **VII SUMMARY OF SITE RISKS**

### **A. Baseline Human Health Risk Assessment**

A baseline quantitative HHRA was conducted in 1997 for the Phase II RI (B&R Environmental, 1998) to characterize potential risks to human receptors under current and potential land uses. A limited, revised update of the HHRA was performed in 2006 (Tetra Tech, 2006) to address changes in risk assessment methodology and risk values that had occurred after the performance of the 1997 assessment. In June 2009 the Site 2 RI Report Addendum (Tetra Tech, June 2009b) incorporated the revised data set corresponding to the reduced size of the exposure unit for Site 2 and updated technical evaluation of the HHRA to reflect current guidance at the time of decision-making.

Toxicity screening levels based on the EPA Regional Screening Levels (RSLs) for residential exposures to soil were used to select constituents of potential concern (COPCs) for both surface and subsurface soil. In addition, EPA soil screening levels (SSLs) for the transfer of contaminants from soil to air were used to determine if the inhalation pathway was potentially significant and required evaluation in the updated HHRA. Chemical concentrations in surface and subsurface soil were compared to the EPA SSLs to evaluate potential for the migration of chemicals from soil to groundwater. EPA SSLs for transfer from soil to groundwater were not used to select COPCs for quantitative evaluation of the direct contact routes of exposure in the HHRA but were presented to allow a qualitative evaluation of the potential for chemical migration from soil to groundwater. EPA RSLs for tap water and EPA maximum contaminant levels (MCLs) were used to select COPCs for groundwater. A chemical was retained as a COPC in groundwater if the maximum detected concentration exceeded the lesser of the EPA RSL and MCL. Ten times the EPA RSLs for tap water and residential exposures to soil were used to select COPCs for surface water and sediment, respectively.

COPC selection for surface soil, subsurface soil, groundwater, surface water, and sediment from the June 2009 Site 2 RI Report Addendum is summarized in Tables 1 through 7.

COPCs for surface soil included semivolatile organic compounds (SVOCs) [benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene], dioxins/furans [2,3,7,8-TCDD equivalents], one pesticide [Dieldrin], inorganics [aluminum, antimony, arsenic, chromium, cobalt, iron, manganese, and vanadium].

COPCs for subsurface soil included SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene], and inorganics [aluminum, arsenic, chromium, cobalt, iron, manganese, thallium, and vanadium].

COPCs for groundwater included trichloroethene, bis(2-ethylhexyl)phthalate, arsenic, chromium, and iron.

COPCs for surface water included Dieldrin, arsenic, and manganese.

COPCs for sediment included SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene], one pesticide [Dieldrin], and inorganics [arsenic, cobalt, iron, lead, and manganese].

The potential receptors evaluated in the initial HHRA included current occupational workers, current adolescent and adult trespassers, future excavation workers, future recreational children, and future residents. The Site 2 RI Report Addendum updated HHRA considered occupational workers and

hypothetical residents, since they were identified as the critical receptors in the initial study. The risk evaluation assumed that potential human receptors would be exposed to the COPCs in all Site 2 media including soil, surface water and sediment, and groundwater via ingestion, dermal contact while bathing or showering, and inhalation of airborne vapors while showering.

The quantitative HHRA evaluated each potential receptor under a reasonable maximum exposure (RME) scenario and a less conservative central tendency exposure (CTE). RME is the exposure that is expected to represent a high end, but not worst-case, exposure in a given medium of concern. CTE incorporates input parameters that are representative of an average or median exposure scenario.

Excess lifetime cancer risks were determined for each receptor by multiplying a daily dose by the chemical-specific cancer slope factor. Cancer slope factors have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. According to the NCP, the maximum acceptable cancer risk range for site-related exposure is  $1 \times 10^{-6}$  to  $1 \times 10^{-4}$ . This represents an increased chance of from one in one million to one in ten thousand that a person will contract cancer as a result of exposure to contaminants at a particular site.

The non-cancer risk from a chemical is presented in the form of a Hazard Quotient (HQ), which is determined by dividing the daily dose of that chemical by the published reference dose (RfD). RfDs have been developed by EPA and represent a level to which an individual may be exposed that is not expected to result in any deleterious effect. An HQ of less than or equal to 1.0 indicates that a receptor's dose of a single contaminant is less than or equal to the RfD, and that adverse non-carcinogenic effects from that chemical are unlikely. The HQs for each of the COPCs that the receptor is assumed to be exposed to via a specific pathway are summed to yield the Hazard Index (HI) for that pathway. A total HI is then calculated for each receptor by summing the pathway-specific HIs. RME and CTE cancer risks and non-cancer hazard indices are summarized in Tables 8 and Table 9.

### Occupational Workers

Occupational workers were assumed to be exposed to only surface soil. The incremental lifetime carcinogenic risk (ILCR) for occupation workers under the RME scenario ( $6 \times 10^{-6}$ ) was within EPA's acceptable risk range of  $10^{-4}$  to  $10^{-6}$ . The ILCR for occupational workers under the CTE scenario ( $7 \times 10^{-7}$ ) was less than EPA's acceptable risk range. The HI for occupational workers under the RME (HI = 0.6) and CTE (HI = 0.2) scenarios were less than the acceptable level of 1.

As noted above, occupational workers were only exposed to surface soil. A hypothetical scenario was also evaluated for occupational workers where surface soil had been replaced with subsurface soil that

had been brought to the surface as a result of excavation activities. ILCRs for occupational workers exposed to subsurface soil under the RME ( $2 \times 10^{-5}$ ) and CTE ( $2 \times 10^{-6}$ ) scenarios were within the EPA acceptable risk range. HIs for occupational workers exposed to subsurface soil under the RME (HI = 0.2) and CTE (HI = 0.07) scenarios were less than 1, indicating that potential adverse non-carcinogenic health effects are not anticipated under the defined exposure conditions.

#### Hypothetical Child Residents

The cumulative HI for a hypothetical child resident (HI = 8) exposed to all media (i.e., surface soil, groundwater, surface water, and sediment) under the RME scenario exceeds unity. HIs developed on a target organ basis for exposures to all media also exceed unity for the blood (HI = 2), central nervous system (HI = 2), gastrointestinal system (HI = 3), and bone (HI = 2). Potential exposures to surface soil (HI = 6) were the main contributor to the HI for the child resident. For exposures to surface soil, individual target organ HIs for the blood and gastrointestinal system also exceeded 1. Cobalt (HI = 2) was the only contributor to the HI for blood. Concentrations of metals in one sample from location 02SS05 were the major contributors to the HI. Cobalt was detected at a maximum concentration of 67.5 mg/kg at location 02SS05. If sample 02SS05 is not included in the analysis, then the HI for exposures to cobalt in surface soil would be 0.5 and the target organ HI for blood would be 0.6, which are within acceptable levels. Chromium (HI = 1) and iron (HI = 0.6) were the major contributors to the HI for the gastrointestinal system. Concentrations of chromium and iron were also elevated in the surface soil sample collected at location 02SS05. If sample 02SS05 is not included in the analysis, then the target organ HI for the gastrointestinal system would be 0.5, which is within acceptable levels. The total HI for exposures to all media would be 5 if sample 02SS05 is excluded from the analysis. HIs developed on a target organ basis would exceed unity for the central nervous system (HI = 2).

Also, only total chromium data was available; therefore, in accordance with EPA Region 3 risk assessment guidance, chromium was evaluated as hexavalent chromium in the HHRA. If chromium was evaluated as trivalent chromium the HI for exposures to chromium in surface soil (including sample 02SS05) would be 0.003 and the target organ HI for the gastrointestinal system would be 0.6, which are within acceptable levels.

The cumulative HI for a hypothetical child exposed to all media includes both site related COPCs and non-site related COPCs (chemicals present at background levels). If sample 02SS05 and non-site related COPCs are not included in the evaluation then cumulative HIs developed on a target organ basis for hypothetical child residents exposed to all media are less than or equal to 1.

The cumulative HI for a child resident (HI = 3) exposed to surface soil, groundwater, surface water, and sediment under the CTE scenario exceeds unity, although as shown below, HIs for the individual target organs are all less than or equal to 1.

Target Organ	Hazard Quotient <sup>a</sup>
Blood	0.8
Central Nervous System	0.5
Cardiovascular System	0.3
Gastrointestinal System	1
Kidney	0.1
Liver	0.09
Skin	0.3
None Reported	0.02
Bone	0.6

a – HI calculated using CTE scenario.

Hypothetical child residents are not exposed to subsurface soil. A hypothetical scenario was also evaluated for hypothetical child residents where surface soil had been replaced by subsurface soil that had been brought to the surface as a result of excavation activities. HIs developed on a target-organ-specific basis for hypothetical child residents exposed to subsurface soil under the RME and CTE scenarios are less than 1 indicating that potential adverse non-carcinogenic health effects are not anticipated under the defined exposure conditions.

#### Hypothetical Adult Residents

The cumulative HI for adult residents exposed to all media (i.e., surface soil, groundwater, surface water, and sediment) under the RME scenario was 1. The cumulative HI for adult residents (HI = 0.5) exposed to all media under the CTE scenario was less than unity.

#### Hypothetical Lifelong Residents

The cumulative ILCR of  $1 \times 10^{-4}$  for hypothetical lifelong residents exposed to all media (i.e., surface soil, groundwater, surface water, and sediment) under the RME scenario was equal to the upper bound of EPA's acceptable risk range. The cumulative ILCR for hypothetical lifelong residents ( $8 \times 10^{-6}$ ) exposed to all media under the CTE scenario was within EPA's acceptable risk range.

Hypothetical lifelong residents are not exposed to subsurface soil. A hypothetical scenario was also evaluated for hypothetical lifelong residents where surface soil had been replaced by subsurface soil that had been brought to the surface as a result of excavation activities. The ILCR for hypothetical lifelong residents (ILCR =  $2 \times 10^{-4}$ ) exposed to subsurface soil under the RME scenario exceeds the EPA

acceptable risk range. The ILCR for hypothetical lifelong residents ( $6 \times 10^{-5}$ ) exposed to subsurface soil under the CTE scenario is within EPA's acceptable risk range. Carcinogenic PAHs were the major contributor to the ILCR for the hypothetical resident exposed to subsurface soil. Concentrations of carcinogenic PAHs were elevated in the sample collected at a depth of 5.5 to 6 feet at location TP05. The boring logs for this sample indicate that there was a two inch layer of asphalt-like material at a depth of 5.75 feet at this location. Consequently the analytical results are likely representative of asphalt and not soil. If this sample is excluded from the analysis then the ILCR would be  $9 \times 10^{-5}$  under the RME scenario, which is within the EPA acceptable risk range.

## **B. Ecological Risk Assessment**

An ecological risk assessment (ERA) was performed for Site 2 to characterize the potential risks from site-related contaminants to the ecological receptors (the flora and fauna) that inhabit the installation.

Soil screening values used to evaluate potential risks to soil invertebrates and terrestrial vegetation were preferentially Ecological Soil Screening Levels (Eco-SSLs) established by EPA. The lowest Eco-SSL among plant, invertebrate, mammal, and avian values was used as the screening value. EPA Region 3 Biological Technical Assistance Group (BTAG) soil screening levels were used as screening values for chemicals that do not have an Eco-SSL. Sediment ecological risk screening values (ESVs) used to evaluate potential risk to benthic organisms were EPA Region 3 BTAG Freshwater Sediment Screening Benchmarks issued in August 2006. Surface water ESVs used to evaluate potential risk to aquatic organisms were EPA Region 3 BTAG Freshwater Screening Benchmarks issued in July 2006.

Tables 10, 11, and 12 present a summary of ecological COPCs. PAH compounds, pesticides, and metals were the contaminants most often detected in surface soil, sediment and surface water samples collected at Site 2.

### Soil

Surface soil concentrations of ecological COPCs tended to be low in most samples and pose negligible or minor potential risks, or risks that are similar to potential risks posed by background conditions. Concentrations of metals were elevated in one surface soil sample and PAHs were elevated in one surface soil sample. Since potential risk is primarily limited to the vicinity of these two samples, and since there is little possibility of off-site contaminant migration from these areas, overall ecological risk is considered minor at worst, and remediation of soil at Site 2 is unnecessary. No further action related to Site 2 landfill soils is recommended.

## Surface Water and Sediment

Dieldrin was elevated in several sediment samples. However, it does not appear that dieldrin in sediments is due to landfill wastes since dieldrin concentrations in surface soil were within the range of background surface soil concentrations, and dieldrin was not detected in subsurface soils. Dieldrin was not detected in sediment samples downstream of Site 2 and Horsham Road, so potential risk to off-Base receptors from Site 2 appears to be negligible. Dieldrin was probably widely used in the past for pest control on the Base and off-Base.

Because concentrations of surface water and sediment COPCs were elevated in a few discrete locations and do not pose potential risks at other sediment sample locations or in off-Base sediments downstream of Horsham Road, and since the intermittent stream in which these samples were collected is a small area that does not support a permanent aquatic and benthic community, remediation of sediments at Site 2 is considered to be unnecessary, and no further action is proposed for Site 2 surface water and sediment.

### **VIII. NO ACTION DETERMINATION**

Based on the results of the RI, HHRA, and ERA, there are no unacceptable risks to human health or the environment in excess of background from unrestricted exposure to site media at Site 2. The Navy, in partnership with the EPA, and with concurrence by PADEP, determines no action is warranted. The no action determination meets the statutory requirements of CERCLA and the regulatory requirements of the NCP for protection of human health and the environment. No remedial response action and no restrictions on land use or exposure are necessary at Site 2.

### **IX. DOCUMENTATION OF SIGNIFICANT CHANGES**

No significant changes from the Proposed Plan appear in this ROD.

**RECORD OF DECISION**  
**Naval Air Station Joint Reserve Base (NAS JRB)**  
**Site 2 - Antenna Field Landfill**  
**Operable Unit 5 and Operable Unit 9**

**PART III - RESPONSIVENESS SUMMARY**

The purpose of this Responsiveness Summary is to review public response to the Proposed Plan for Site 2. It also documents the consideration of comments during the decision-making process and provides answers to any comments raised during the public comment period.

**I. STAKEHOLDER ISSUES AND NAVY RESPONSES**

On July 29, 2009, a newspaper notification in *The Intelligencer* newspaper announced the availability of the Proposed Plan for Site 2 OU 5 and OU 9 and invited public comment on the Proposed Plan. The newspaper public notice identified the time and location of the public meeting to be held to present the Navy's Proposed Plan and preferred alternative for Site 2. In the newspaper notification, the Navy explained that a copy of the Proposed Plan, along with a copy of the entire AR file, was available for public review at the Navy's Information Repository, and advertised the time frame for the public comment period as well as the address to which written comments could be sent. The Information Repository is located at the Horsham Township Public Library, 435 Babylon Road, Horsham, Pennsylvania.

The public meeting was held on August 5, 2009 at 6:00 pm at the Horsham Township Public Library, 435 Babylon Road, Willow Grove, Pennsylvania. At this meeting, representatives from the Navy, EPA and PADEP were available to answer questions concerning the Site 2 no action remedy. At the public meeting, the Navy reiterated the time frame for the public comment period and the address to which written comments could be sent. The public comment period ran from July 29, 2009 to September 11, 2009. No additional comments were received.

**II. TECHNICAL AND LEGAL ISSUES**

No technical or legal issues have been identified for Site 2 with respect to this ROD.

### III. COMMENT RESPONSES

#### Verbal Comments and Response

Questions or comments concerning Site 2 OU 5 and OU 9 received from the public at the August 5, 2009 public meeting and the responses are as follows:

1. One attendee asked if the boundary shouldn't go right down to the Base property line (referring to the projected slide of the Site 2 boundary) all the way to the street (Horsham Road), saying that from the beginning he didn't understand why the red line (site boundary) doesn't go all the way to the fence line.

Response: Mr. Lewandowski and Russ Turner explained that the red line encompassing the area of Site 2 on the figure showing Site 2 is conceptual. Samples taken in soil throughout the area bound by the line encountered no real contamination, and sample collection was not limited to the boundary noted. Surface water and sediment samples for instance were collected upstream and downstream from the area depicted on the figure referred to. Also, the boundary shown is somewhat arbitrary. If there had been a landfill there, it probably could not have extended beyond the Navy perimeter road inside the fence, although we show the Site 2 boundary line on the fence side of the perimeter road.

2. One attendee asked if the Proposed Plan gets signed or is there another document?

Response: Mr. Lewandowski explained that after the public comment period for the Proposed Plan is over, any comments received from the public will be incorporated into the Responsiveness Summary in the Record of Decision (ROD) document. Public comment could change the Proposed Plan, but this is not considered a controversial site. The ROD will be finalized after review by EPA counsel. Then PADEP will review the ROD and provide a concurrence letter that will become part of the final ROD document if they agree. Then the EPA and the Navy will sign off on the ROD.

#### Written Comment and Response

There were no additional written comments or any other comments received during the Site 2 public comment period.

## REFERENCES

B&R Environmental (Brown & Root Environmental), 1998. Phase II Remedial Investigation Report for Sites for NAS JRB Willow Grove (Volume I and Volume II). April.

Tetra Tech (Tetra Tech NUS, Inc.), 2006. Technical Memorandum of Risk Assessment Evaluation. July.

Tetra Tech, 2009a. Remedial Investigation Report for Site 2 - Antenna Field Landfill, Naval Air Station Joint Reserve Base Willow Grove, Pennsylvania. March.

Tetra Tech, 2009b. Remedial Investigation Report Addendum for Site 2 - Antenna Field Landfill, Naval Air Station Joint Reserve Base Willow Grove, Pennsylvania. June.

Tetra Tech, 2009c. Site 2 Groundwater Confirmation Sampling Report, Antenna Field Landfill, Naval Air Station Joint Reserve Base Willow Grove, Pennsylvania. June.

Tetra Tech, 2009d, Proposed Remedial Action Plan for Site 2 Soil (OU 5) and Groundwater (OU 9), NAS JRB Willow Grove, Pennsylvania. July.

USGS (United States Geological Survey), 2002. Hydrogeological Investigation at Site 5, Willow Grove Naval Air Station/Joint Reserve Base, Horsham Township, Montgomery County, Pennsylvania.

## TABLES

**TABLE 1**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE SOIL**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Noneducts <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional RSL (Residential) <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Dioxins/Furans (ng/kg)</b>									
1,2,3,4,6,7,8,9-OCDD	12,360 K	12,640 K	02SS08	1/1	---	12,640	15,000	No	BSL
1,2,3,4,6,7,8,9-OCDF	1.1	1.5	02SS08-D	1/1	---	1.5	15,000	No	BSL
1,2,3,4,6,7,8-HPCDD	54.1	57	02SS08-D	1/1	---	57	450	No	BSL
1,2,3,4,6,7,8-HPCDF	0.79	1.9	02SS08-D	1/1	---	1.9	450	No	BSL
1,2,3,4,7,8-HXCDD	0.51	0.85	02SS08-D	1/1	---	0.85	45	No	BSL
1,2,3,4,7,8-HXCDF	0.29	0.68	02SS08-D	1/1	---	0.68	45	No	BSL
1,2,3,6,7,8-HXCDD	0.69	0.85	02SS08-D	1/1	---	0.85	45	No	BSL
1,2,3,6,7,8-HXCDF	0.1	0.23	02SS08-D	1/1	---	0.23	45	No	BSL
1,2,3,7,8,9-HXCDD	1.3	1.6	02SS08-D	1/1	---	1.6	45	No	BSL
1,2,3,7,8-PECDD	0.43	0.43	02SS08-D	1/1	0.4 - 0.4	0.43	4.5	No	BSL
2,3,4,6,7,8-HXCDF	0.39	0.52	02SS08-D	1/1	---	0.52	45	No	BSL
2,3,7,8-TCDD	0.12	0.12	02SS08	1/1	0.2 - 0.2	0.12	4.5	No	BSL
2,3,7,8-TCDF	0.24	0.49	02SS08-D	1/1	---	0.49	45	No	BSL
<b>2,3,7,8-TCDD Equivalents</b>	5.03	5.41	02SS08-D	1/1	---	5.41	<b>4.5</b>	<b>Yes</b>	ASL
Total HPCDD	118	121	02SS08	1/1	---	121	NA	No	NTX
Total HPCDF	0.79	2.7	02SS08-D	1/1	---	2.7	NA	No	NTX
Total HXCDD	13.2	15.7	02SS08-D	1/1	---	15.7	NA	No	NTX
Total HXCDF	1.3	2.7	02SS08-D	1/1	---	2.7	NA	No	NTX
Total PECDD	0.82	2.5	02SS08-D	1/1	---	2.5	NA	No	NTX
Total PECDF	2.2	2.2	02SS08-D	1/1	1.4 - 1.4	2.2	NA	No	NTX
Total TCDD	0.14	0.39	02SS08	1/1	---	0.39	NA	No	NTX
Total TCDF	0.24	0.71	02SS08-D	1/1	---	0.71	NA	No	NTX
<b>Semivolatile Organic Compounds (µg/kg)</b>									
Anthracene	35 J	43 J	02SS07	2/8	390 - 470	43	1,700,000	No	BSL
<b>Benzo(a)anthracene</b>	35 J	380 J	02SS07	8/8	390 - 470	380	<b>150</b>	<b>Yes</b>	ASL
<b>Benzo(a)pyrene</b>	48 J	480	02SS07	8/8	390 - 470	480	<b>15</b>	<b>Yes</b>	ASL
<b>Benzo(b)fluoranthene</b>	88 J	550	02SS07	5/8	390 - 470	550	<b>150</b>	<b>Yes</b>	ASL
Benzo(g,h,i)perylene	57 J	300 J	02SS07	7/8	390 - 470	300	170,000	No	BSL
Benzo(k)fluoranthene	99 J	340 J	02SS07	5/8	390 - 470	340	1,500	No	BSL
Bis(2-ethylhexyl)phthalate	430 J	430 J	02SS03	1/8	390 - 470	430	35,000	No	BSL
Chrysene	60 J	460	02SS07	8/8	390 - 470	460	15,000	No	BSL
<b>Dibenzo(a,h)anthracene</b>	71 J	71 J	02SS07	1/8	390 - 470	71	<b>15</b>	<b>Yes</b>	ASL
Fluoranthene	97 J	680	02SS08	8/8	---	680	230,000	No	BSL
<b>Indeno(1,2,3-cd)pyrene</b>	64 J	360 J	02SS07	7/8	390 - 470	360	<b>150</b>	<b>Yes</b>	ASL
Phenanthrene	52 J	370 J	02SS03	8/8	390 - 390	370	170,000	No	BSL
Pyrene	84 J	610	02SS07	8/8	---	610	170,000	No	BSL
<b>Pesticides (µg/kg)</b>									
<b>Dieldrin</b>	21 J	570	02SS03	7/8	3.9 - 4.6	570	<b>30</b>	<b>Yes</b>	ASL
<b>Inorganics (mg/kg)</b>									
<b>Aluminum</b>	9,830	41,900	02SS05	8/8	---	41,900	<b>7,700</b>	<b>Yes</b>	ASL
<b>Antimony</b>	5.2	5.2	02SS08	1/8	4.7 - 5.7	5.2	<b>3.1</b>	<b>Yes</b>	ASL
<b>Arsenic</b>	3.8 K	12.6	02SS03	8/8	---	12.6	<b>0.39</b>	<b>Yes</b>	ASL, BKG <sup>(4)</sup>
Barium	79.3	330	02SS05	8/8	---	330	1,500	No	BSL

**TABLE 1**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SURFACE SOIL**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Noneducts <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional RSL (Residential) <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
Beryllium	0.76	2.3	02SS05	8/8	---	2.3	16	No	BSL
Calcium	1,040	15,700	02SS08	8/8	---	15,700	NA	No	NUT
<b>Chromium</b>	13.6	179	02SS05	8/8	---	179	<b>23</b>	<b>Yes</b>	ASL
<b>Cobalt</b>	7	67.5	02SS05	8/8	---	67.5	<b>2.3</b>	<b>Yes</b>	ASL
Copper	10.9	87	02SS05	8/8	---	87	310	No	BSL
<b>Iron</b>	15,400	63,200	02SS05	8/8	---	63,200	<b>5,500</b>	<b>Yes</b>	ASL
Lead	9.3 L	53.7 L	02SS07	8/8	---	53.7	400	No	BSL, BKG <sup>(4)</sup>
Magnesium	1,200	7,360	02SS08	8/8	---	7,360	NA	No	NUT
<b>Manganese</b>	430	1,180	02SS05	8/8	---	1,180	<b>180</b>	<b>Yes</b>	ASL
Nickel	9.4 K	71.2	02SS05	8/8	---	71.2	150	No	BSL
Potassium	397	1,690	02SS04	8/8	---	1,690	NA	No	NUT
Sodium	112	208	02SS08	5/8	94.1 - 109	208	NA	No	NUT
Thallium	0.27	0.27	02SS04	1/8	0.24 - 0.29	0.27	0.51	No	BSL, BKG <sup>(4)</sup>
<b>Vanadium</b>	20.1	160	02SS05	8/8	---	160	<b>39</b>	<b>Yes</b>	ASL
Zinc	22.3	96.2	02SS02	8/8	---	96.2	2,300	No	BSL, BKG <sup>(4)</sup>

**Footnotes:**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The statistical analysis presented in the Remedial Investigation Report of Site 2 - Antenna Field Area, April, 2008 was used to determine whether site concentrations were above background concentrations.
- 5 - Oak Ridge National Laboratory (ORNL) Regional Screening Level. The noncarcinogenic values (denoted with a "N" flag) are the screening level divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (ORNL, April 2009).
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be above site background. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
K = Value estimated with a high bias  
L = Value estimated with a low bias  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BKG = Below Background  
BSL = Below Screening Level  
NUT = Essential Nutrient  
NTX = No Toxicity Data

**TABLE 2**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SURFACE SOIL TO GROUNDWATER**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondetects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional Screening Level <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Dioxins/Furans (ng/kg)</b>									
<b>1,2,3,4,6,7,8,9-OCDD</b>	12,360 K	12,640 K	02SS08	1/1	---	12,640	<b>500</b>	<b>Yes</b>	ASL
1,2,3,4,6,7,8,9-OCDF	1.1	1.5	02SS08-D	1/1	---	1.5	500	No	BSL
<b>1,2,3,4,6,7,8-HPCDD</b>	54.1	57	02SS08-D	1/1	---	57	<b>15</b>	<b>Yes</b>	ASL
1,2,3,4,6,7,8-HPCDF	0.79	1.9	02SS08-D	1/1	---	1.9	15	No	BSL
1,2,3,4,7,8-HXCDD	0.51	0.85	02SS08-D	1/1	---	0.85	1.5	No	BSL
1,2,3,4,7,8-HXCDF	0.29	0.68	02SS08-D	1/1	---	0.68	1.5	No	BSL
1,2,3,6,7,8-HXCDD	0.69	0.85	02SS08-D	1/1	---	0.85	1.5	No	BSL
1,2,3,6,7,8-HXCDF	0.1	0.23	02SS08-D	1/1	---	0.23	1.5	No	BSL
<b>1,2,3,7,8,9-HXCDD</b>	1.3	1.6	02SS08-D	1/1	---	1.6	<b>1.5</b>	<b>Yes</b>	ASL
<b>1,2,3,7,8-PECDD</b>	0.43	0.43	02SS08-D	1/1	0.4 - 0.4	0.43	<b>0.15</b>	<b>Yes</b>	ASL
2,3,4,6,7,8-HXCDF	0.39	0.52	02SS08-D	1/1	---	0.52	1.5	No	BSL
2,3,7,8-TCDD	0.12	0.12	02SS08	1/1	0.2 - 0.2	0.12	0.15	No	BSL
2,3,7,8-TCDF	0.24	0.49	02SS08-D	1/1	---	0.49	1.5	No	BSL
<b>2,3,7,8-TCDD Equivalents</b>	5.0	5	02SS08-D	1/1	---	5	<b>0.15</b>	<b>Yes</b>	ASL
Total HPCDD	118	121	02SS08	1/1	---	121	NA	No	NTX
Total HPCDF	0.79	2.7	02SS08-D	1/1	---	2.7	NA	No	NTX
Total HXCDD	13.2	15.7	02SS08-D	1/1	---	15.7	NA	No	NTX
Total HXCDF	1.3	2.7	02SS08-D	1/1	---	2.7	NA	No	NTX
Total PECDD	0.82	2.5	02SS08-D	1/1	---	2.5	NA	No	NTX
Total PECDF	2.2	2.2	02SS08-D	1/1	1.4 - 1.4	2.2	NA	No	NTX
Total TCDD	0.14	0.39	02SS08	1/1	---	0.39	NA	No	NTX
Total TCDF	0.24	0.71	02SS08-D	1/1	---	0.71	NA	No	NTX
<b>Semivolatile Organic Compounds (µg/kg)</b>									
Anthracene	35 J	43 J	02SS07	2/8	390 - 470	43	450,000	No	BSL
<b>Benzo(a)anthracene</b>	35 J	380 J	02SS07	8/8	390 - 470	380	<b>14</b>	<b>Yes</b>	ASL
<b>Benzo(a)pyrene</b>	48 J	480	02SS07	8/8	390 - 470	480	<b>4.6</b>	<b>Yes</b>	ASL
<b>Benzo(b)fluoranthene</b>	88 J	550	02SS07	5/8	390 - 470	550	<b>47</b>	<b>Yes</b>	ASL
Benzo(g,h,i)perylene	57 J	300 J	02SS07	7/8	390 - 470	300	150,000	No	BSL
Benzo(k)fluoranthene	99 J	340 J	02SS07	5/8	390 - 470	340	460	No	BSL
Bis(2-ethylhexyl)phthalate	430 J	430 J	02SS03	1/8	390 - 470	430	1,600	No	BSL
Chrysene	60 J	460	02SS07	8/8	390 - 470	460	1,400	No	BSL
<b>Dibenzo(a,h)anthracene</b>	71 J	71 J	02SS07	1/8	390 - 470	71	<b>15</b>	<b>Yes</b>	ASL
Fluoranthene	97 J	680	02SS08	8/8	---	680	210,000	No	BSL
<b>Indeno(1,2,3-cd)pyrene</b>	64 J	360 J	02SS07	7/8	390 - 470	360	<b>160</b>	<b>Yes</b>	ASL
Phenanthrene	52 J	370 J	02SS03	8/8	390 - 390	370	150,000	No	BSL
Pyrene	84 J	610	02SS07	8/8	---	610	150,000	No	BSL
<b>Pesticides (µg/kg)</b>									
<b>Dieldrin</b>	21 J	570	02SS03	7/8	3.9 - 4.6	570	<b>0.09</b>	<b>Yes</b>	ASL
<b>Inorganics (mg/kg)</b>									
Aluminum	9,830	41,900	02SS05	8/8	---	41,900	55,000	No	BSL
<b>Antimony</b>	5.2	5.2	02SS08	1/8	4.7 - 5.7	5.2	<b>0.66</b>	<b>Yes</b>	ASL
<b>Arsenic</b>	3.8 K	12.6	02SS03	8/8	---	12.6	<b>0.0013</b>	<b>Yes</b>	ASL, BKG <sup>(4)</sup>
<b>Barium</b>	79.3	330	02SS05	8/8	---	330	<b>300</b>	<b>Yes</b>	ASL
Beryllium	0.76	2.3	02SS05	8/8	---	2.3	58	No	BSL

**TABLE 2**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SURFACE SOIL TO GROUNDWATER**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondetects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional Screening Level <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
Calcium	1,040	15,700	02SS08	8/8	---	15,700	NA	No	NUT
Chromium	13.6	179	02SS05	8/8	---	179	2,100	No	BSL
<b>Cobalt</b>	7	67.5	02SS05	8/8	---	67.5	<b>0.49</b>	<b>Yes</b>	ASL
<b>Copper</b>	10.9	87	02SS05	8/8	---	87	<b>51</b>	<b>Yes</b>	ASL
<b>Iron</b>	15,400	63,200	02SS05	8/8	---	63,200	<b>640</b>	<b>Yes</b>	ASL
Lead	9.3 L	53.7 L	02SS07	8/8	---	53.7	NA	No	NTX, BKG <sup>(4)</sup>
Magnesium	1,200	7,360	02SS08	8/8	---	7,360	NA	No	NUT
<b>Manganese</b>	430	1,180	02SS05	8/8	---	1,180	<b>57</b>	<b>Yes</b>	ASL
<b>Nickel</b>	9.4 K	71.2	02SS05	8/8	---	71.2	<b>48</b>	<b>Yes</b>	ASL
Potassium	397	1,690	02SS04	8/8	---	1,690	NA	No	NUT
Sodium	112	208	02SS08	5/8	94.1 - 109	208	NA	No	NUT
<b>Thallium</b>	0.27	0.27	02SS04	1/8	0.24 - 0.29	0.27	<b>0.17</b>	<b>Yes</b>	ASL, BKG <sup>(4)</sup>
Vanadium	20.1	160	02SS05	8/8	---	160	180	No	BSL
Zinc	22.3	96.2	02SS02	8/8	---	96.2	680	No	BSL, BKG <sup>(4)</sup>

**Footnotes:**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The statistical analysis presented in the Remedial Investigation Report of Site 2 - Antenna Field Area, April, 2008 was used to determine whether site concentrations were above background concentrations.
- 5 - Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites, Risk-based soil screening level for migration to groundwater, April 2009.
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be above site background. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
K = Value estimated with a high bias  
L = Value estimated with a low bias  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BKG = Below Background  
BSL = Below Screening Level  
NUT = Essential Nutrient  
NTX = No Toxicity Data

**TABLE 3**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondelects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional SSL (Residential) <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Dioxins/Furans (ng/kg)</b>									
1,2,3,4,6,7,8,9-OCDD	9,590	9,590	02TP05B	1/1	---	9,590	15,000	No	BSL
1,2,3,4,6,7,8,9-OCDF	2.9 J	2.9 J	02TP05B	1/1	---	2.9	15,000	No	BSL
1,2,3,4,6,7,8-HPCDD	64	64	02TP05B	1/1	---	64	450	No	BSL
1,2,3,4,6,7,8-HPCDF	2.2	2.2	02TP05B	1/1	---	2.2	450	No	BSL
1,2,3,4,7,8-HXCDD	0.89	0.89	02TP05B	1/1	---	0.89	45	No	BSL
1,2,3,4,7,8-HXCDF	0.33	0.33	02TP05B	1/1	---	0.33	45	No	BSL
1,2,3,6,7,8-HXCDD	1.2	1.2	02TP05B	1/1	---	1.2	45	No	BSL
1,2,3,7,8,9-HXCDD	1.8 J	1.8 J	02TP05B	1/1	---	1.8	45	No	BSL
1,2,3,7,8-PECDD	0.44	0.44	02TP05B	1/1	---	0.44	4.5	No	BSL
2,3,7,8-TCDF	0.27	0.27	02TP05B	1/1	---	0.27	45	No	BSL
2,3,7,8-TCDD Equivalents	4.4	4	02TP05B	1/1	---	4	4.5	No	BSL
Total HPCDD	151	151	02TP05B	1/1	---	151	NA	No	NTX
Total HPCDF	2.2	2.2	02TP05B	1/1	---	2.2	NA	No	NTX
Total HXCDD	22.7	22.7	02TP05B	1/1	---	22.7	NA	No	NTX
Total HXCDF	1.4	1.4	02TP05B	1/1	---	1.4	NA	No	NTX
Total PECDD	1.4	1.4	02TP05B	1/1	---	1.4	NA	No	NTX
Total TCDF	0.78	0.78	02TP05B	1/1	---	0.78	NA	No	NTX
<b>Volatile Organic Compounds (µg/kg)</b>									
2-Butanone	21	36 J	02TP06C	2/24	12 - 13	36	2,800,000	No	BSL
Acetone	17 J	90 J	02TP06C	8/24	12 - 13	90	6,100,000	No	BSL
<b>Semivolatile Organic Compounds (µg/kg)</b>									
2-Methylnaphthalene	49 J	5,100 J	02TP05C	3/24	380 - 430	5,100	31,000	No	BSL
Acenaphthene	95 J	8,100	02TP05C	3/24	380 - 430	8,100	340,000	No	BSL
Acenaphthylene	92 J	700	02TP05C	2/24	380 - 430	700	340,000	No	BSL
Anthracene	38 J	11,000	02TP05C	4/24	380 - 430	11,000	1,700,000	No	BSL
Benzo(a)anthracene	92 J	9,300	02TP05C	5/24	380 - 430	9,300	150	Yes	ASL
Benzo(a)pyrene	78 J	7,400 J	02TP05C	5/24	380 - 430	7,400	15	Yes	ASL
Benzo(b)fluoranthene	180 J	6,600 J	02TP05C	4/24	380 - 430	6,600	150	Yes	ASL
Benzo(g,h,i)perylene	100 J	2,700 J	02TP05C	4/24	380 - 430	2,700	170,000	No	BSL
Benzo(k)fluoranthene	140 J	6,800 J	02TP05C	4/24	380 - 430	6,800	1,500	Yes	ASL
Carbazole	130 J	7,100 J	02TP05C	3/24	380 - 430	7,100	NA	No	NTX
Chrysene	56 J	9,200	02TP05C	6/24	380 - 430	9,200	15,000	No	BSL
Dibenzo(a,h)anthracene	610	1,300 J	02TP05C	2/24	380 - 430	1,300	15	Yes	ASL
Dibenzofuran	89 J	7,700	02TP05C	4/24	380 - 430	7,700	NA	No	NTX
Fluoranthene	80 J	27,000	02TP05C	7/24	380 - 430	27,000	230,000	No	BSL
Fluorene	120 J	12,000	02TP05C	3/24	380 - 430	12,000	230,000	No	BSL
Indeno(1,2,3-cd)pyrene	53 J	3,500 J	02TP05C	5/24	380 - 430	3,500	150	Yes	ASL
Naphthalene	220 J	8,900	02TP05C	2/24	380 - 430	8,900	390	Yes	ASL
Phenanthrene	67 J	48,000	02TP05C	9/24	380 - 430	48,000	170,000	No	BSL
Pyrene	64 J	23,000	02TP05C	8/24	380 - 430	23,000	170,000	No	BSL
<b>Inorganics (mg/kg)</b>									
Aluminum	6,000	30,600	02TP03D	24/24	---	30,600	7,700	Yes	ASL

**TABLE 3**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SUBSURFACE SOIL**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional SSL (Residential) <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Arsenic</b>	1.1 J	6 L	02TP02C	24/24	---	6	<b>0.39</b>	<b>Yes</b>	ASL, BKG <sup>(4)</sup>
Barium	48.8	198	02TP04C	24/24	---	198	1,500	No	BSL
Beryllium	0.58	1.4	02TP03D	24/24	---	1.4	16	No	BSL, BKG <sup>(4)</sup>
Calcium	398 J	4,340	02TP05C	21/24	573 - 773	4,340	NA	No	NUT
<b>Chromium</b>	6	179	02TP03D	24/24	---	179	<b>23</b>	<b>Yes</b>	ASL
<b>Cobalt</b>	5.8	46.8	02TP03D	24/24	---	46.8	<b>2.3</b>	<b>Yes</b>	ASL
Copper	2.6	66.5	02TP03D	24/24	---	66.5	310	No	BSL
<b>Iron</b>	9,750	55,900	02TP03D	24/24	---	55,900	<b>5,500</b>	<b>Yes</b>	ASL
Lead	2.9	32.4	02TP05C	24/24	---	32.4	400	No	BSL, BKG <sup>(4)</sup>
Magnesium	887	3,920	02TP03D	24/24	---	3,920	NA	No	NUT
<b>Manganese</b>	214 L	1,070	02TP03D	24/24	---	1,070	<b>180</b>	<b>Yes</b>	ASL, BKG <sup>(4)</sup>
Nickel	7.7	46.2	02TP03D	24/24	---	46.2	150	No	BSL
Potassium	386	1,530	02TP02B	23/24	368 - 368	1,530	NA	No	NUT
Silver	1.3	1.3	02TP03D	1/24	1.1 - 1.2	1.3	39	No	BSL
Sodium	98	145	02TP02B	21/24	96.7 - 98.3	145	NA	No	NUT
<b>Thallium</b>	0.25	0.53	02TP03D	14/24	0.23 - 0.25	0.53	<b>0.51</b>	<b>Yes</b>	ASL
<b>Vanadium</b>	10.7	135	02TP03D	24/24	---	135	<b>39</b>	<b>Yes</b>	ASL
Zinc	14.8 L	44	02TP06C	24/24	---	44	2,300	No	BSL, BKG <sup>(4)</sup>

**Footnotes:**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The statistical analysis presented in the Remedial Investigation Report of Site 2 - Antenna Field Area, April, 2008 was used to determine whether site concentrations were above background concentrations.
- 5 - Oak Ridge National Laboratory (ORNL) Regional Screening Level. The noncarcinogenic values (denoted with a "N" flag) are the screening level divided by 10 to correspond to a target hazard quotient of 0.1. Carcinogenic values represent an incremental cancer risk of 1.0E-06 (carcinogens denoted with a "C" flag) (ORNL, April 2009).
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be above site background. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
K = Value estimated with a high bias  
L = Value estimated with a low bias  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BKG = Below Background  
BSL = Below Screening Level  
NUT = Essential Nutrient  
NTX = No Toxicity Data

**TABLE 4**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SUBSURFACE SOIL TO GROUNDWATER**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Noneducts <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional Screening Level <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Dioxins/Furans (ng/kg)</b>									
<b>1,2,3,4,6,7,8,9-OCDD</b>	9,590	9,590	02TP05B	1/1	---	9,590	<b>500</b>	<b>Yes</b>	ASL
1,2,3,4,6,7,8,9-OCDF	2.9 J	2.9 J	02TP05B	1/1	---	2.9	500	No	BSL
1,2,3,4,6,7,8-HPCDD	64	64	02TP05B	1/1	---	64	15	No	BSL
1,2,3,4,6,7,8-HPCDF	2.2	2.2	02TP05B	1/1	---	2.2	15	No	BSL
1,2,3,4,7,8-HXCDD	0.89	0.89	02TP05B	1/1	---	0.89	1.5	No	BSL
1,2,3,4,7,8-HXCDF	0.33	0.33	02TP05B	1/1	---	0.33	1.5	No	BSL
1,2,3,6,7,8-HXCDD	1.2	1.2	02TP05B	1/1	---	1.2	1.5	No	BSL
1,2,3,7,8,9-HXCDD	1.8 J	1.8 J	02TP05B	1/1	---	1.8	1.5	No	BSL
<b>1,2,3,7,8-PECDD</b>	0.44	0.44	02TP05B	1/1	---	0.44	<b>0.15</b>	<b>Yes</b>	ASL
2,3,7,8-TCDF	0.27	0.27	02TP05B	1/1	---	0.27	1.5	No	BSL
<b>2,3,7,8-TCDD Equivalents</b>	4.4	4	02TP05B	1/1	---	4	<b>0.15</b>	<b>Yes</b>	ASL
Total HPCDD	151	151	02TP05B	1/1	---	151	NA	No	NTX
Total HPCDF	2.2	2.2	02TP05B	1/1	---	2.2	NA	No	NTX
Total HXCDD	22.7	22.7	02TP05B	1/1	---	22.7	NA	No	NTX
Total HXCDF	1.4	1.4	02TP05B	1/1	---	1.4	NA	No	NTX
Total PECDD	1.4	1.4	02TP05B	1/1	---	1.4	NA	No	NTX
Total TCDF	0.78	0.78	02TP05B	1/1	---	0.78	NA	No	NTX
<b>Volatile Organic Compounds (µg/kg)</b>									
2-Butanone	21	36 J	02TP06C	2/24	12 - 13	36	1,500	No	BSL
Acetone	17 J	90 J	02TP06C	8/24	12 - 13	90	4,400	No	BSL
<b>Semivolatile Organic Compounds (µg/kg)</b>									
<b>2-Methylnaphthalene</b>	49 J	5,100 J	02TP05C	3/24	380 - 430	5,100	<b>900</b>	<b>Yes</b>	ASL
Acenaphthene	95 J	8,100	02TP05C	3/24	380 - 430	8,100	27,000	No	BSL
Acenaphthylene	92 J	700	02TP05C	2/24	380 - 430	700	27,000	No	BSL
Anthracene	38 J	11,000	02TP05C	4/24	380 - 430	11,000	450,000	No	BSL
<b>Benzo(a)anthracene</b>	92 J	9,300	02TP05C	5/24	380 - 430	9,300	<b>14</b>	<b>Yes</b>	ASL
<b>Benzo(a)pyrene</b>	78 J	7,400 J	02TP05C	5/24	380 - 430	7,400	<b>4.6</b>	<b>Yes</b>	ASL
<b>Benzo(b)fluoranthene</b>	180 J	6,600 J	02TP05C	4/24	380 - 430	6,600	<b>47</b>	<b>Yes</b>	ASL
Benzo(g,h,i)perylene	100 J	2,700 J	02TP05C	4/24	380 - 430	2,700	150,000	No	BSL
<b>Benzo(k)fluoranthene</b>	140 J	6,800 J	02TP05C	4/24	380 - 430	6,800	<b>460</b>	<b>Yes</b>	ASL
Carbazole	130 J	7,100 J	02TP05C	3/24	380 - 430	7,100	NA	No	NTX
<b>Chrysene</b>	56 J	9,200	02TP05C	6/24	380 - 430	9,200	<b>1,400</b>	<b>Yes</b>	ASL
<b>Dibenzo(a,h)anthracene</b>	610	1,300 J	02TP05C	2/24	380 - 430	1,300	<b>15</b>	<b>Yes</b>	ASL
Dibenzofuran	89 J	7,700	02TP05C	4/24	380 - 430	7,700	NA	No	NTX
Fluoranthene	80 J	27,000	02TP05C	7/24	380 - 430	27,000	210,000	No	BSL
Fluorene	120 J	12,000	02TP05C	3/24	380 - 430	12,000	33,000	No	BSL
<b>Indeno(1,2,3-cd)pyrene</b>	53 J	3,500 J	02TP05C	5/24	380 - 430	3,500	<b>160</b>	<b>Yes</b>	ASL
<b>Naphthalene</b>	220 J	8,900	02TP05C	2/24	380 - 430	8,900	<b>0.55</b>	<b>Yes</b>	ASL
Phenanthrene	67 J	48,000	02TP05C	9/24	380 - 430	48,000	150,000	No	BSL
Pyrene	64 J	23,000	02TP05C	8/24	380 - 430	23,000	150,000	No	BSL
<b>Inorganics (mg/kg)</b>									
Aluminum	6,000	30,600	02TP03D	24/24	---	30,600	55,000	No	BSL
<b>Arsenic</b>	1.1 J	6 L	02TP02C	24/24	---	6	<b>0.0013</b>	<b>Yes</b>	ASL, BKG

**TABLE 4**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - MIGRATION FROM SUBSURFACE SOIL TO GROUNDWATER**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondelects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional Screening Level <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
Barium	48.8	198	02TP04C	24/24	---	198	300	No	BSL
Beryllium	0.58	1.4	02TP03D	24/24	---	1.4	58	No	BSL, BKG
Calcium	398 J	4,340	02TP05C	21/24	573 - 773	4,340	NA	No	NUT
<b>Chromium</b>	6	179	02TP03D	24/24	---	179	2100	<b>Yes</b>	ASL
<b>Cobalt</b>	5.8	46.8	02TP03D	24/24	---	46.8	<b>0.49</b>	<b>Yes</b>	ASL
Copper	2.6	66.5	02TP03D	24/24	---	66.5	51	No	BSL
<b>Iron</b>	9,750	55,900	02TP03D	24/24	---	55,900	<b>640</b>	<b>Yes</b>	ASL
<b>Lead</b>	2.9	32.4	02TP05C	24/24	---	32.4	NA	<b>Yes</b>	ASL, BKG
Magnesium	887	3,920	02TP03D	24/24	---	3,920	NA	No	NUT
<b>Manganese</b>	214 L	1,070	02TP03D	24/24	---	1,070	<b>57</b>	<b>Yes</b>	ASL, BKG
Nickel	7.7	46.2	02TP03D	24/24	---	46.2	48	No	BSL
Potassium	386	1,530	02TP02B	23/24	368 - 368	1,530	NA	No	NUT
Silver	1.3	1.3	02TP03D	1/24	1.1 - 1.2	1.3	1.6	No	BSL
Sodium	98	145	02TP02B	21/24	96.7 - 98.3	145	NA	No	NUT
<b>Thallium</b>	0.25	0.53	02TP03D	14/24	0.23 - 0.25	0.53	<b>0.17</b>	<b>Yes</b>	ASL
Vanadium	10.7	135	02TP03D	24/24	---	135	180	No	BSL
Zinc	14.8 L	44	02TP06C	24/24	---	44	680	No	BSL, BKG

**Footnotes:**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The statistical analysis presented in the Remedial Investigation Report of Site 2 - Antenna Field Area, April, 2008 was used to determine whether site concentrations were above background concentrations.
- 5 - Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites, Risk-based soil screening level for migration to groundwater, April 2009.
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be above site background. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
K = Value estimated with a high bias  
L = Value estimated with a low bias  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BKG = Below Background  
BSL = Below Screening Level  
NUT = Essential Nutrient  
NTX = No Toxicity Data

**TABLE 5**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - GROUNDWATER**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 1**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional Tapwater Screening Levels <sup>(4)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Volatile Organic Compounds (µg/L)</b>									
<b>Trichloroethene</b>	2 J	2 J	02MW03I, 02MW03I-D	1/7	10	2	1.7	Yes	ASL
<b>Semi-Volatile Organic Compounds (µg/L)</b>									
<b>Bis(2-Ethylhexyl)Phthalate</b>	1 J	8 J	02MW01I	3/6	10	8	4.8	Yes	ASL
<b>Inorganics (µg/L)</b>									
Aluminum	69.7	964	02MW01I	5/7	50	964	3,700	No	BSL
<b>Arsenic</b>	1.3	1.3	02MW02S	1/7	1	1.3	0.045	Yes	ASL
Barium	105	674	02MW04S	7/7	---	674	730	No	BSL
Calcium	10,600	48,700	02MW01I	7/7	---	48,700	NA	No	NUT
<b>Chromium</b>	23.4	23.4	02MW04S	1/7	5	23.4	11	Yes	ASL
<b>Iron</b>	50.7	3,190	02MW02S	6/7	50	3,190	2,600	Yes	ASL
Lead	1.5	1.5	02MW02S	1/7	1 - 4	1.5	15	No	BSL
Magnesium	3,420	15,100	02MW04I	7/7	---	15,100	NA	No	NUT
Manganese	8.1	66.2	02MW02S	5/7	5	66.2	88	No	BSL
Nickel	20.6	20.6	02MW04S	1/7	20	20.6	73	No	BSL
Potassium	1,500	3,440	02MW04S	3/7	1,500	3,440	NA	No	NUT
Sodium	8,150	16,600	02MW01I	7/7	---	16,600	NA	No	NUT
Zinc	10.3	15.1	02MW04S	3/7	5 - 5.6	15.1	1,100	No	BSL

**Footnotes**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The ORNL tap water regional screening level is presented. Value represents the risk based tap water screening level divided by 10 to correspond to a target hazard quotient of 0.1 for noncarcinogens (denoted with a "N" flag), or an incremental cancer risk of 1.0E-6 for carcinogens (denoted with a "C" flag) (ORNL, April 2009).
- 5 - USEPA 2006 Edition of the Drinking Water Standards and Health Advisories (USEPA, August 2006). The values presented are based on MCLs or SMCLs and are presented for reference purposes only.
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BSL = Below Screening Level  
NUT = Essential Nutrient

**TABLE 6**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SURFACE WATER**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 1**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional Tapwater Screening Levels <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Semi-Volatile Organic Compounds (µg/L)</b>									
Bis(2-ethylhexyl)phthalate	10 J	10 J	02SW04B	1/16	4 - 10	10	48	No	BSL
di-n-Butyl Phthalate	30 J	30 J	02SW04B	1/16	10 - 10	30	3,700	No	BSL
<b>Pesticides (µg/L)</b>									
<b>Dieldrin</b>	0.04 J	0.46	02SP02L	3/16	0.1 - 0.1	0.46	<b>0.042</b>	<b>Yes</b>	ASL
<b>Inorganics (µg/L)</b>									
Aluminum	157	1,890	02SP02L	5/16	50 - 666	1,890	37,000	No	BSL
<b>Arsenic</b>	1.8 K	1.8 K	02SP02L	1/16	1 - 10	1.8	<b>0.45</b>	<b>Yes</b>	ASL
Barium	8	188	02SW07	16/16	- - -	188	7,300	No	BSL
Beryllium	4	4	02SW04B	1/16	1 - 4	4	73	No	BSL, BKG <sup>(4)</sup>
Calcium	6,710	52,200	02SP02L	16/16	- - -	52,200	NA	No	NUT
Chromium	7	11	02SW12	2/16	5 - 7	11	110	No	BSL, BKG <sup>(4)</sup>
Cobalt	5	5	02SP02L	1/16	5 - 10	5	11	No	BSL, BKG <sup>(4)</sup>
Iron	209	6,100	02SP02L	12/16	167 - 287	6,100	26,000	No	BSL
Lead	1.2 K	10.5	02SP02L	13/16	1 - 1	10.5	15	No	BSL
Magnesium	2,200	18,500	02SP02L	16/16	- - -	18,500	NA	No	NUT
<b>Manganese</b>	13.5	4,010	02SP02L	16/16	- - -	4,010	<b>880</b>	<b>Yes</b>	ASL
Potassium	1,660	186,000	02SW04B	11/16	1500 - 2710	186,000	NA	No	BSL, BKG <sup>(4)</sup>
Sodium	3,440	53,400	02SW04B	7/16	4450 - 4450	53,400	NA	No	NUT
Zinc	11.8	27	02SW04B, 02SW11	6/16	5 - 25	27	11,000	No	BSL

**Footnotes**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The statistical analysis presented in the Remedial Investigation Report of Site 2 - Antenna Field Area, April, 2008 was used to determine whether site concentrations were above background concentrations.
- 5 - The Regional Screening Level for tap water screening level is presented. Value represents the risk based tap water screening level multiplied by a factor of 10 for anticipated reduced exposure to surface water. Before the factor is applied, the risk based tap water screening level is divided by 10 to correspond to a target hazard quotient of 0.1 for noncarcinogens (denoted with a "N" flag), or an incremental cancer risk of 1.0E-6 for carcinogens (denoted with a "C" flag) (ORNL, April 2009).
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be above site background. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
K = Value estimated with a high bias  
MCL = Maximum Contaminant Level  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BKG = Below Background  
BSL = Below Screening Level  
NUT = Essential Nutrient

TABLE 7  
 OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT  
 SITE 2 - ANTENNA FIELD LANDFILL  
 NAS JRB WILLOW GROVE, PENNSYLVANIA  
 PAGE 1 OF 2

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondelects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional RSL (Residential) <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
<b>Volatile Organic Compounds (µg/kg)</b>									
Toluene	13	13	02SD13	1/17	5 - 20	13	5,000,000	No	BSL
<b>Semivolatile Organic Compounds (µg/kg)</b>									
2,4-Dinitrotoluene	1,100	1,100	02SD02	1/17	380 - 4500	1,100	1,600	No	BSL
2,6-Dinitrotoluene	79 J	79 J	02SD02	1/17	380 - 4500	79	61,000	No	BSL
2-Methylnaphthalene	170 J	170 J	02SD04-D	1/17	380 - 4500	170	310,000	No	BSL
Acenaphthene	41 J	2,300 J	02SD04	4/17	390 - 4500	2,300	3,400,000	No	BSL
Acenaphthylene	170 J	170 J	02SD07	1/17	380 - 4500	170	3,400,000	No	BSL
Anthracene	45 J	6,100 J	02SD04	11/17	430 - 820	6,100	17,000,000	No	BSL
<b>Benzo(a)anthracene</b>	180 J	12,000 J	02SD04	13/17	430 - 820	12,000	<b>1,500</b>	<b>Yes</b>	ASL
<b>Benzo(a)pyrene</b>	160 J	12,000 J	02SD04	13/17	430 - 820	12,000	<b>150</b>	<b>Yes</b>	ASL
<b>Benzo(b)fluoranthene</b>	140 J	15,000 J	02SD04	13/17	430 - 820	15,000	<b>1,500</b>	<b>Yes</b>	ASL
Benzo(g,h,i)perylene	75 J	4,900	02SD15	12/17	430 - 2500	4,900	1,700,000	No	BSL
Benzo(k)fluoranthene	190 J	9,500 J	02SD04	11/17	430 - 820	9,500	15,000	No	BSL
Bis(2-ethylhexyl)phthalate	66 J	2,600 J	02SD04	6/17	390 - 4500	2,600	350,000	No	BSL
Butyl Benzyl Phthalate	53 J	69 J	02SD14	2/17	380 - 4500	69	2,600,000	No	BSL
Carbazole	170 J	1,800 J	02SD15	2/6	550 - 660	1,800	NA	No	NTX
Chrysene	86 J	14,000 J	02SD04	14/17	430 - 820	14,000	150,000	No	BSL
<b>Dibenzo(a,h)anthracene</b>	56 J	2,000 J	02SD15	8/17	390 - 820	2,000	<b>150</b>	<b>Yes</b>	ASL
Dibenzofuran	44 J	1,600 J	02SD04	4/17	390 - 4500	1,600	NA	No	NTX
Fluoranthene	140 J	28,000 J	02SD04	14/17	430 - 820	28,000	2,300,000	No	BSL
Fluorene	49 J	3,600 J	02SD04	7/17	390 - 4500	3,600	2,300,000	No	BSL
<b>Indeno(1,2,3-cd)pyrene</b>	87 J	6,300 J	02SD04	12/17	430 - 820	6,300	<b>1,500</b>	<b>Yes</b>	ASL
n-Nitrosodiphenylamine	620	620	02SD02	1/17	380 - 4500	620	990,000	No	BSL
Naphthalene	250 J	250 J	02SD04-D	1/17	380 - 4500	250	3,900	No	BSL
Phenanthrene	220 J	27,000 J	02SD04	13/17	430 - 820	27,000	1,700,000	No	BSL
Pyrene	130 J	24,000 J	02SD04	14/17	430 - 820	24,000	1,700,000	No	BSL
<b>Pesticides (µg/kg)</b>									
Aldrin	19	19	02SD01	1/17	2.2 - 60	19	290	No	BSL
alpha-Chlordane	7 J	7 J	02SD15	1/17	2.2 - 600	7	16,000	No	BSL
<b>Dieldrin</b>	40 J	2,400	02SP02S	7/17	4.5 - 120	2,400	<b>300</b>	<b>Yes</b>	ASL
Endosulfan I	12	12	02SD01	1/17	2.2 - 60	12	370,000	No	BSL
gamma-Chlordane	11	11	02SD15	1/17	2.2 - 600	11	16,000	No	BSL
<b>Inorganics (mg/kg)</b>									
Aluminum	4,330	19,400	02SD13	17/17	---	19,400	77,000	No	BSL
Antimony	6.9	18.9	02SD15	4/17	5.1 - 13.6	18.9	31	No	BSL, BKG <sup>(4)</sup>
<b>Arsenic</b>	1.7 J	7.3	02SD14	17/17	---	7.3	<b>3.9</b>	<b>Yes</b>	ASL
Barium	55.2	704 K	02SD04	17/17	---	704	15,000	No	BSL
Beryllium	0.63	10.5 K	02SD04-D	7/17	0.59 - 1.2	10.5	160	No	BSL
Cadmium	1.6 L	2.3 L	02SD09	3/17	0.79 - 2.4	2.3	70	No	BSL, BKG <sup>(4)</sup>
Calcium	749	49,500	02SD04-D	17/17	---	49,500	NA	NA	NUT, BKG <sup>(4)</sup>
Chromium	10	145	02SD04-D	16/17	10.9 - 10.9	145	230	No	BSL
<b>Cobalt</b>	3.6	98.1	02SD04-D	17/17	---	98.1	<b>23</b>	<b>Yes</b>	ASL

**TABLE 7**  
**OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - DIRECT CONTACT WITH SEDIMENT**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Minimum Concentration <sup>(1)</sup>	Maximum Concentration <sup>(1)</sup>	Sample with Maximum Concentration	Frequency of Detection	Range of Nondects <sup>(2)</sup>	Concentration Used for Screening <sup>(3)</sup>	ORNL Regional RSL (Residential) <sup>(5)</sup>	COPC Flag	Rationale for Contaminant Deletion or Selection <sup>(6)</sup>
Copper	9.5 K	980 K	02SD04-D	14/17	6.9 - 8.5	980	3,100	No	BSL
Cyanide	3	3	02SD14	1/6	0.63 - 0.98	3	1,600	No	BSL, BKG <sup>(4)</sup>
<b>Iron</b>	7,670 J	75,600 J	02SD09	17/17	---	75,600	<b>55,000</b>	<b>Yes</b>	ASL
<b>Lead</b>	6.6 J	687 J	02SD04-D	17/17	---	687	<b>400</b>	<b>Yes</b>	ASL
Magnesium	618	27,400	02SD04-D	17/17	---	27,400	NA	NA	NUT, BKG <sup>(4)</sup>
<b>Manganese</b>	136 J	3,580	02SD15	17/17	---	3,580	<b>1,800</b>	<b>Yes</b>	ASL
Nickel	5.7 K	379 J	02SD04-D	16/17	15.9 - 15.9	379	1,500	No	BSL
Potassium	650	1,260	02SD04	10/17	423 - 1190	1,260	NA	NA	NUT, BKG <sup>(4)</sup>
Selenium	2.1 K	2.1 K	02SD04-D	1/17	0.25 - 10	2.1	390	No	BSL, BKG <sup>(4)</sup>
Sodium	141	1,890 K	02SD04	4/17	132 - 1350	1,890	NA	NA	NUT, BKG <sup>(4)</sup>
Thallium	0.36	0.36	02SP04S	1/17	0.25 - 0.65	0.36	5.1	No	BSL, BKG <sup>(4)</sup>
Vanadium	11.8	38.6	02SD13	17/17	---	38.6	390	No	BSL, BKG <sup>(4)</sup>
Zinc	36.2	4,390 J	02SD04-D	17/17	---	4,390	23,000	No	BSL

**Footnotes:**

- 1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
- 2 - Values presented are sample-specific quantitation limits.
- 3 - The maximum detected concentration is used for screening purposes.
- 4 - The statistical analysis presented in the Remedial Investigation Report of Site 2 - Antenna Field Area, April, 2008 was used to determine whether site concentrations were above background concentrations.
- 5 - The USEPA Regional Screening level for residential exposures to soil is presented. Value represents the risk based soil screening level multiplied by a factor of 10 for anticipated reduced exposure to surface water. Before the factor is applied, the risk based soil screening level is divided by 10 to correspond to a target hazard quotient of 0.1 for noncarcinogens (denoted with a "N" flag), or an incremental cancer risk of 1.0E-6 for carcinogens (denoted with a "C" flag) (ORNL, April 2009).
- 6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level and is statistically determined to be above site background. Chemicals selected as COPCs are indicated by shaded chemical names.

**Definitions:**

COPC = Chemical Of Potential Concern  
J = Estimated value  
K = Value estimated with a high bias  
L = Value estimated with a low bias  
NA = Not Applicable/Not Available

**Rationale Codes:**

ASL = Above Screening Level and site background  
BKG = Below Background  
BSL = Below Screening Level  
NUT = Essential Nutrient  
NTX = No Toxicity Data

**TABLE 8**  
**SUMMARY OF CANCER RISKS AND HAZARD INDICES**  
**REASONABLE MAXIMUM EXPOSURES**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-5</sup> and ≤ 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-6</sup> and ≤ 10 <sup>-5</sup>	Hazard Index	Chemicals Contributing to an HI > 1	
Occupational Worker	Surface Soil	Incidental Ingestion	4E-06	--	--	Dieldrin	0.3	--	
		Dermal Contact	3E-06	--	--	Dieldrin	0.3	--	
		Total	6E-06	--	--	Dieldrin	0.6	--	
Child Residents	Surface Soil	Incidental Ingestion	3E-05	--	--	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Dieldrin	5	Cobalt	
		Dermal Contact	9E-06	--	--	Benzo(a)pyrene, Dieldrin	1	--	
		Total	4E-05	--	Benzo(a)pyrene	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Dieldrin	6	Chromium, Cobalt, Iron	
	Groundwater	Ingestion	8E-06	--	--	Arsenic	1.0	--	
		Dermal Contact	8E-07	--	--	--	0.2	--	
		Total	8E-06	--	--	Arsenic, Bis(2-ethylhexyl)phthalate	1	--	
	Surface Water	Incidental Ingestion	9E-07	--	--	--	0.3	--	
		Dermal Contact	1E-06	--	--	--	0.4	--	
		Total	2E-06	--	--	Dieldrin	0.6	--	
	Sediment	Incidental Ingestion	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Dieldrin	0.2	--	
		Dermal Contact	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene	0.09	--	
		Total	7E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Dieldrin	0.3	--	
			Total All Media	1E-04				8	Aluminum, Chromium, Cobalt, Iron, Manganese <sup>(1)</sup>
	Adult Residents	Surface Soil	Incidental Ingestion	6E-06	--	--	Benzo(a)pyrene, Dieldrin	0.5	--
			Dermal Contact	3E-06	--	--	--	0.2	--
Total			9E-06	--	--	Benzo(a)pyrene, Dieldrin	0.7	--	
Groundwater		Ingestion	1E-05	--	--	Arsenic	0.4	--	
		Dermal Contact	1E-06	--	--	--	0.09	--	
		Inhalation	9E-08	--	--	--	0.01	--	
		Total	1E-05	--	--	Bis(2-ethylhexyl)phthalate, Arsenic	0.5	--	
Surface Water		Incidental Ingestion	2E-07	--	--	--	0.01	--	
		Dermal Contact	3E-06	--	--	Dieldrin	0.2	--	
		Total	3E-06	--	--	Dieldrin	0.2	--	
Sediment		Incidental Ingestion	6E-06	--	--	Benzo(a)pyrene	0.03	--	
		Dermal Contact	6E-06	--	--	Benzo(a)pyrene	0.01	--	
		Total	1E-05	--	--	Benzo(a)pyrene, Dieldrin	0.04	--	
		Total All Media	4E-05				1	--	

**TABLE 8**  
**SUMMARY OF CANCER RISKS AND HAZARD INDICES**  
**REASONABLE MAXIMUM EXPOSURES**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-5</sup> and ≤ 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-6</sup> and ≤ 10 <sup>-5</sup>	Hazard Index	Chemicals Contributing to an HI > 1	
Lifelong Residents (Child and Adult)	Surface Soil	Incidental Ingestion	3E-05	--	Arsenic	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Dieldrin	NA	--	
		Dermal Contact	1E-05	--	--	Benzo(a)pyrene, Dieldrin	NA	--	
		Total	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Dieldrin	NA	--	
	Groundwater	Ingestion	2E-05	--	Arsenic	Bis(2-ethylhexyl)phthalate	NA	--	
		Dermal Contact	2E-06	--	--	Bis(2-ethylhexyl)phthalate	NA	--	
		Inhalation	9E-08	--	--	--	NA	--	
		Total	2E-05	--	Arsenic	Bis(2-ethylhexyl)phthalate	NA	--	
	Surface Water	Incidental Ingestion	1E-06	--	--	--	NA	--	
		Dermal Contact	4E-06	--	--	Dieldrin	NA	--	
		Total	5E-06	--	--	Dieldrin	NA	--	
	Sediment	Incidental Ingestion	4E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Dieldrin	NA	--	
		Dermal Contact	3E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Dieldrin	NA	--	
		Total	8E-05	--	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Dieldrin	NA	--	
			<b>Total All Media</b>	<b>1E-04</b>				<b>NA</b>	<b>--</b>

Note:  
1 - No target organs are greater than one when sample 02SS05 and non-site related COPCs are excluded from the evaluation.

**TABLE 9  
SUMMARY OF CANCER RISKS AND HAZARD INDICES  
CENTRAL TENDENCY EXPOSURES  
SITE 2 - ANTENNA FIELD LANDFILL  
NAS JRB WILLOW GROVE, PENNSYLVANIA**

PAGE 1 OF 2

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-5</sup> and ≤ 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-6</sup> and ≤ 10 <sup>-5</sup>	Hazard Index	Chemicals Contributing to an HI > 1
Occupational Worker	Surface Soil	Incidental Ingestion	6E-07	--	--	--	0.2	--
		Dermal Contact	8E-08	--	--	--	0.02	--
		Total	7E-07	--	--	--	0.2	--
Child Residents	Surface Soil	Incidental Ingestion	1E-06	--	--	--	2	None, no target organ HI > 1
		Dermal Contact	2E-07	--	--	--	0.2	--
		Total	1E-06	--	--	--	2	None, no target organ HI > 1
	Groundwater	Ingestion	2E-06	--	--	Arsenic	0.7	--
		Dermal Contact	1E-07	--	--	--	0.09	--
		Total	2E-06	--	--	Arsenic	0.8	--
	Surface Water	Incidental Ingestion	8E-08	--	--	--	0.06	--
		Dermal Contact	2E-07	--	--	--	0.09	--
		Total	2E-07	--	--	--	0.2	--
	Sediment	Incidental Ingestion	8E-07	--	--	--	0.06	--
		Dermal Contact	2E-07	--	--	--	0.009	--
		Total	1E-06	--	--	--	0.07	--
		<b>Total All Media</b>	<b>5E-06</b>				<b>3</b>	<b>None, no target organ HI &gt; 1</b>
Adult Residents	Surface Soil	Incidental Ingestion	5E-07	--	--	--	0.2	--
		Dermal Contact	6E-08	--	--	--	0.02	--
		Total	6E-07	--	--	--	0.2	--
	Groundwater	Ingestion	2E-06	--	--	Arsenic	0.2	--
		Dermal Contact	2E-07	--	--	--	0.03	--
		Inhalation	2E-09	--	--	--	0.003	--
		Total	2E-06	--	--	Arsenic	0.2	--
	Surface Water	Incidental Ingestion	1E-08	--	--	--	0.003	--
		Dermal Contact	3E-07	--	--	--	0.04	--
		Total	3E-07	--	--	--	0.04	--
	Sediment	Incidental Ingestion	3E-07	--	--	--	0.006	--
		Dermal Contact	7E-08	--	--	--	0.0009	--
Total		4E-07	--	--	--	0.007	--	
		<b>Total All Media</b>	<b>3E-06</b>				<b>0.5</b>	

**TABLE 9  
SUMMARY OF CANCER RISKS AND HAZARD INDICES  
CENTRAL TENDENCY EXPOSURES  
SITE 2 - ANTENNA FIELD LANDFILL  
NAS JRB WILLOW GROVE, PENNSYLVANIA**

PAGE 2 OF 2

Receptor	Medium	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-5</sup> and ≤ 10 <sup>-4</sup>	Chemicals with Cancer Risks > 10 <sup>-6</sup> and ≤ 10 <sup>-5</sup>	Hazard Index	Chemicals Contributing to an HI > 1	
Lifelong Residents (Child and Adult)	Surface Soil	Incidental Ingestion	2E-06	--	--	--	NA	--	
		Dermal Contact	2E-07	--	--	--	NA	--	
		Total	2E-06	--	--	--	NA	--	
	Groundwater	Ingestion	4E-06	--	--	Arsenic	NA	--	
		Dermal Contact	3E-07	--	--	--	NA	--	
		Inhalation	2E-09	--	--	--	NA	--	
		Total	4E-06	--	--	Arsenic	NA	--	
	Surface Water	Incidental Ingestion	9E-08	--	--	--	NA	--	
		Dermal Contact	4E-07	--	--	--	NA	--	
		Total	5E-07	--	--	--	NA	--	
	Sediment	Incidental Ingestion	1E-06	--	--	--	NA	--	
		Dermal Contact	3E-07	--	--	--	NA	--	
		Total	1E-06	--	--	--	NA	--	
			Total All Media	8E-06				NA	

**TABLE 10**  
**SURFACE SOIL ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Chemical	Frequency of Detection	Range of Detected Concentrations <sup>(1)</sup>		Location of Maximum Concentration	Range of Non-Detects <sup>(2)</sup>	Ecological Screening Value <sup>(3)</sup>	Hazard Quotient <sup>(4)</sup>	COPC (Yes/No)	Rationale for COPC Selection <sup>(5)</sup>
		Minimum	Maximum						
<b>SEMIVOLATILES (µg/kg)</b>									
ACENAPHTHENE	2/18	43	86	02SS18	390 - 4200	100	0.9	Yes	BIO
ANTHRACENE	6/18	35	2200	02SS13	400 - 800	100	22.0	Yes	ASV, BIO
BENZ(A)ANTHRACENE	15/18	35	8800	02SS13	410 - 450	100	88	Yes	ASV, BIO
BENZO(A)PYRENE	15/18	48	8,200	02SS13	410 - 450	100	82.0	Yes	ASV, BIO
BENZO(B)FLUORANTHENE	13/18	88	11000	02SS13	410 - 450	100	110	Yes	ASV, BIO
BENZO(G,H,I)PERYLENE	12/18	57	4,600	02SS13	410 - 820	100	46.0	Yes	ASV, BIO
BENZO(K)FLUORANTHENE	11/18	99	5,200	02SS13	410 - 820	100	52.0	Yes	ASV, BIO
BIS(2-ETHYLHEXYL)PHTHALATE	1/18	430	430	02SS03	390 - 4200	NA	NA	Yes	NSV
CARBAZOLE	3/18	95	180	02SS15	390 - 4200	NA	NA	Yes	NSV
CHRYSENE	16/18	60	9,400	02SS13	410 - 420	100	94.0	Yes	ASV, BIO
DI-N-BUTYLPHTHALATE	1/18	300	300	02SS18	390 - 4200	NA	NA	Yes	NSV
DIBENZ(A,H)ANTHRACENE	5/18	57	760	02SS13	390 - 820	100	7.6	Yes	ASV, BIO
DIBENZOFURAN	2/18	52	53	02SS15	390 - 4200	NA	NA	Yes	NSV
FLUORANTHENE	17/18	98.5	16,000	02SS13	420 - 450	100	160.0	Yes	ASV, BIO
FLUORENE	1/18	48	48	02SS09	390 - 4200	100	0.5	Yes	BIO
INDENO(1,2,3-CD)PYRENE	12/18	64	4900	02SS13	410 - 450	100	49.0	Yes	ASV, BIO
PHENANTHRENE	16/18	54	6700	02SS13	410 - 420	100	67.0	Yes	ASV, BIO
PYRENE	17/18	86.5	14000	02SS13	420 - 420	100	140	Yes	ASV, BIO
TOTAL PAHs	17/18	320	91,760	02SS13	-	NA	NA	Yes	NSV, BIO
<b>PESTICIDES (µg/kg)</b>									
BETA-BHC	1/18	2.6	2.6	02SS15	2 - 2.5	100000	0.00003	Yes	BIO
DIELDRIN	8/18	8.6	570	02SS03	4.1 - 4.8	100	5.7	Yes	ASV, BIO
<b>DIOXINS/FURANS (ng/kg)</b>									
TCDD TEQ <sup>(6)</sup>	2/2	2.76463	3.76585	02SS11	-	10000	0.0004	Yes	BIO

**TABLE 10**  
**SURFACE SOIL ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Frequency of Detection	Range of Detected Concentrations <sup>(1)</sup>		Location of Maximum Concentration	Range of Non-Detects <sup>(2)</sup>	Ecological Screening Value <sup>(3)</sup>	Hazard Quotient <sup>(4)</sup>	COPC (Yes/No)	Rationale for COPC Selection <sup>(5)</sup>
		Minimum	Maximum						
<b>INORGANICS (mg/kg)</b>									
ALUMINUM	18/18	8,890	41,900	02SS05	-	1	41900	Yes	ASV
ANTIMONY	4/18	3.8	5.8	02SS12	4.7 - 5.8	0.27	21.5	Yes	ASV
ARSENIC	18/18	3.8	12.6	02SS03	-	18	0.7	Yes	BIO
BARIUM	18/18	63.7	330	02SS05	-	330	1.00	No	BSV
BERYLLIUM	18/18	0.76	2.3	02SS05	-	21	0.1	No	BSV
CALCIUM	18/18	341	8540	02SS08	-	NA	NA	No	Nutrient
CHROMIUM	18/18	11.9	179	02SS05	-	26	6.9	Yes	ASV, BIO
COBALT	18/18	6.3	67.5	02SS05	-	13	5.2	Yes	ASV
COPPER	18/18	9.8	87	02SS05	-	28	3.1	Yes	ASV, BIO
IRON	18/18	12600	63200	02SS05	-	12	5267	Yes	ASV
LEAD	18/18	9.3	81.1	02SS18	-	11	7.4	Yes	ASV, BIO
MAGNESIUM	18/18	1100	5,620	02SS12	-	4400	1.3	No	Nutrient
MANGANESE	18/18	247	1,180	02SS05	-	220	5.4	Yes	ASV
NICKEL	18/18	9.1	71.2	02SS05	-	38	1.9	Yes	ASV, BIO
POTASSIUM	16/18	409	1,690.0	02SS04	369 - 413	NA	NA	No	Nutrient
SODIUM	8/18	116	160	02SS08	94.1 - 116	NA	NA	No	Nutrient
THALLIUM	1/18	0.27	0.27	02SS04	0.24 - 0.29	0.001	270	Yes	ASV
VANADIUM	18/18	20.1	160	02SS05	-	7.8	20.5	Yes	ASV
ZINC	18/18	23.45	96.2	02SS02	-	10	9.6	Yes	ASV, BIO

1 The average of the sample and duplicate was used when determining the minimum and maximum concentrations and the frequency of detection.

2 Values presented are sample-specific quantitation limits.

3 Ecological screening values from EPA (1995 and 2005); see Section 7.2.1.

4 Hazard quotient = maximum detected concentration ÷ ecological screening value

5 Rationale codes: ASV=maximum concentration is greater than screening value

BIO=bioaccumulative chemical

BSV=maximum concentration is equal to or less than ecological screening value

NSV=ecological screening value not available

Nutrient=essential nutrient

6 TCDD toxic equivalents; detected concentrations were calculated by assigning a value of one-half the detection limit for non-detected congeners.

**TABLE 11**  
**SEDIMENT ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 2**

Chemical	Frequency of Detection	Range of Detected Concentrations <sup>(1)</sup>		Location of Maximum Concentration	Range of Non-Detects <sup>(2)</sup>	Ecological Screening Value <sup>(3)</sup>	Hazard Quotient <sup>(4)</sup>	COPC (Yes/No)	Rationale for COPC Selection <sup>(5)</sup>
		Minimum	Maximum						
<b>VOLATILES (µg/kg)</b>									
TOLUENE	1/19	13	13	02SD13	5 - 20	NA	NA	Yes	NSV
<b>SEMIVOLATILES (µg/kg)</b>									
2,4-DINITROTOLUENE	1/19	1100	1100	02SD02	360 - 4500	41.6	26.4	Yes	ASV
2,6-DINITROTOLUENE	1/19	79	79	02SD02	360 - 4500	NA	NA	Yes	NSV
2-METHYLNAPHTHALENE	1/19	170	170	02SD04	360 - 4500	20.2	8.4	Yes	ASV
ACENAPHTHENE	5/19	38	1555	02SD04	360 - 4500	6.7	232.1	Yes	ASV, BIO
ACENAPHTHYLENE	1/19	170	170	02SD07	360 - 4500	5.9	28.8	Yes	ASV, BIO
ANTHRACENE	13/19	56	4200	02SD04	430 - 820	57.2	73.4	Yes	ASV, BIO
BENZ(A)ANTHRACENE	15/19	180	9050	02SD04	430 - 820	108	83.8	Yes	ASV, BIO
BENZO(A)PYRENE	15/19	160	9300	02SD04	430 - 820	150	62.0	Yes	ASV, BIO
BENZO(B)FLUORANTHENE	15/19	140	11450	02SD04	430 - 820	NA	NA	Yes	NSV, BIO
BENZO(G,H,I)PERYLENE	14/19	75	4900	02SD15	430 - 820	170	28.8	Yes	ASV, BIO
BENZO(K)FLUORANTHENE	13/19	190	7950	02SD04	430 - 820	240	33.1	Yes	ASV, BIO
BIS(2-ETHYLHEXYL)PHTHALATE	8/19	37	1515	02SD04	390 - 4500	180	8.4	Yes	ASV
BUTYLBENZYLPHTHALATE	2/19	53	69	02SD14	360 - 4500	10,900	0.006	No	BSV
CARBAZOLE	2/6	170	1800	02SD15	560 - 560	NA	NA	Yes	NSV
CHRYSENE	16/19	86	11000	02SD15	430 - 820	166	66.3	Yes	ASV, BIO
DIBENZ(A,H)ANTHRACENE	10/19	43	2000	02SD15	390 - 820	33	60.6	Yes	ASV, BIO
DIBENZOFURAN	4/19	44	1180	02SD04	360 - 4500	415	2.8	Yes	ASV
FLUORANTHENE	16/19	140	24000	02SD15	430 - 820	423	56.7	Yes	ASV, BIO
FLUORENE	8/19	49	2550	02SD04	360 - 4500	77.4	32.9	Yes	ASV, BIO
INDENO(1,2,3-CD)PYRENE	14/19	87	5100	02SD15	430 - 820	17	300	Yes	ASV, BIO
N-NITROSODIPHENYLAMINE	1/19	620	620	02SD02	360 - 4500	2680	0.2	No	BSV
NAPHTHALENE	1/19	250	250	02SD04	360 - 4500	176	1.4	Yes	ASV
PHENANTHRENE	15/19	220	20000	02SD04	430 - 820	204	98.0	Yes	ASV, BIO
PYRENE	16/19	130	18000	02SD04	430 - 820	195	92.3	Yes	ASV, BIO
TOTAL PAHs	16/19	356	125170	02SD04	-	1610	77.7	Yes	ASV
<b>PESTICIDES (µg/kg)</b>									
ALDRIN	1/19	19	19	02SD01	2.2 - 54.5	2	9.5	Yes	ASV, BIO
ALPHA-CHLORDANE	1/19	7	7	02SD15	2.2 - 545	3.24	2.2	Yes	ASV, BIO
GAMMA-CHLORDANE	1/19	11	11	02SD15	2.2 - 545	3.24	3.4	Yes	ASV, BIO
DIELDRIN	9/19	40	2400	02SP02S	4.5 - 109	1.9	1263.2	Yes	ASV, BIO
ENDOSULFAN I	1/19	12	12	02SD01	2.2 - 54.5	2.14	5.6	Yes	ASV, BIO

**TABLE 11**  
**SEDIMENT ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 2 OF 2**

Chemical	Frequency of Detection	Range of Detected Concentrations <sup>(1)</sup>		Location of Maximum Concentration	Range of Non-Detects <sup>(2)</sup>	Ecological Screening Value <sup>(3)</sup>	Hazard Quotient <sup>(4)</sup>	COPC (Yes/No)	Rationale for COPC Selection <sup>(5)</sup>
		Minimum	Maximum						
<b>INORGANICS (mg/kg)</b>									
ALUMINUM	19/19	4,330	19400	02SD13	-	25,500 <sup>(6)</sup>	0.8	No	BSV
ANTIMONY	4/19	7	18.9	02SD15	5.1 - 13.6	2	9.5	Yes	ASV
ARSENIC	19/19	2	7.3	02SD14	-	9.8	0.7	Yes	BIO
BARIUM	19/19	55	479.5	02SD04	-	NA	NA	Yes	NSV
BERYLLIUM	7/7	1	9.1	02SD04	-	NA	NA	Yes	NSV
CADMIUM	3/18	1.6	2.3	02SD09	0.71 - 2	0.99	2.3	Yes	ASV, BIO
CALCIUM	19/19	749	35900	02SD04	-	NA	NA	No	Nutrient
CHROMIUM	18/18	10	121.9	02SD04	-	43.4	2.8	Yes	ASV, BIO
COBALT	19/19	3.6	78.4	02SD04	-	50	1.6	Yes	ASV
COPPER	16/16	9.5	902.5	02SD04	-	31.6	28.6	Yes	ASV, BIO
CYANIDE	1/6	3	3	02SD14	0.63 - 0.98	0.1	30	Yes	ASV
IRON	19/19	7670	75600	02SD09	-	20,000	3.8	Yes	ASV
LEAD	19/19	6.6	496.5	02SD04	-	35.8	13.9	Yes	ASV, BIO
MAGNESIUM	19/19	618	19200	02SD04	-	NA	NA	No	Nutrient
MANGANESE	19/19	125	3580	02SD15	-	460	7.8	Yes	ASV
MERCURY	1/19	0.12	0.12	02SD06	0.09 - 0.2	0.18	0.7	Yes	BIO
NICKEL	18/18	5.7	326.5	02SD04	-	22.7	14.4	Yes	ASV, BIO
POTASSIUM	12/19	650	1030	02SD09	423 - 647	NA	NA	No	Nutrient
SELENIUM	1/19	1.2825	1.2825	02SD04	0.25 - 5.48	2	0.6	Yes	BIO
SODIUM	4/19	141	1885	02SD04	132 - 1350	NA	NA	No	Nutrient
THALLIUM	2/19	0.36	0.45	02SD06	0.25 - 0.65	NA	NA	Yes	NSV
VANADIUM	19/19	11.8	38.6	02SD13	-	NA	NA	Yes	NSV
ZINC	19/19	36.2	3890	02SD04	-	121	32.1	Yes	ASV, BIO

1 The average of the sample and duplicate was used when determining the minimum and maximum concentrations and the frequency of detection.

2 Values presented are sample-specific quantitation limits.

3 Ecological screening values are EPA Region III BTAG screening levels (EPA, 2006a), except where noted.

4 Hazard quotient = maximum detected concentration ÷ ecological screening value

5 Rationale codes: ASV=maximum concentration is greater than screening value

BIO=bioaccumulative chemical

BSV=maximum concentration is less than ecological screening value

NSV=ecological screening value not available

Nutrient=essential nutrient

6 Region III BTAG screening value not available, screening value shown is lowest available NOAA SQiRT sediment value (Buchman, 1999)

NA: ecological screening value not available

**TABLE 12**  
**SURFACE WATER ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN**  
**SITE 2 - ANTENNA FIELD LANDFILL**  
**NAS JRB WILLOW GROVE, PENNSYLVANIA**  
**PAGE 1 OF 1**

Chemical	Frequency of Detection	Range of Detected Concentrations <sup>(1)</sup>		Location of Maximum Concentration	Range of Non-Detects <sup>(2)</sup>	Ecological Screening Value <sup>(3)</sup>	Hazard Quotient <sup>(4)</sup>	COPC (Yes/No)	Rationale for COPC Selection <sup>(5)</sup>
		Minimum	Maximum						
<b>PESTICIDES (µg/L)</b>									
DIELDRIN	3/17	0.04	0.46	02SP02L	0.1	0.056	8.2	Yes	BIO
<b>SEMIVOLATILES (µg/L)</b>									
BIS(2-ETHYLHEXYL)PHTHALATE	1/15	10	10	02SW04B	10	16	0.6	No	BSV
DI-N-BUTYLPHTHALATE	1/17	30	30	02SW04B	10	19	1.6	Yes	ASV
<b>INORGANICS (µg/L)</b>									
ALUMINUM	6/7	157	1,890	02SP02L	50	87	21.7	Yes	ASV
ARSENIC	2/17	1	2	02SP02L	1	5	0.4	Yes	BIO
BARIIUM	17/17	8	188	02SW07		4	47.0	Yes	ASV
BERYLLIUM	1/7	4	4	02SW04B	1	0.66	6.1	Yes	ASV
CALCIUM	17/17	6,710	52,200	02SP02L		116,000	0.5	No	Nutrient
CHROMIUM	2/17	7	11	02SW12	5	11	1.0 <sup>(6)</sup>	Yes	BIO
COBALT	1/17	5	5	02SP02L	5	23	0.2	No	BSV
IRON	13/13	209	6100	02SP02L		300	20.3	Yes	ASV
LEAD	14/17	1.2	10.5	02SP02L	1	2.5	4.2	Yes	ASV, BIO
MAGNESIUM	17/17	2200	18500	02SP02L		82,000	0.2	No	BSV
MANGANESE	17/17	13.5	4150	02SP04L		120	34.6	Yes	ASV
POTASSIUM	12/17	1660	186000	02SW04B	1500	53,000	3.5	No	Nutrient
SODIUM	8/17	3440	53400	02SW04B	4450	680,000	0.08	No	Nutrient
ZINC	7/8	11.2	27	02SW04B	5	120	0.2	Yes	BIO

1 The average of the sample and duplicate was used when determining the minimum and maximum concentrations and the frequency of detection.

2 Values presented are sample-specific quantitation limits.

3 Ecological screening values are EPA Region III BTAG screening levels (EPA, 2006b).

4 Hazard quotient = maximum detected concentration ÷ ecological screening value

5 Rationale codes: ASV=maximum concentration is greater than screening value

BIO=bioaccumulative chemical

BSV=maximum concentration is less than ecological screening value

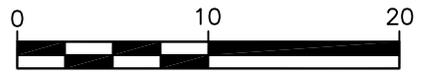
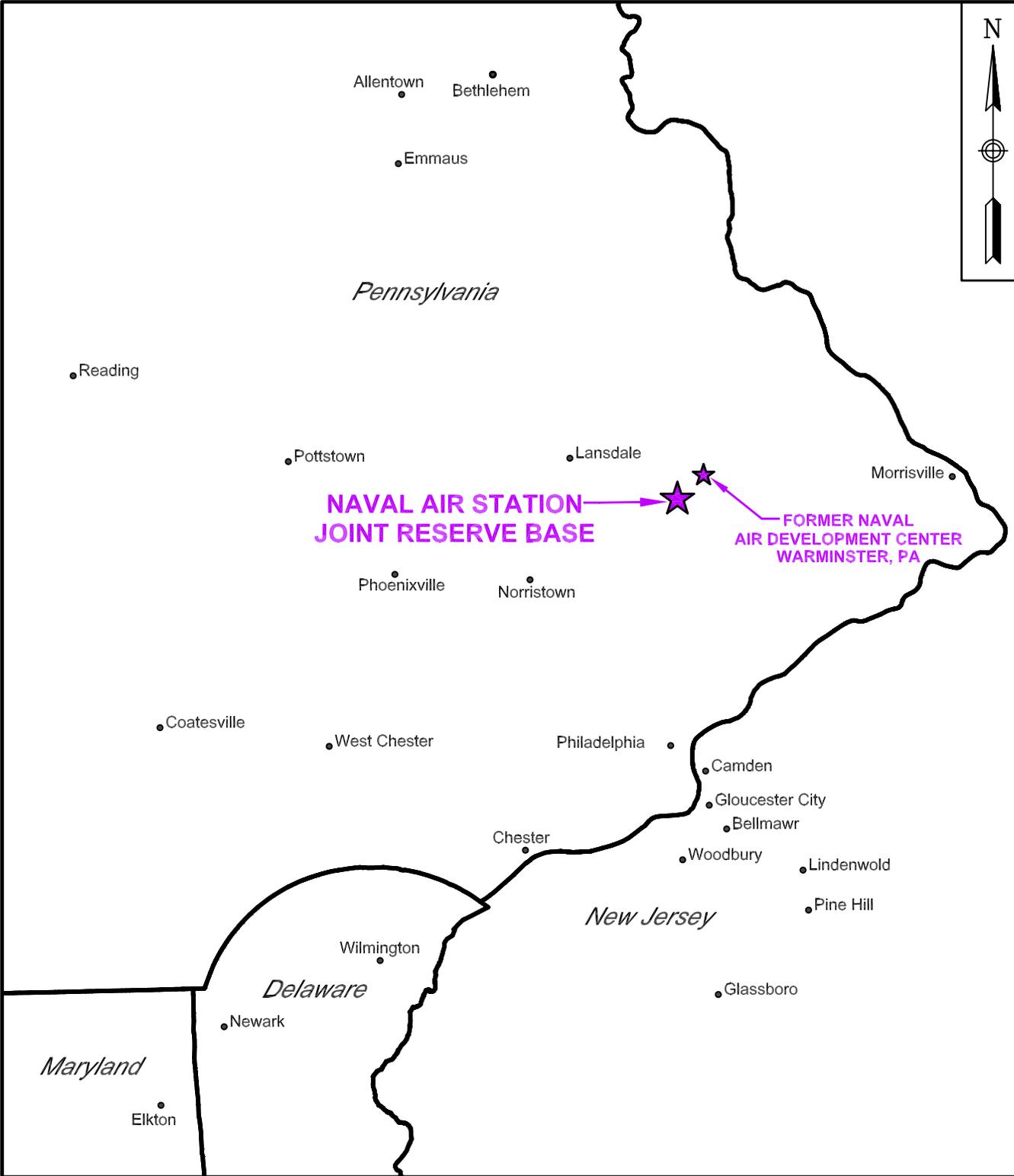
NSV=ecological screening value not available

Nutrient=essential nutrient

6 Screening value for hexavalent chromium.

NA ecological screening value not available

## FIGURES



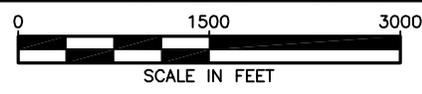
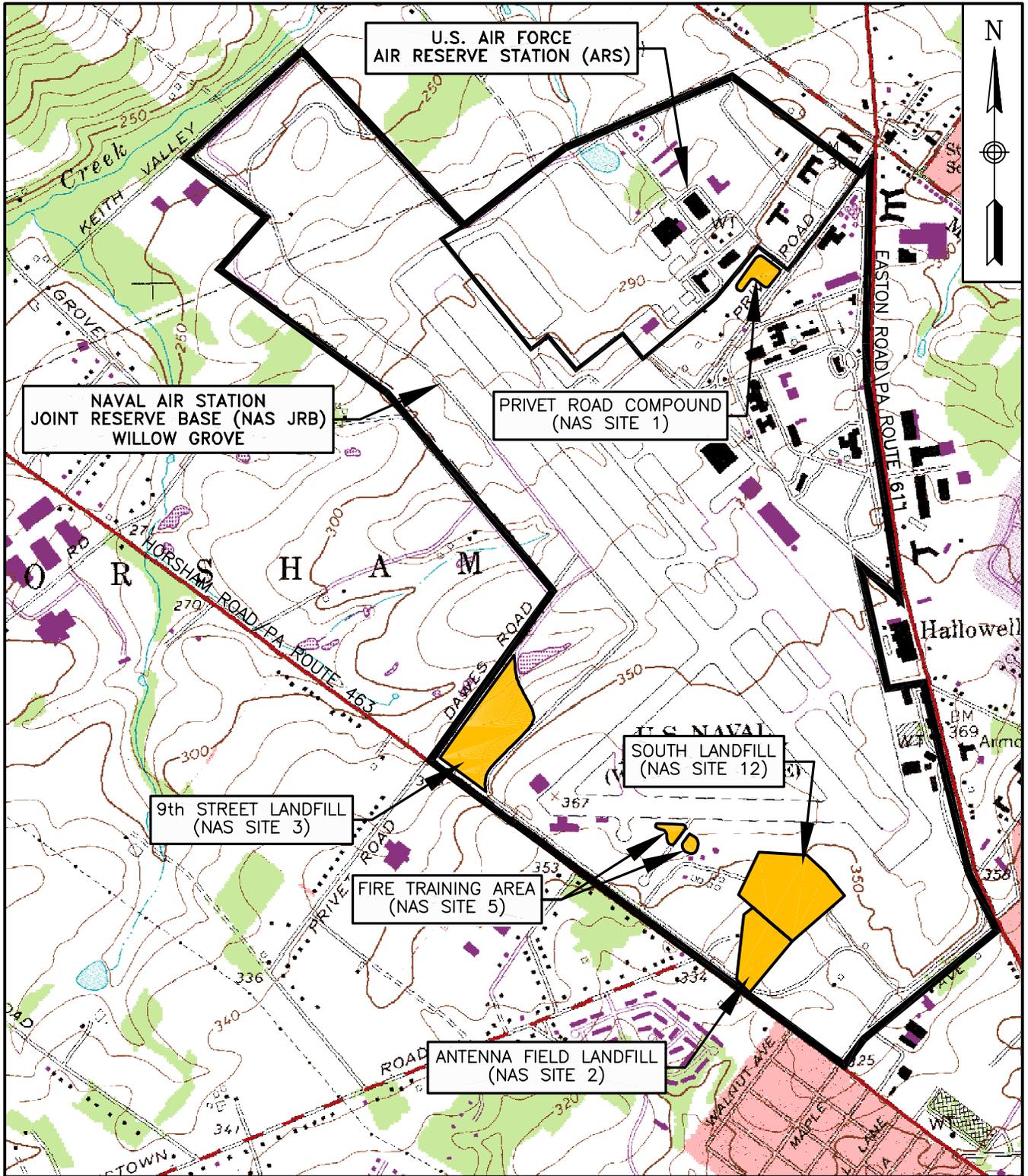
SCALE IN MILES



TETRA TECH NUS, INC.

FACILITY LOCATION  
NAS JRB WILLOW GROVE  
WILLOW GROVE, PENNSYLVANIA

SCALE AS NOTED	
FILE 2192CM03	
REV 0	DATE 07/06/09
FIGURE NUMBER FIGURE 1	



**LEGEND**

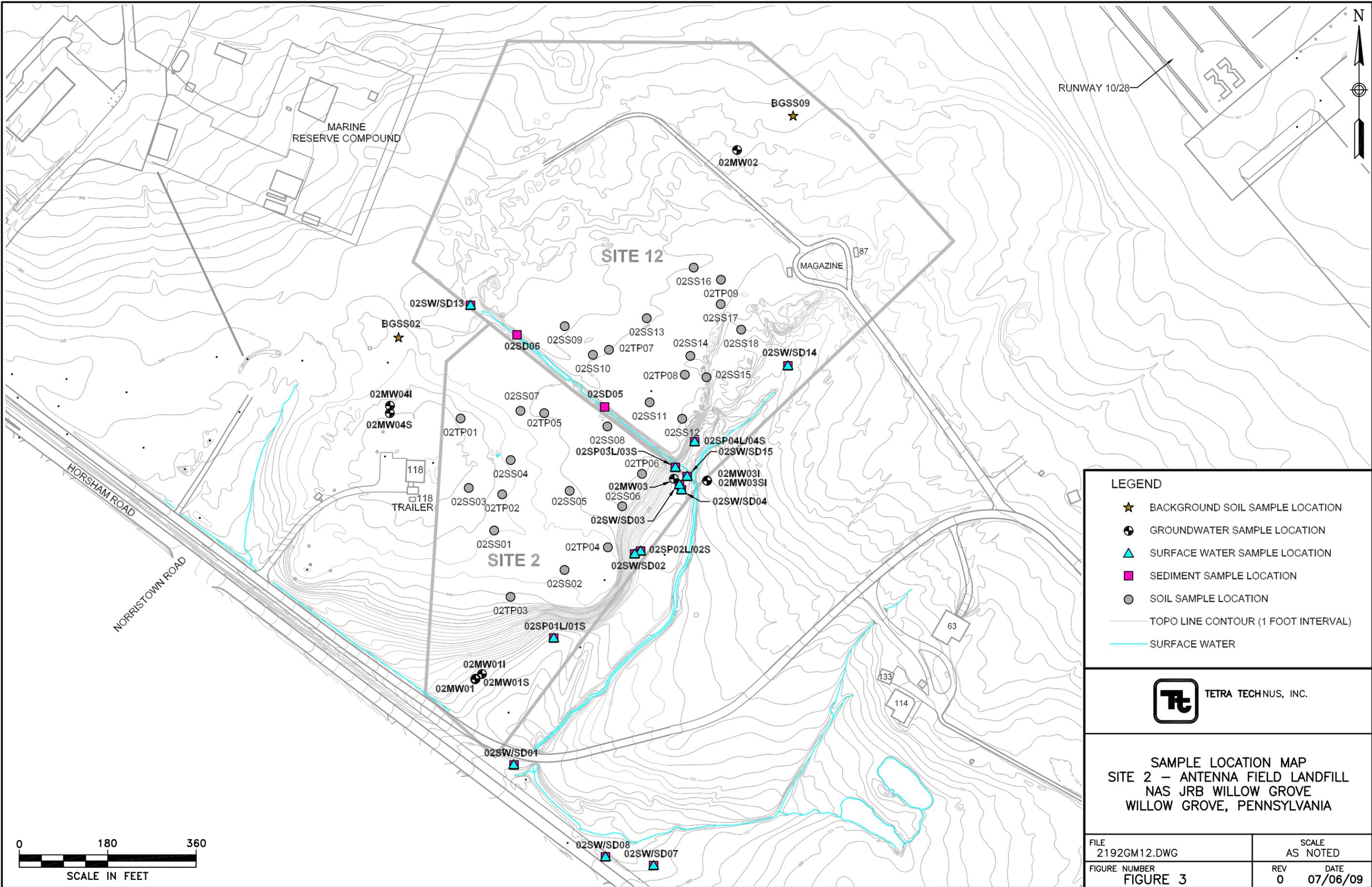
- SITE BOUNDARY
- STATE ROAD

BASE MAP IS A PORTION OF THE AMBLER, PA U.S.G.S. 7.5 MINUTE QUADRANGLE MAP, DATED 1963, PHOTOREVISED IN 1983.



**LOCATION OF IR SITES  
NAS JRB WILLOW GROVE  
WILLOW GROVE, PENNSYLVANIA**

SCALE AS NOTED	
FILE 2192CM04.DWG	
REV 0	DATE 07/22/09
FIGURE NUMBER <b>FIGURE 2</b>	

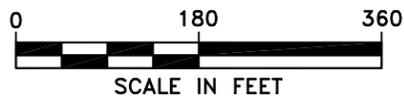


**LEGEND**

- ★ BACKGROUND SOIL SAMPLE LOCATION
- ⊙ GROUNDWATER SAMPLE LOCATION
- ▲ SURFACE WATER SAMPLE LOCATION
- SEDIMENT SAMPLE LOCATION
- SOIL SAMPLE LOCATION
- TOPO LINE CONTOUR (1 FOOT INTERVAL)
- SURFACE WATER



**SAMPLE LOCATION MAP  
SITE 2 – ANTENNA FIELD LANDFILL  
NAS JRB WILLOW GROVE  
WILLOW GROVE, PENNSYLVANIA**



FILE 2192GM12.DWG	SCALE AS NOTED
FIGURE NUMBER FIGURE 3	REV DATE 0 07/06/09

**PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION  
CONCURRENCE LETTER  
SITE 2 (OU 5 AND OU 9) RECORD OF DECISION**



# pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION  
SOUTHEAST REGIONAL OFFICE

May 14, 2010

Mr. Robert Lewandowski  
BRAC Environmental Coordinator  
NASJRB Willow Grove  
BRAC PMO Northeast  
4911 South Broad Street  
Building 679, PNBC  
Philadelphia, PA 19112

Re: Naval Air Station Joint Reserve Base  
Willow Grove  
Horsham Township  
Montgomery County  
Site 2 (OU-5 and OU-9) Record of Decision

Dear Mr. Lewandowski:

The Record of Decision ("ROD") dated February 2010 for Site 2 Antenna Field Landfill Operable Unit-5 soil ("OU-5") and Operable Unit-9 groundwater ("OU-9") at the Naval Air Station Joint Reserve Base Willow Grove ("Site") has been reviewed by the Commonwealth of Pennsylvania's Department of Environmental Protection ("Department").

The Department hereby concurs with the remedy selected for Site 2, OU-5 and OU-9, for the following reasons:

Based on the results of the Remedial Investigation, Human Health Risk Assessment, and Ecological Risk Assessment, there are no unacceptable risks to human health or the environment in excess of background from unrestricted exposure to site media at Site 2. The no action determination meets the statutory requirements of Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") and the regulatory requirements of the National Contingency Plan for protection of human health and the environment. All sample results for soil and groundwater meet Act 2 residential use standards for soil and groundwater. No remedial response action and no restrictions on land use or exposure are necessary at Site 2.

The Department hereby concurs with the remedy selected for the Site with the following conditions:

Pennsylvania's Land Recycling and Environmental Remediation Standards Act, Act 2 of 1995, 35 P.S. Sections 6026.101-6029.909 ("Act 2"), Pennsylvania's Solid Waste Management Act, Act 97 of 1980, as amended, 35 P.S. Sections 6018.101 et seq. ("Act 97"), and the regulations adopted pursuant to these statutes are Applicable, Relevant, and Appropriate Requirements ("ARARs") for this response. Implementation of any component or components of this response will not necessarily result in protection from liability pursuant to Act 2, for any party.

The Department will be given the opportunity to concur with the decisions related to future Remedial Design and Remedial Actions to assure compliance with the Department's ARARs and design specific ARARs.

The Department reserves the rights to concur with any Explanation of Significant Differences issued and/or any financial impacts it may have on the remedy.

This concurrence with the selected remedial actions is not intended to provide any assurance pursuant to CERCLA Section 104(c)(3), 42 U.S.C. Section 9604(c)(3).

The Department reserves the rights and responsibilities to take independent enforcement actions pursuant to state and federal laws.

This letter documents the Department's concurrence with the remedy selected by the Navy in the ROD for the Site 2 Antenna Field Landfill.

If you have any questions, please contact me at the phone number located in the first page footer.

Sincerely,



Joseph A. Feola  
Southeast Regional Director

cc: Mr. Sinding  
Mr. R. Patel  
Mr. Hartzell  
Mr. Sheehan  
Mr. Clark  
Re 30 (GJS10)134-10