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Record of Decision:

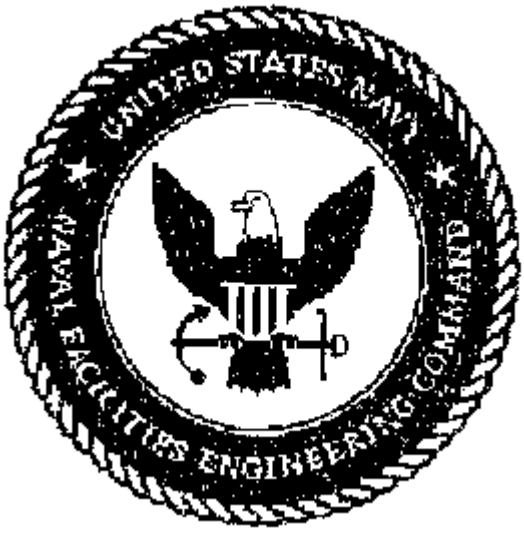
NORFOLK NAVAL BASE (SEWELLS POINT NAVAL COMPLEX)
EPA ID: VA6170061463
OU 02
NORFOLK, VA
12/06/2000

Record of Decision

NM Slag Pile

Naval Station Norfolk

Norfolk, Virginia



Department of the Navy

Atlantic Division

Naval Facilities Engineering Command

Norfolk, Virginia

October 2000

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Acronyms and Abbreviations

AWQC	ambient water quality criteria
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
COC	chemical of concern
COPC	chemical of potential concern
CRPC	Community Relations Plan
4,4'-DDD	dichlorodiphenyldichloroethane
4,4'-DDE	dichlorodiphenyldichloroethene
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ERM	effects range-median
FFA	Federal Facilities Agreement
FS	Feasibility Study
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
IR	Installation Restoration
LOAEL	lowest observed adverse effect level
LUC	land use control
LUCIP	land use control implementation plan
MCL	maximum contaminant level
MOA	memorandum of agreement
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
µg/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NM	naval magazine

Acronyms and Abbreviations (Continued)

NOAEL	no observed adverse effects level
NPL	National Priorities List
NPW	net present worth
NSN	Naval Station Norfolk
O&M	operation and maintenance
PAH	polynuclear aromatic hydrocarbons
ppb	parts per billion
ppm	parts per million
PRAP	Proposed Remedial Action Plan
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	remedial investigation
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
TBC	to be considered
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
VDEQ	Virginia Department of Environmental Quality

1.0 Declaration

1.1 Site Name and Location

NM Slag Pile — Site 2
Naval Station Norfolk
Norfolk, Virginia

1.2 Statement of Basis and Purpose

This record of decision (ROD) presents the selected remedy for the Naval Magazine (NM) Slag Pile - Site 2, located at the Naval Station Norfolk (NSN), Norfolk, Virginia. The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The information supporting the decision on the selected remedy is contained in the administrative record file for the NM Slag Pile Site.

The Commonwealth of Virginia concurs with the selected remedy.

1.3 Assessment of the Site

Actual or threatened releases of hazardous substances from Site 2, if not addressed by implementing the remedial actions selected in this ROD, may present an imminent and substantial endangerment to public health, public welfare, or the environment.

1.4 Description of the Selected Remedy

The remedy for NM Slag Pile — Site 2 is part of a comprehensive environmental remediation being conducted at the NSN under the Navy Installation Restoration Program. The selected remedy in this ROD is the permanent remedy for controlling contaminated soil, groundwater, surface water, and sediment at NM Slag Pile — Site 2. The major components of the selected remedy include the following:

- Placing an asphalt and soil cover over the entire slag pile to reduce exposure to site contaminants and provide for suitable reuse as a parking lot area.
- Institutional controls to limit future site land use. Institutional controls will prohibit 1) future excavation or disturbance of the covered area within Site 2; 2) the use of groundwater underlying Site 2 for drinking water: and 3) any other action on Site 2 that

would disturb the integrity of the asphalt and soil cover or disturb the function of the groundwater monitoring systems.

- Long-term groundwater monitoring for inorganics on an annual basis for five years, and once every five years thereafter.
- Excavating approximately 1,000 cubic yards of contaminated sediment in the drainage channel adjacent to the slag pile to achieve a cleanup level of 218 milligrams per kilogram (mg/kg) for lead, dewatering the excavated sediment, and transporting and disposing of the excavated sediment off-site. If a minimum of two feet of sediment has been excavated and the lead cleanup level cannot be achieved the drainage channel bed will be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill to prevent future migration of sediment.
- Stabilization of the west bank of the drainage channel immediately adjacent to the slag pile area to prevent soil erosion from the slag pile into the drainage channel.
- Monitoring the sediment and surface water in the drainage channel for inorganics on an annual basis for five years.

1.5 Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to this remedial action, and is cost-effective.

The remedy addresses the remediation of subsurface soil, groundwater, surface water, and sediment at the site. The asphalt and soil cover will reduce direct contact and ingestion threats from contaminated soil and reduce possible leaching and erosion of soil contaminants to the groundwater and adjacent drainage channel. Removing contaminated sediment from the drainage channel will reduce risks to ecological receptors from contaminated sediment.
Remediation of Site 2 sediment will result in a reduction of contaminant levels in the surface water since surface water in the drainage channel no longer will come into contact with contaminated sediment.

The selected remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable at Site 2. The selected remedy does not satisfy the statutory preference for remedies using, as a principal element, treatment that permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants. The selected remedy represents a better balance of tradeoffs under the evaluation criteria than the alternatives using treatment. The large volume of contaminated soil led to treatment alternatives for the subsurface soil that were not cost-competitive with the selected remedy. Alternative 4 for sediment and surface water, which includes treating contaminated sediment by phytoremediation, was not selected for sediment remediation because arsenic, dichlorodiphenyldichloroethane (4,4'-DDD), and dichlorodiphenyldichloroethene (4,4'-DDE) cannot be treated through phytoremediation.

Because the remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted no less often than every 5 years after the remedial action is initiated to ensure that the remedy continues to provide adequate protection of human health and the environment.

Steven W. Johnson, CAPT, CEC, USN
Regional Engineer
By direction of the Commander
Navy Region Mid-Atlantic

11/30/00
Date

Abraham Ferdas, Director
Hazardous Site Cleanup Division
U.S. EPA Region III

12/6/00
Date

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2.0 Decision Summary

2.1 Site Name, Location, and Description

This ROD presents the U.S. Department of the Navy's (Navy) selected remedy for Site 2 – Soil, Groundwater, Sediment, and Surface Water at the NM Slag Pile, NSN, Norfolk, Virginia.

Site 2 is located in the southeast corner of NSN near the intersection of Interstate-64 (I-64) and Interstate-564 (I-564) (Figure 2-1). The site covers an area of approximately 2 acres (Figure 2-2) and is bordered by Patrol Road to the southwest, the fenced NM Van Facility to the southeast, and a fenced weapons storage area to the northeast.

As indicated in the NSN Land Use Plan, Site 2 is broadly classified as open space. Site 2 is located within a broad open area adjacent to a remnant pine forest. The proposed land use through the year 2010 is an open space retained to define a buffer zone around the weapons area (Naval Base, Norfolk, 2010 Land Use Plan, August 1995). The weapons area is a magazine area for the NSN where ordnance is stored. Activities surrounding the weapons area are restricted by barbed wire fencing, armed guards, and other security measures.

The drainage channel adjacent to the slag pile conveys water from I-564, adjacent railroad tracks, residential and commercial areas in the upstream watershed, and the shallow water table aquifer underlying the site, as well as stormwater runoff fro m the slag pile area.
Stormwater drainage from the site flows eastward and northward to the drainage channel.
Downstream of the site, this channel intersects another channel flowing in a perpendicular direction. This downstream channel generally collects water from the weapons storage area, I-64, and off-site residential and commercial areas. These channels combine and flow northwesterly and then northeasterly toward Mason Creek. This channel then is connected to Mason Creek through a dual 30-inch pipe culvert under Patrol Road located north of the weapons area. Mason Creek is, in turn, connected to Willoughby Bay through a large culvert that runs under the northeast corner of the NSN.

2.2 Site History and Enforcement Activities

The history of the site, previous site investigations, and highlights of community participation are summarized below.

2.2.1 Site History

Site 2 was used for disposing of slag generated by aluminum smelting operations conducted by the Navy during the 1950s and 1960s in the NM area of what was formerly known as the Naval Air Station. The slag is a residual cindery material derived from a blast furnace. Slag

LEGEND

INSTALLATION PROPERTY BOUNDARY

Figure 2-1
INSTALLATION LOCATION MAP
Naval Station, Norfolk

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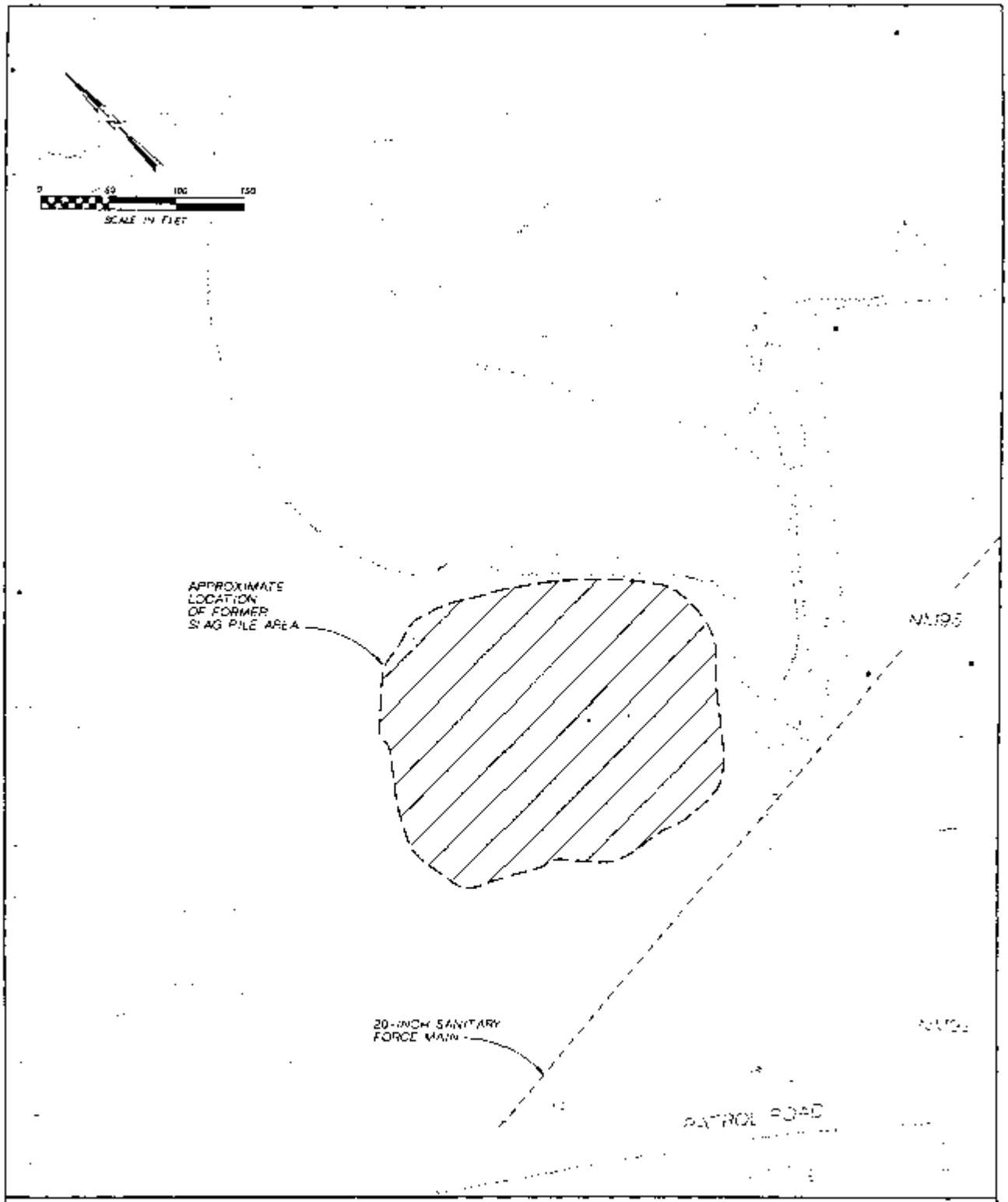

Figure 2-2
SITE MAP
SITE 2 - NM AREA SLAG PILE
Naval Station, Norfolk

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is formed from the fusion of a mineral such as limestone (used to lower the fusion temperature of an ore mineral) with impurities from the aluminum ore and ash from the blast furnace fuel (likely to be coke). To create a level area upon which the slag-could be deposited, fly ash and/or bottom ash, derived from coal burning operations elsewhere on the NSN, apparently were used as a fill material for Site 2.

During the smelting operation, the slag pile area was well-defined by a lack of vegetation around the site and by the slag pile itself, which consisted of rounded slag and pieces of various metals. The surface of the site subsequently has been regraded and planted. Now, part of the former slag pile area is covered by a gravel parking lot. This parking lot is being used daily by 30 to 40 employees of the NM Van Facility (buildings NM 92 and NM 95 and surrounding facilities). The site is adjacent to the NM Van Facility, which provides maintenance and repair of mobile offices and equipment storage units.

2.2.2 Previous Investigations

The following studies of Site 2 have been conducted:

- *Initial Assessment Study of the Sewell's Point Naval Complex, Norfolk, Virginia* (IAS), (Environmental Science and Engineering, Inc. [ESE], February 1983)
- *Installation Restoration Program Remedial Investigation—Interim Report, Naval Base, Norfolk, Virginia* (IRP RI), (Malcolm Pirnie, Inc., March 1988)
- *Revised Final Phase II RCRA Facility Assessment of the Norfolk Naval Base—Sewell's Point, Norfolk, Virginia,* (A.T. Kearney, Inc., March 1992)
- *Final Remedial Investigation of the NM Slag Pile, Naval Base Norfolk, Norfolk, Virginia* (RI), (CH2M HILL, August 1998); and *Addendum to Master Project Plan for Pre-Design Investigations, NM Slag Pile (Site 2) and Pesticide Disposal Site (Site 5), Naval Base, Norfolk, Virginia,* (March 1998)
- *Final Feasibility Study, NM Slag Pile, Naval Base Norfolk, Norfolk, Virginia* (FS), (CH2M HILL, September 1998)

In April 1982, an IAS was conducted at the Sewell's Point Naval Complex, Naval Station Norfolk. The IAS identified 18 sites of concern with regard to potential contamination. The NM Slag Pile was included as a potential area of concern. The IAS report, completed in February 1983, documented that the slag pile at Site 2 was a potential source of surface stormwater and groundwater contamination because of potential leaching through the soil and overland flow or downward migration of metals, primarily chromium, cadmium, and zinc, into the water table aquifer.

The 1988 IRP RI included an investigation at Site 2 to determine if suspected inorganic constituents (metals) identified in the IAS report were present in the site soil and surface water within the stormwater drainage channel adjacent to the site. Analytical data indicated that cadmium, chromium, copper, lead, nickel, and zinc were significantly higher in the soil

at the slag pile than at the background sample location (a location that is unaffected by Site 2 activities). Analyses of surface water samples indicated no evidence of inorganic constituents entering the surface water; however, sediment samples collected in the same location indicated that inorganic constituents associated with the slag pile had eroded into the drainage channel and had been transported downstream. Recommendations included leveling and covering the slag pile with a hard surface to minimize the potential for continued erosion (after conducting additional sampling to identify specific areas to be covered) and implementing erosion-control measures to prevent erosion of sediment located between the cover and the drainage channel. The report also stated that removal actions were not warranted.

The purpose of the Phase II Resource Conservation and Recovery Act (RCRA) Facility Assessment, conducted in 1992, was to conduct a preliminary review of available and relevant documents, conduct visual inspections, and, if appropriate, conduct sampling visits. Recommendations for Site 2 included conducting soil and sediment sampling for metals analyses to determine if a release of hazardous substances or wastes had occurred.

The results of the previous investigations guided the scoping of the RI, completed in 1998.
The RI was completed in three separate phases of sampling. Soil, sediment, groundwater, and surface water samples were collected. The results of the RI are presented later in this document, and this information was used as the basis for the FS, completed in 1998, that identified and evaluated potential remedial alternatives for the site. The results of the FS also are presented later in this document, and this information was used as the basis for the Proposed Remedial Action Plan (PRAP).

2.2.3 Enforcement Actions

The NSN was placed on the National Priorities List (NPL) on April 1, 1997.

A Federal Facilities Agreement (FFA) was signed by the Deputy Assistant Secretary of the Navy on February 11, 1999, and by the Regional Administrator of EPA Region III on February 18, 1999. This agreement is intended to meet the provisions of CERCLA, 42 U.S.C. Section 9601 et seq., and Sections 3004(u) and (v) and 3008(h) of the Resource Conservation and Recovery Act (RCRA), as amended, 42 U.S.C. Sections 6924(u) and (v) and 6928(h). As described in paragraph 4.1 of the FFA, the general purposes of the agreement are to accomplish the following:

A. Ensure that the environmental impacts associated with the past and present activities at Site 2 are investigated thoroughly and that the appropriate remedial action is taken as necessary to protect public health, public welfare, and the environment.

B. Establish a procedural framework and schedule for developing, implementing and monitoring appropriate response actions at Site 2 in accordance with CERCLA as amended by SARA, the NCP, Superfund guidance and policy, RCRA, RCRA guidance and policy, and applicable state law.

C. Facilitate cooperation, exchange of information, and participation of the parties in such actions.

The FFA identifies 10 Installation Restoration (IR) sites, four site screening areas (SSAs), and eight areas of concern (AOCs) at NSN that are to be addressed by the Navy. Site 2 is included as one of the IR sites warranting investigation.

2.2.4 Highlights of Community Participation

The RI (August 1998), FS (September 1998), and PRAP (January 1999) for Site 2 have been released and made available to the public in the administrative record file at the Kirn Memorial Branch of the Norfolk Public Library in Norfolk, Virginia, and at information repositories maintained at the Naval Station Library and at the Mary Pretlow Branch of the Naval Station Library.

The notice of availability of the RI, FS, and PRAP was published in the *Virginian Pilot* on December 28-30, 1998. A public comment period for these documents was held from December 28, 1998, to January 28, 1999.

No written comments were received during the comment period. A public meeting was conducted on Thursday, January 21, 1999, at the Navy Lodge in Norfolk, Virginia. No one from the local community attended the meeting and no comments or questions were raised.

2.3 Scope and Role of Response Action at site 2

The selected remedy identified in this ROD addresses all contaminated media of concern at the site as identified in the RI and FS reports, and composes the overall cleanup strategy for the site. In Section 2.8, the selected remedy for Site 2 is identified and the rationale for its selection is described.

The selected remedy will reduce the potential risk to human health and the environment associated with the subsurface soil, groundwater, sediment, and surface water. The remedy includes installing an asphalt and soil cover over the contaminated soil and excavating and disposing of contaminated sediment.

The remedy is consistent with the long-term remedial goals for Site 2. The asphalt and soil cover will prevent or minimize human health exposure to levels above health-based criteria of inorganic contaminants in the subsurface soil. The asphalt and soil cover also will help prevent degradation of groundwater quality by limiting downward percolation of precipitation (and thereby the potential for dissolved lead) into the water table aquifer at Site 2. Excavating and disposing of contaminated sediment, along with stabilizing the bank, will minimize the current risk to the ecological receptors posed by contaminated sediment at Site 2, and will prevent further migration of contaminated sediment from Site 2. In addition, remediation of Site 2 sediment will result in reduced contaminant levels in the surface water. Groundwater, sediment, and surface water monitoring will track contaminant migration over time. Land use restrictions will prohibit the future use of the Yorktown Aquifer as a potable

water source at the site and prohibit excavation or other disturbance of the soil and asphalt cover.

The selected remedy will comply with applicable or relevant and appropriate requirements (ARARs) and "to-be-considered" (TBC) criteria. ARARs and TBC criteria are federal and state environmental statutes that are either directly applicable or relevant and appropriate, or considered in developing and evaluating remedial alternatives at a particular site. Chemical-, location-, and action-specific ARARs have been evaluated for Site 2. Chemical-specific ARARs/TBCs are discussed below. Location- and action-specific ARARs for Site 2 are presented in Appendix A.

Soil — There are no Federal or Commonwealth of Virginia promulgated cleanup levels for contaminated soil. Because of this, human health preliminary remediation goals (PRGs) for soil were developed for the chemicals of potential concern (COPCs) under the construction worker scenario (presented in Table 2-1).

TABLE 2-1
Preliminary Remediation Goals
Construction Worker Scenario (Subsurface Soil)
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia[1]

Chemicals of Potential Concern	Recommended Soil PRG (mg/kg)	Maximum Concentration (mg/kg)
Aluminum	210,000	180,000
Antimony	**39**	**240**
Arsenic	64	18
Cadmium	**48**	**110**
Chromium	**96**	**1900**
Copper	**4,300**	**78,000**
Iron	**32,000**	**110,000**
Lead	**609[2]**	**9,820**
Nickel	**3,900**	**7,100**

[1] Shaded constituents represent inorganics with maximum concentrations that exceed their respective recommended soil PRGs.

[2] A lead screening level of 1,218 parts per million (ppm) (industrial scenario) was calculated based on adult worker exposure to lead in soil following current EPA guidance (EPA, 1996; see Section 4.0 References, below). However, since then, EPA has requested a higher ingestion rate be assumed, which results in the 609 ppm cleanup level.

Two chemicals, aluminum and arsenic, were selected as COPCs by the screening performed in the baseline human health risk assessment but have maximum concentrations less than their respective recommended soil PRGs. These chemicals are included in Table 2-1 only because they were COPCs and are not considered further because their PRGs were not exceeded. The maximum concentrations of antimony, cadmium, chromium, copper, iron,

lead, and nickel are greater than their perspective recommended soil PRGs and thus these COPCs were considered for response action in the Site 2 subsurface soil.

Lead is found in all soil samples and is the indicator parameter for the inorganics. Since it is co-located with other chemicals of potential concern, reduction of exposure to lead to acceptable levels is expected to reduce exposure to all other inorganic chemicals of potential concern to acceptable levels.

If the soil is classified as hazardous, then prohibitions on land disposal specified in 40 Code of Federal Regulations (CFR) Part 268, may apply.

Groundwater – The EPA has established a drinking water action level of 15 parts per billion (ppb) for lead, which will be the chemical-specific ARAR for groundwater at Site 2. The presence of elevated metals concentrations measured in unfiltered groundwater samples (versus those in filtered samples) usually is attributed to the presence of sedimentation in those samples. This is demonstrated by higher detected concentrations of metals in unfiltered samples than those in corresponding filtered samples. Risks potentially associated with exposures to unfiltered inorganics (total metals) and filtered inorganics (dissolved metals) were evaluated in the human health risk assessment under scenarios that best represented actual exposure conditions. Unfiltered groundwater samples were evaluated only for determining risks from accidental exposures to shallow groundwater during excavation and construction activities, and filtered groundwater samples were evaluated for determining risks from potable use of groundwater.

Although the action level for lead is exceeded in unfiltered groundwater at Site 2, the lead concentrations in the unfiltered groundwater from the site wells were not statistically different from the concentrations from the upgradient wells (using a one-tailed Mann-Whitney U test for an upper confidence level of 95 percent, and the Wilcoxon-Mann-Whitney Rank Sums test in the case of tied ranks). Because of this, remedial action at Site 2 alone would not reduce levels of lead in unfiltered groundwater at the site to the action level. If construction activities were to occur where exposure to lead in groundwater was possible, necessary precautions would have to be taken to prevent risk to a construction worker:

Sediment – Arsenic, cadmium, chromium, copper, lead, nickel, silver, zinc, 4,4'-DDD, and 4,4'-DDE were detected at concentrations that exceed the EPA Region III Biological Technical Assistance Group (BTAG) screening levels for sediment. Lead is the indicator parameter in sediment. Removal of lead to the established cleanup level also will remove the other elevated contaminants posing an ecological risk.

Guidance relevant to the lead contamination in sediment includes the effects range-median (ERM) for lead, or 218 mg/kg, dry weight (Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder, 1995). The ERM is the concentration of a contaminant in sediment at which adverse biological effects to living resources may be observed 50 percent of the time. Since ERM values are screening levels, they are classified as to be considered" (TBC) criteria. The TBCs are meant to complement ARARs, and not to compete with or replace them.

If the sediment is determined to be hazardous by characteristic, then prohibitions on land disposal specified in 40 CFR Part 268 may apply.

2.4 Summary of Site Characteristics

This section provides a summary of the features of the site, and of the nature and extent of soil, groundwater, sediment, and surface water contamination at the site.

Soil – The site geology was delineated based on the previously documented geologic information, and on RI boring logs, monitoring well installations, and direct-push soil sampling results. Typically, the upper five feet consists of medium-brown to orange-brown sandy fill with intermixed construction debris and ash material. The material from five feet to approximately 25 feet below ground surface (bgs) is composed of medium-brown to gray silty sands with occasional silty clay lenses. Based on one deep well located in the northern corner of the site, the lithology from 25 to 80 feet bgs is described as olive-gray, medium-coarse sand with occasional shell fragments.

Sediment – The drainage channel adjacent to the slag pile area contains sediment that consists of coarse to fine sand, silt, and silty clay, intermixed with organic debris. A medium-brown-to-gray silty sand underlies the sediment. Areas of the drainage channel with low-velocity flow or still water contain a deposit of watery mud mixed with organic matter that overlies the sediment.

Surface Water – The drainage channel adjacent to the slag pile area conveys water from I-564, adjacent railroad tracks, residential and commercial areas in the upstream watershed, and the shallow water table aquifer underlying the site, as well as stormwater runoff from the slag pile area. Stormwater drainage from the site flows eastward and northward to the drainage channel. Downstream of the site, this channel intersects another channel flowing in a perpendicular direction. This downstream channel generally collects water from the NSN weapons area, 1-64, and off-site residential and commercial areas. These channels combine and flow in a northwesterly direction toward Mason Creek.

Groundwater – Shallow groundwater flows in an east-northeasterly direction at Site 2. The shallow groundwater discharges into the drainage channel as surface water. The average groundwater table elevation derived from eight surveyed monitoring points is 6.13 feet above mean sea level. The Site 2 horizontal groundwater gradient ranges from 0.01 to 0.025. A vertical groundwater gradient exists between the shallow and deep aquifer as illustrated by the hydraulic head difference of 0.46 feet between a shallow monitoring well and its deep counterpart. Assuming that the hydraulic head distribution at this one pair of wells is indicative of conditions across the site, a downward component of groundwater flow also exists at the site.

A specific data quality objective concerning the hydrogeology of Site 2 during the 1998 RI involved determining the presence or absence of a confining unit separating the unconfined shallow aquifer from the underlying Yorktown Aquifer. One monitoring well was drilled with this objective in mind. No significant confining layer was observed in this monitoring

well. The observed thin lenses of silty clay in the 6-to-28-foot interval were not thick enough to be considered laterally continuous to any certain degree. In other areas of NSN, a confining clay layer (where present) ranges from 25 feet to approximately 40 feet bgs. The confining clay unit was breached possibly by scouring, a result of erosional forces associated with Mason Creek. This absence also could be the result of a variable, depositional, shallow marine environment (transgressing and regressing seas) or a combination of both.

2.4.1 Sources of Contamination

The primary source of contamination present at the site is ash material encountered in the subsurface soil of the slag pile area. The principal zone of metals contamination actually was found to be confined within ash beds of two inches to 2.5 feet in thickness and within zones of silty sand with intermixed ash. The principal media of contamination is interpreted as fly ash and/or bottom ash, derived from coal burning operations and that most likely had been used as general fill in the area of Site 2 to level the site for industrial use. The ash contains elevated concentrations of heavy metals, especially lead. The concentration range of lead in the subsurface soil was 7.2 mg/kg to 9,820 mg/kg. Some of the lead-contaminated soil has eroded into the adjacent drainage channel and has been transported downstream, resulting in sediment contamination. The ash in the slag pile area is in contact with the shallow groundwater. However, groundwater quality data indicate that the ash material has not contributed to groundwater contamination.

Residual pieces of slag material resulting from industrial use of the site were found primarily in the upper two inches of the soil profile. This finding indicates that the area was filled with fill material that included ash material to form a flat, elevated surface. The slag subsequently was piled on the elevated surface. The slag generated by aluminum smelting operations in the NM area of the former Naval Air Station and disposed of at Site 2 is no longer thought to be the principal source of lead contamination.

2.4.2 Description of Contamination

The chemicals detected in samples collected during the 1998 RI were mostly inorganics (e.g., lead), but some organics also were detected (e.g., 4,4'-DDD, 4,4'-DDE, trichloroethylene (TCE), and several polynuclear aromatic hydrocarbons (PAHs)). A summary of field investigation results and the standards and screening levels that they were compared with (using the most recent standards and screening levels at the time of the 1998 RI) are presented in Table 2-2 and are summarized below. Summary tables of regulatory exceedances for each media are contained in Appendix B.

Groundwater

Groundwater at the site was characterized by installing several permanent monitoring wells and collecting *in situ* groundwater at down-gradient locations between well locations, using a Geoprobe. To support risk assessment, the wells were sampled two times during the 1998 RI and one additional time after the 1998 RI was completed.

TABLE 2-2
Summary of Field Investigation Results
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Phase I Investigation Activity		Major Findings [1]
Phase I	Groundwater Sampling filtered)	Arsenic and trichloroethylene (TCE) exceeded risk-based concentrations (RBCs) for tap water. Thallium exceeded the maximum contaminant level (MCL). Iron, manganese, selenium, and zinc exceeded the Virginia Groundwater Standards.
	Surface Soil Sampling	Arsenic exceeded the RBC for industrial soil. Multiple inorganics exceeded BTAG screening levels, including aluminum, beryllium, chromium, copper, iron, lead, nickel, vanadium, and zinc. Several polynuclear aromatic hydrocarbons (PAHs) also exceeded BTAG screening levels.
	Subsurface Soil Sampling	Arsenic and beryllium exceeded the RBC for industrial soil. Lead exceeded the EPA action level for residential soil.
	Sediment Sampling	Several inorganics exceeded BTAG screening levels, including arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc. 4,4'-DDE also exceeded STAG screening level.
	Surface Water Sampling	Several inorganics exceeded BTAG screening levels, including aluminum, cadmium, copper, lead, silver, and zinc. Iron and lead exceeded ambient water quality criteria (AWQC).
Phase II Investigation Activity		**Major Findings [1]**
Phase II	Geophysical Surveys	Electromagnetic and ground-penetrating radar surveys helped to delineate the extent of lead-contaminated soil. The surveys revealed a more extensive boundary to the lead-contaminated area than what had been estimated originally as the slag pile area. The anomaly defined by the electromagnetic survey correlated well with the occurrence of lead-contaminated ash in the subsurface and is now interpreted to define the distribution of lead-contaminated ash. The ash material, rather than the slag, is the apparent source of elevated lead levels found at Site 2.
	Field XRF Screening	Subsurface soil was screened for total lead at 49 locations using a portable XRF. The lead-contaminated soil was located and characterized.
	Groundwater Sampling (filtered)	Arsenic, iron, and beryllium exceeded RBCs for tap water and thallium exceeded MCLs. Selenium and manganese exceeded Virginia Groundwater Standards.
	Surface Soil Sampling	One surface soil sample was collected and several inorganics exceeded BTAG screening levels, including aluminum, antimony, beryllium, cadmium, chromium, copper, iron, lead, nickel, silver, vanadium, and zinc.
	Subsurface Soil Sampling	Arsenic and beryllium exceeded the RBC for industrial soil. Lead exceeded the EPA action level for residential soil.
	Background Soil Sampling	Several inorganics exceeded BTAG screening levels, including aluminum, chromium, iron, lead, nickel, vanadium, and zinc.
	Sediment Sampling	Several inorganics exceeded BTAG screening levels, including arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc. 4,4'-DDD and 4,4'- DDE also exceeded BTAG screening level.
	Surface Water Sampling	Several inorganics exceeded BTAG screening levels, including aluminum, cadmium, lead, and silver. Iron and lead exceeded AWQC.
Phase III Investigation Activity		**Major Findings [1]**
Phase III	Sediment Sampling	Lead concentrations exceeded the cleanup level of 218 mg/kg in 9 out of 17 shallow sediment samples, 7 out of 10 mid-level sediment samples, and 3 out of 10 deep sediment samples. None of the samples collected in the weapons station drainage channel exceeded the cleanup level. Lead concentrations exceeded the cleanup level of 218 mg/kg in 9 out of 12 surface soil samples collected in the wooded wetlands area.

1 The analytical results were screened against the most recent standards and screening levels at the time of the 1998 RI.

Specifically, the groundwater analytical results were compared with EPA Region III risk-based concentrations (RBCs) for tap water, Federal maximum contaminant levels (MCLs), and Virginia Groundwater Standards. Soil analytical results were compared with RBCs for industrial soil, BTAG screening levels for ecological concerns, and the EPA action level for lead. Sediment analytical results were compared with BTAG screening levels, and the ERM level for lead. Surface water analytical results were compared with BTAG screening levels, and ambient water quality criteria (AWQC).

Groundwater from Site 2 contained arsenic, iron, beryllium, and TCE at concentrations that exceeded RBCs for tap water (those in effect at the time the draft RI was submitted, September 1997) and thallium that exceeded the MCL. Selenium and zinc exceeded the Virginia Groundwater Standard. Arsenic and iron were detected at elevated concentrations in upgradient groundwater monitoring wells as well as in downgradient wells, indicating an off-site (and off-Station) source. The TCE was only detected one time in one well and was not detected in a subsequent sampling round. The RBC for beryllium was increased after the 1998 RI sampling was completed. At the concentrations detected, beryllium did not exceed the revised RBC. Thallium was detected in downgradient monitoring wells only, as a dissolved contaminant. However, each time it was detected in a monitoring well, the detection was qualified as being an estimated value. The final round of sampling yielded non-detections for thallium. Soil containing the ash material with elevated heavy metals had detections for thallium, selenium, and zinc but the detected values were below the RBC for ingestion of residential soil. Therefore, there is no indication that the presence of these inorganics in filtered groundwater is related to the metals-contaminated soil at the slag pile area.

EPA's drinking water action level for lead is 15 micrograms per liter (µg/L). Although this action level was exceeded in unfiltered groundwater at Site 2, the lead concentrations in the unfiltered groundwater from the site wells were not statistically different than the concentrations from the upgradient wells; therefore, remedial action at Site 2 alone would not reduce levels in unfiltered groundwater at the site to the EPA drinking water action level. In addition, Human Health Consensus Agreement No. 6.C states that unfiltered groundwater samples need to be evaluated only for determining risks from accidental exposures to shallow groundwater during excavation/construction activities, and not for evaluating risks from potable use of groundwater. If construction activities were to occur where exposure to lead in groundwater was possible, necessary precautions will have to be taken to prevent risk to construction workers.

Surface Water

Surface water samples were collected along the reach of the drainage channel upstream, adjacent to, and downstream of the slag pile area. The surface water samples were compared with ambient water quality criteria and BTAG screening levels. Iron and lead exceeded ambient water quality criteria. Several inorganics, including aluminum, cadmium, copper, lead, silver, and zinc, exceeded BTAG screening levels. Although groundwater discharges to surface water at the site, the 1998 RI groundwater sampling results for dissolved constituents in downgradient monitoring wells indicated that groundwater discharge to surface water was

not adversely affecting the surface water quality at the site. Therefore, removal of the sediment from the drainage channel in the vicinity of the slag pile area, as proposed, is expected to remediate any problems with the surface water.

Soil

Soil contamination was primarily characterized using Geoprobe soil sampling in a grid pattern within and surrounding an area that, using geophysical techniques, was characterized as anomalous. The soil sampling indicated that a fill material, characterized as an ash, was the source for elevated metals in the soil. Surface and subsurface soil samples also were collected during well installation. Soil sample results were compared with EPA Region III RBCs for ingestion of industrial soil.

In surface soil, arsenic exceeded the RBC for industrial soil. Multiple inorganics, including aluminum, beryllium, chromium, copper, iron, lead, nickel, vanadium, and zinc, exceeded BTAG screening levels. Several polynuclear aromatic hydrocarbons also exceeded BTAG screening levels.

In subsurface soil, arsenic and beryllium exceeded the RBC for industrial soil. Lead exceeded the EPA action level for residential soil. Installing an asphalt and soil cover over the contaminated area, as proposed, will restrict exposure to and transport of contaminated surface and subsurface soil.

Sediment

Sediment samples were collected at multiple depths along the reach of the drainage channel upstream, adjacent to, and downstream of the slag pile area. The sediment samples were compared with BTAG screening levels. Several inorganics, including arsenic, cadmium, chromium, copper, lead, nickel, silver, and zinc, exceeded BTAG screening levels. 4,4'-DDD and 4,4'-DDE also exceeded BTAG screening levels.

Lead concentrations exceeded the cleanup level of 218 mg/kg in nine out of 17 shallow sediment samples, seven out of 10 mid-level sediment samples, and three out of 10 deep sediment samples. None of the samples collected in the drainage channel adjacent to the weapons storage area exceeded the cleanup level. Lead concentrations exceeded the cleanup level of 218 mg/kg in nine out of 12 surface soil samples collected in the wooded wetlands area adjacent to the site.

The proposed sediment removal from the drainage channel will remediate the contamination. The BTAG reviewed the contamination in the wooded wetland adjacent to the site and determined that any attempts at removal would do more to destroy habitat than would leaving the sediment in place.

2.4.3 Contaminant Migration

The fate of most contaminants found at Site 2 is that they will remain in place bound to soil, sediment, and organic matter. Some transport of particulate-bound contaminants into the drainage channel adjacent to the site has occurred via surface runoff and erosion, as

evidenced by relatively high levels of inorganic contaminants detected in sediment and surface water. Most contamination that can be attributed to Site 2 is found within the site or adjacent to the site, in the drainage channel. The contamination detected in the sediment and surface water has resulted from erosion of soil adjacent to the drainage channel that contains the lead-contaminated ash material.

The overall rate of contaminant transport in the drainage channel is interpreted to be very slow. The most rapid mechanism for contaminant migration is via surface water, which transports particulate-sorbed contaminants toward Mason Creek. However, the extent of contamination in surface water and sediment that can be attributed to Site 2 is limited to a short distance downgradient from the site before dispersion lowers concentrations in the surface water and sediment to levels below established regulatory standards.

Phase I and II analytical results for surface water indicated evidence of temporal variability in inorganic contaminant concentrations (i.e., at one location, the concentration of lead in surface water decreased from 1,190 mg/L during Phase I to non-detection during Phase II). In addition, surface water samples were turbid, indicating that the lead contamination likely was caused by the sediment suspended in the stream flow. This interpretation is supported further by the absence of dissolved lead contamination in groundwater, which discharges to surface water in the drainage channel.

Groundwater quality data indicate that site contaminants are not dissolved in or transported by site groundwater. Although thallium was detected only in downgradient wells, thallium detections have been qualified as being estimated values, and the final round of sampling yielded non-detections for thallium. There is no indication that the presence of thallium in groundwater is related to contaminated soil at the slag pile. Lead was detected in unfiltered groundwater only, indicating that its presence in groundwater is in particulate (non-dissolved) form. Therefore, lead is not expected to migrate between the subsurface soil and groundwater. Elevated lead concentrations were detected in unfiltered samples from upgradient wells and from downgradient wells.

2.5 Summary of Site Risks

The public health and ecological risks associated with exposure to contaminated media at Site 2 were presented in the 1998 RI report. The public health baseline risk assessment evaluated and assessed the potential public health risks that might result under current and potential future land use scenarios. An ecological evaluation also was performed and assessed the ecological risks at Site 2. The public health and ecological risks associated with the site are summarized below.

2.5.1 Summary of Human Health Risks

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) established acceptable levels of carcinogenic risk for Superfund sites ranging from one excess cancer case per 10,000 people exposed to one excess cancer case per one million people exposed. This translates to a risk range of between one in 10,000 and one in one million additional

cancer cases. Expressed as scientific notation, this risk range is between $1x10^{-4}$ and $1x10^{-6}$. Remedial action is warranted at a site when the calculated cancer risk level exceeds $1x10^{-4}$.

The NCP also states that sites should not pose a health threat because of a noncarcinogenic, but otherwise hazardous, chemical. EPA defines a noncarcinogenic threat by the ratio of the contaminant concentration that a person may encounter at the site to the established safe concentration. If the ratio, called the hazard index (HI), exceeds 1.0, there may be concern for the potential noncarcinogenic health effects associated with exposure to the contaminants. The HI identifies the potential for the most sensitive individuals to be adversely affected by the noncarcinogenic effects of contaminants. As a general rule, the greater the value of the HI above 1.0, the greater the level of concern. Cancer risks and the potential to experience noncarcinogenic adverse effects as measured by the HI were evaluated in the risk assessment. Cancer risks were compared with the acceptable risk range of $1x10^{-4}$ to $1x10^{-6}$. The calculated HI was compared with the threshold value of 1.0.

The baseline risk assessment evaluated potential exposures to current and future receptors. The receptors included the following:

- Current and future on-site workers (surface soil and groundwater)
- Current and future recreational adults and adolescents (surface water, surface soil, and sediment)
- Future construction workers (groundwater and subsurface soil)
- Future gardener and agricultural users (groundwater)
- Future downgradient hand-bay car wash users (groundwater)

The risk assessment indicates that past practices at Site 2 have contaminated certain media to the extent that they pose a potential threat to human health only under certain potential land use scenarios. A future residential scenario was not considered to be a complete pathway and, therefore, was not evaluated in this assessment. The results of the human health risk assessment for the various exposure scenarios are summarized below. Appendix C presents the summary of media-specific risks and hazards for each scenario evaluated.

Current and Future On-site Workers

The "current and future on-site worker" risk scenario was evaluated for on-site workers at the NSN who may contact surface soil and groundwater at the site. Results indicate that there are no unacceptable risks to current and future on-site workers posed by the surface soil and groundwater at Site 2.

Current and Future Recreational Adults and Adolescents

For the "current and future recreational adults and adolescents" scenario, it was conservatively assumed that adults and older children (ages seven to 15 years), who live in the vicinity of the site, may trespass onto the site and become exposed to site surface soil,

surface water, and sediment. As shown in Appendix C, there are no unacceptable risks to current and future recreational adults and adolescents posed by the surface soil, surface water, and sediment at Site 2.

Future Construction Workers

This exposure scenario was evaluated for future construction workers who may contact groundwater and subsurface soil during any future excavation and construction activities performed at the site.

After completing the baseline human health risk assessment for Site 2, EPA determined that beryllium no longer is classified as a carcinogen by the ingestion route. Beryllium no longer is a COPC; the maximum concentration detected in the subsurface soil samples does not exceed the EPA Region III industrial worker risk-based screening value. In addition, after completing the baseline human health risk assessment, the oral reference dose (RfD) for chromium increased from $3.0x10^{-3}$ to $5.0x10^{-3}$, which increases both the ingestion and dermal hazard quotients (HQs). The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure to the human population, including sensitive subpopulations, in which the exposure is likely to be without appreciable risk of deleterious effects during a lifetime. The HQ is the ratio of a single-substance exposure level over a specified period (e.g. subchronic) to a reference dose for that substance derived from a similar exposure period. The dermal HQ is an adjustment of the ingestion HQ.

The ingestion and dermal contact of subsurface soil exposure by the construction worker was included in the assessment because of the potential for future work to be performed on the sanitary force main that runs through Site 2. As shown in Appendix C, the ingestion of subsurface soil and dermal contact with subsurface soil by the construction worker (revised cumulative hazard index = 63) resulted in an HI above the EPA's recommended level of 1.0 for noncarcinogens. The cumulative media-specific risk to a construction worker exposed to the subsurface soil ($2.0x10^{-6}$) is within the EPA's target risk range of $1.0x10^{-6}$ to $1.0x\ 10^{-4}$ for carcinogens.

Aluminum, antimony, arsenic, cadmium, chromium, copper, iron, and nickel were selected as COPCs for the construction worker scenario because the maximum concentrations detected in the subsurface soil samples exceeded EPA Region III industrial worker risk-based screening values and the site concentrations were statistically greater than the background concentrations (using a one-tailed Mann-Whitney U test for an upper confidence level of 95 percent).

Future Gardener and Agricultural Users

This exposure scenario was evaluated for future gardener and agricultural users using groundwater for nonpotable uses such as lawn or plant watering. Appendix C presents the results of this scenario. Results indicate that there are no unacceptable risks to future gardener and agricultural users posed by the groundwater at Site 2.

Future Downgradient Hand-Bay Car Wash Users

This exposure scenario was evaluated for future downgradient hand-bay car wash users using groundwater for vehicle washing. Appendix C presents the results of this scenario. Results indicate that there are no unacceptable risks to future downgradient hand-bay car wash users posed by the groundwater at Site 2.

Human Health Risks from Lead

Lead was detected at a maximum concentration of 9,820 parts per million (ppm) in the subsurface soil, 3,900 ppm in the sediment, 71.4 ppb in the unfiltered groundwater (it was not detected in the filtered groundwater), and 1,190 ppb in the surface water. The EPA has established an action level of 15 ppb for lead in groundwater and a residential screening level of 400 ppm for lead in soil. Additionally, a lead screening level of 609 ppm was calculated based on adult worker exposure to lead in soil following current EPA guidance (EPA, 1996) and EPA's requested higher ingestion rate.

The lead levels detected in the unfiltered groundwater and subsurface soil at Site 2 exceed these EPA-derived levels. EPA, the Navy, and Virginia DEQ agreed that unfiltered groundwater samples are to be used for determining risks from accidental exposures to shallow groundwater during excavation/construction activities. Although the lead levels detected in the unfiltered groundwater at Site 2 exceed the drinking water action level of 15 ppb, there was no statistically significant difference between the lead concentration in the unfiltered groundwater from the site wells and the upgradient wells (using a one-tailed Mann-Whitney U test for an upper confidence level of 95 percent). Furthermore, lead was not detected in any of the filtered groundwater samples. In addition, filtered sample results are to be evaluated for determining risks from potable use of groundwater. Additionally, the City of Norfolk Health Department prohibits use of the groundwater from the water table aquifer for public or private potable water supplies under City ordinance Chapter 46.1, Reference 46.1-5.
The City of Norfolk supplies all potable water to the city and NSN, and there are no potable water supply wells at NSN. Therefore, the groundwater is not used as a potable source at NSN.

2.5.2 Summary of Ecological Evaluation

In addition to the human health risks identified for Site 2, an ecological risk assessment (ERA) was completed and documented in the 1998 RI report. The ERA considered the ecological effects from contaminated soil, surface water, and sediment. Groundwater data was not included because, from an ecological perspective at this site, exposure to contaminated groundwater is possible at locations where groundwater discharges to the surface as seeps or discharges into surface water or wetlands. The surface water, therefore, was used to represent contaminant levels in this media.

The ERA evaluated and analyzed the results from the 1998 RI, including sampling and chemical analysis of the media of concern. Potential ecological receptors were determined from observations during the 1998 RI, and from a habitat evaluation that was conducted to

identify potential aquatic and terrestrial ecological receptors. Contaminants detected were evaluated to determine if they posed a risk to aquatic or terrestrial receptors.

The overall list of identified contaminants was reduced to a list of COPCs. The COPCs are site-related contaminants used to estimate ecological exposures and potential adverse effects on the site receptors. The following criteria were used in selecting COPCs:

- Chemicals were compared with established Biological Technical Assistance Group benchmarks
- A benchmark HQ was calculated for each chemical analyzed at Site 2 by dividing the maximum concentration of contaminants detected in soil, sediment, and surface water by the corresponding lowest BTAG benchmark-screening values
- Any chemical having a benchmark HQ greater than 1.0 was designated as a COPC

EPA ecological risk assessment guidance (EPA 1997) was used to calculate risk. Exposure concentrations were compared with ecological endpoints, such as reproductive failure or reduced growth. For each receptor species, the maximum exposure concentration (dose) of each COPC was calculated, based on species-specific information. The dose then was divided by the no-observed-adverse-effects level (NOAEL) and the lowest-observed-adverse-effect level (LOAEL) to calculate the NOAEL HQ and the LOAEL HQ, respectively. The NOAEL is the highest level of a contaminant evaluated in a toxicity test or biological field survey that causes no statistically significant difference in effects compared with the controls or a reference site. The LOAEL is the lowest level of a contaminant evaluated in a toxicity test or biological field survey that causes no statistically significant difference in effects compared with the controls or a reference site. Based on EPA ecological risk assessment guidance, the NOAEL HQ and the LOAEL HQ with a value greater than 1.0 indicates that the exposure concentration has the potential to cause adverse effects in receptor species.

Summaries of the ecological risks to aquatic or terrestrial receptors are presented below.

Aquatic Risks – Potential ecological risks to aquatic receptors were evaluated based on analytical data of surface water and sediment samples. Based on the results of the screening level risk assessment, there is "potential ecological risk" at Site 2 from the following metals in surface water: aluminum, cadmium, copper, iron, lead, silver, and zinc. There is "potential ecological risk" at Site 2 from the following metals in sediment: aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, nickel, selenium, silver, thallium, vanadium, and zinc. Pesticides and PAHs do not pose adverse ecological risk.

Terrestrial Risks – Potential ecological risks to terrestrial receptors were evaluated based on analytical data of soil samples. Based on the results of the screening level risk assessment, there is "potential ecological risk" at Site 2 from the following metals: aluminum, antimony, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. Pesticides and PAHs do not pose adverse ecological risk.

Threatened and Endangered Species – There are no Federal or State endangered or threatened species in the NSN Site 2 area.

Wetlands – Some of the sediment samples collected from the mature wooded wetland area (located southwest of the drainageway and north of the slag pile area) contained concentrations of lead that exceed BTAG screening values. However, there is no clear pattern to or "hot spot" related to the exceedances, and significant habitat destruction would be required to gain access to this area and accomplish any type of sediment removal. The Navy, EPA, and Virginia DEQ, including a representative from BTAG, agreed that it would be more ecologically destructive to remove sediment in this area than to leave the area as it is. Based on this agreement, the Navy, EPA, and Virginia DEQ made a risk management decision to leave the wooded wetland area intact.

Subsequently, representatives of the Navy and the U.S. Army Corps of Engineers conducted a site visit on March 25, 1999. The Corps of Engineers determined that the Site 2 drainageway is a man-made, upland stormwater management ditch and is not a jurisdictional wetland. The Corps determined that there is a small area within the mature wooded area southwest of the drainageway that could be considered jurisdictional wetland. Because the sediment removal action is limited to the stormwater management ditch and does not infringe upon the wooded wetland, the jurisdictional wetland area is not impacted.

2.6 Description of Remedial Alternatives

A detailed analysis of the possible remedial alternatives for the soil, groundwater, sediment, and surface water at Site 2 was conducted as part of the FS and PRAP reports. The detailed analysis was conducted in accordance with the EPA document entitled *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1989) and the NCP. A summary of the remedial alternatives evaluated for the Site 2 soil, groundwater, sediment, and surface water is presented below.

2.6.1 Subsurface Soil Remedial Alternatives

The primary contaminants of concern in the subsurface soil are various inorganics, with lead as the indicator parameter. Seven remedial alternatives were developed for subsurface soil remediation. The remedial alternatives are summarized as follows:

- Alternative 1 – No action
- Alternative 2 – Institutional controls
- Alternative 3 – Asphalt and soil cover, institutional controls, and long-term monitoring
- Alternative 4 – Excavation and off-site disposal
- Alternative 5 – Partial excavation, asphalt cover, institutional controls, and long-term monitoring

- Alternative 6 — *In situ* stabilization, soil cover, institutional controls, and long-term monitoring
- Alternative 7 — Excavation, on-site soil washing, and on-site disposal
- Alternative 8 — Partial excavation and *in situ* stabilization, institutional controls, and long-term monitoring

Table 2-3 presents brief descriptions of these remedial alternatives.

2.6.2 Groundwater Remedial Alternatives

Three groundwater remedial alternatives were developed and evaluated for Site 2. The three groundwater remedial alternatives include the following:

- Alternative 1 — No action
- Alternative 2 — Installation of an asphalt and soil cover and institutional controls
- Alternative 3 — Asphalt and soil cover, long-term monitoring, and institutional controls

A brief description of each groundwater alternative is provided in Table 2-4.

2.6.3 Sediment and Surface Water Remedial Alternatives

Four sediment and surface water remedial alternatives were developed and evaluated for Site 2. As noted previously, remediation of Site 2 sediment will result in a reduction of contaminant levels in the surface water. The four remedial alternatives include the following:

- Alternative 1 — No action
- Alternative 2 — Institutional controls
- Alternative 3 — Excavation, off-site disposal, and monitoring
- Alternative 4 — Excavation, on-site phytoremediation, and monitoring

A brief description of each remedial alternative is provided in Table 2-5.

TABLE 2-3
Summary of Subsurface Soil Remedial Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Asphalt and Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 4 Excavation and Off-Site Disposal	Alternative 5 Partial Excavation Asphalt Cover, Institutional Controls, and Long-Term Monitoring	Alternative 6 *In Situ* Stabilization, Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 7 Excavation, On-site Soil Washing, and On-Site Disposal	Alternative 8 Partial Excavation, *In Situ* Stabilization, Institutional Controls, and Long-Term Monitoring
Description	No remedial efforts will be conducted to reduce the contamination in the subsurface soil. No actions will be taken to reduce human and environmental contact with the subsurface soil contaminants. This remedial alternative was evaluated to provide a baseline for comparison with other remedial alternatives.	No action except land use controls (to prohibit the use of groundwater underlying the site for drinking water) will be incorporated in the Navy planning documents. Five-year site reviews (consisting of visual inspections and qualitative risk analyses) would be required, since contamination would be left in place.	Includes construction of an asphalt cover (over the existing gravel parking lot) and a soil cover (over the grassy field) over the contaminated soil. Includes incorporation of land use controls in the Navy planning documents to prohibit excavation or other disturbance of the soil and asphalt cover and to prohibit the use of groundwater underlying the site for drinking water. Five-year site reviews (based on long-term ground water monitoring) would be required, since contamination would be left in place.	Includes excavation of the contaminated soil, and off-site disposal in either a RCRA Subtitle C landfill (after off-site stabilization of the contaminated material) or disposal in a RCRA Subtitle D landfill, depending on the results of Toxicity Characteristic Leachate Procedure (TCLP) analyses. Characterization samples (for TCLP analyses) will be collected *in situ*, prior to initiation of excavation activities, preferably 90 days before.	Includes excavation of the contaminated soil near the sanitary force main on-site. Off-site disposal of the excavated soil would occur as described in Alternative 4. An asphalt cover also would be constructed over the original area of contamination. Includes incorporation of land use controls in the Navy planning documents to prohibit excavation or other disturbance of the asphalt cove and to prohibit the use of groundwater underlying the site for drinking water. Five-year site reviews (based on long-term groundwater monitoring) would be required, since part of the subsurface soil contamination would be left in place.	Includes *in situ* stabilization of the contaminated soil and installation of a soil cover over the stabilized media (to provide a buffer zone between potential receptors and the stabilized media). Stabilization uses a mix of inorganic reagents (for example, cement and lime) and the waste to form a chemically and mechanically stable solid. Includes incorporation of land use controls in the Navy planning documents to prohibit disturbance of the stabilized soil and soil cover and to prohibit the use of groundwater underlying the site for drinking water. Five-year site reviews (based on long-term ground-water monitoring), to track future contaminant migration would be required, since contaminated soil would be left in place.	Includes excavation of the contaminated soil, on-site soil washing of the excavated soil, and on-site disposal of the treated soil (after ensuring that the PRGs have been met).	Includes excavation of the contaminated soil down to the groundwater table and *in situ* stabilization of the remaining contaminated soil lying below the groundwater table (eliminates having to de-water the contaminated area). Stabilization uses a mix of inorganic reagents (for example, cement and lime) and the waste to form a chemically and mechanically stable solid. Includes incorporation of land use controls in the Navy planning documents to prohibit disturbance of the stabilized soil and to prohibit the use of groundwater underlying the site for drinking water. Five-year site reviews will be conducted (based on long-term groundwater monitoring) since part of the sub-surface soil contamination would be left in place. Off-site disposal of the excavated soil would occur as described in Alternative 4.
Estimated Time Until Action Is Complete	Immediate	1 month	1 month	3 months	1 month	2 1/2 months	8 1/2 months	3 months
Estimated Capital Cost	$0	$0	$437,000	$2.44 million - $8.19 million	$762,000 - $1.1 million	$2.93 million	$5.24 million	$2.44 million – $6.65 million

TABLE 2-3
Summary of Subsurface Soil Remedial Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Asphalt and Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 4 Excavation and Off-Site Disposal	Alternative 5 Partial Excavation Asphalt Cover, Institutional Controls, and Long-Term Monitoring	Alternative 6 *In Situ* Stabilization, Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 7 Excavation, On-site Soil Washing, and On-Site Disposal	Alternative 8 Partial Excavation, In Situ Stabilization, Institutional Controls, and Long-Term Monitoring
Estimated Annual O&M Cost	$0	$3,400	$14,000	$0	$14,000	$8,000	$0	$8,000
Estimated Net Present-Worth Cost	$0	$9,500	$573,000	$2.44 million - $8.19 million[2,3]	$898,000 ? $1.24 million[2]	$2.93 million	$5.24 million	$2.49 million ? $6.70 million[2]

[1] Assumes a duration of 30 years, for cost estimating purposes.

[2] The magnitude of the estimated net present-worth ranges for Alternative Nos. 4, 5, and 8 is dependent on whether the excavated waste is hazardous. The higher cost for hazardous waste disposal is attributed to the higher transportation and treatment/disposal costs. The cost range assumes that either 100 percent of the waste is hazardous (resulting in the higher estimated net present worth) or 100 percent of the waste is nonhazardous (resulting in the lower estimated net present worth).

[3] For Alternative 4, the estimated net present-worth cost assumes that either 100 percent of the excavated waste is nonhazardous or 100 percent of the excavated waste is hazardous. In fact, the actual conditions are likely to be that some material is hazardous, and some is not. If the assumption is made that 1/4 of the excavated waste is hazardous, 1/4 of the excavated waste is nonhazardous, and $^1/_2$ of the excavated waste can be used as backfill, the estimated net present-worth cost would be $2,509,000. If the assumption is made that 1/3 of the excavated waste is hazardous, 1/3 of the excavated waste is nonhazardous, and 1/3 of the excavated waste can be used as backfill, the estimated net present-worth cost would be $3,166,000. The costs for these last two sub-alternatives incorporate the costs for an extensive *in situ* characterization study (prior to excavation), which would take an additional 1.5 months to complete.

TABLE 2-4
Summary of Groundwater Remedial Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Installation of an Asphalt and Soil Cover and Institutional Controls	Alternative 3 Asphalt and Soil Cover, Long-Term Monitoring, and Institutional Controls
Description	No remedial efforts will be conducted to reduce potential for contamination to the groundwater. No action will be taken to reduce human and environmental contact with the groundwater. This remedial alternative was evaluated to provide a baseline for comparison to other alternatives.	Includes construction of an asphalt and soil cover, to limit downward percolation of precipitation into the groundwater table. Includes incorporation of land use controls in the Navy planning documents to prohibit the use of groundwater underlying the site for drinking water and prohibit excavation or other disturbance of the asphalt and soil cover. Fiveyear site reviews will be conducted since contamination will be left in place.	Includes construction of a cover, consisting of asphalt and soil, to limit downward percolation of precipitation into the groundwater table. Long-term monitoring would consist of collecting unfiltered and filtered groundwater samples from the six existing monitoring wells on-site annually for the first 5 years, and every 5 years thereafter (composing the five-year site reviews to ensure that further degradation of groundwater quality does not occur). Samples would be analyzed for inorganics. Includes incorporation of land use controls in the Navy planning documents to prohibit the use of groundwater underling the site for drinking water and to prohibit excavation or other disturbance of the asphalt and soil cover.
Estimated Time Until Action Is Complete	Immediate	1 month.	Same as Alternative 2.
Estimated Capital Cost	$0	$437,000	$437,000
Estimated Annual O&M Costs1	$0	$9,400	$14,000
Estimated Net Present-Worth Cost	$0	$523,000	$573,000

[1] Assumes a duration of 30 years, for cost estimating purposes.

TABLE 2-5
Summary of Sediment and Surface Water Remedial Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Excavation, Off-Site Disposal, and Monitoring	Alternative 4 Excavation, On-Site Phytoremediation, and Monitoring
Description	No remedial efforts will be conducted to reduce the contamination in the sediment and surface water. No actions will be taken to reduce human and environmental contact with the sediment and surface water contaminants. This remedial alternative was evaluated to provide a baseline for comparison with other remedial alternatives.	Includes incorporation of land use controls in the Navy planning documents to prohibit the use of groundwater underlying the site for drinking water. Five-year site reviews would be required, since contamination would be left in place. Five-year site reviews would consist of collecting and analyzing surface water and sediment samples.	Includes excavation of the contaminated sediment (to a depth of its interface with the underlying soil) and off-site disposal in either a RCRA Subtitle C landfill (after off-site stabilization of the contaminated material) or disposal in a RCRA Subtitle D landfill, depending on the results of Toxicity Characteristic Leachate Procedure (TCLP) analyses. Characterization samples (for TCLP analyses) will be collected *in situ*, prior to initiation of excavation activities, preferably 90 days before. If sediment contamination exists deeper than 2 feet below ground surface, the contamination may be excavated further or covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill (decision will be based on the direction of the Navy). Sediment and surface water contamination will be monitored to confirm that the channel has not been re-contaminated. Such monitoring will be conducted every year for the first 5 years after the contaminated sediment is excavated. Also includes stabilization of the west bank of the upstream section of the drainage channel (to prevent further erosion of contaminated sediment). Five-year reviews would be required if sediment contamination exists deeper than 2 feet below ground surface and such contaminated sediment is left in place and covered with an engineered cover layer.	Includes excavation of the contaminated sediment (to a depth of its interface with the underlying soil) and on-site phytoremediation of the excavated sediment. If sediment contamination exists deeper than 2 feet below ground surface, the contamination may be excavated further or covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill (decision will be made at the direction of the Navy). Sediment and surface water contamination will be monitored to confirm that the channel has not been re-contaminated. Also includes stabilization of the west bank of the upstream section of the drainage channel (to prevent further erosion of contaminated sediment). Five-year reviews would be required if sediment contamination exists deeper than 2 feet below ground surface and such contaminated sediment is left in place and covered with an engineered cover layer.
Estimated Time Until Action Is Complete	Immediate	1 month	2 months.	9 months (anticipated total time for on-site treatment of the sediment is one growing season).

TABLE 2-5
Summary of Sediment and Surface Water Remedial Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Excavation, Off-Site Disposal, and Monitoring	Alternative 4 Excavation, On-Site Phytoremediation, and Monitoring
Estimated Capital Cost	$0	$0	$270,000 - $590,000	$300,000
Estimated Annual O&M Costs[1]	$0	$10,400	$10,400	$10,400
Estimated Net Present-Worth Cost	$0	$29,000	$320,000 - $630,000[2].	$340,000[3]

1 Assumes a duration of five years for cost estimating purposes.

2 The magnitude of the estimated net present-worth range for Alternative No. 3 is dependent on whether the excavated waste is hazardous or not. The higher cost for hazardous waste disposal is attributed to the higher transportation and treatment/disposal costs. The cost range assumes that either 100 percent of the waste is hazardous (resulting in the higher estimated net present worth) or 100 percent of the waste is nonhazardous (resulting in the lower estimated net present worth).

3 The cost of Alternative No. 4 assumes that treated sediment can be left in place on-site after lead levels are reduced below 218 mg/kg.

2.7 Summary of the Comparative Analysis of Alternatives

As required by CERCLA, the remedial alternatives for soil, groundwater, sediment, and surface water described in Section 2.6 were evaluated against the nine evaluation criteria identified in the NCP at 40 C.F.R. Section 300.430(e)(9). The nine evaluation criteria fall into three categories: threshold criteria, primary balancing criteria, and modifying criteria.

The threshold criteria must be met for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major trade-offs among alternatives. Generally, the modifying criteria are taken into account after public comment is received on the PRAP. The nine evaluation criteria, which are summarized in Table 2-6, include the following:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with ARARs

Primary Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

2.7.1 Threshold Criteria

Overall Protection of Human Health and the Environment

Evaluation of the overall protectiveness of alternatives focused on whether a specific alternative would achieve adequate protection of human health and the environment and how risks posed by each exposure pathway would be eliminated, reduced, or controlled through treatment, engineering, or institutional controls. The overall assessment of the level of protection includes the evaluations conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Compliance with ARARs

This evaluation involved determining whether each alternative would meet all of the pertinent Federal and State ARARs. Chemical-specific ARARs are identified in Section 2.3 and location-and action-specific ARARs are identified in Appendix A of this ROD.

TABLE 2-6
Glossary of Evaluation Criteria
Site 2, Naval Station Norfolk, Norfolk, Virginia

- **Overall Protection of Human Health and the Environment** – Addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering, or institutional controls.
- **Compliance with ARARs/TBCs** – Addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements (ARARs), other criteria to be considered (TBCs), or other federal and state environmental statutes and/or provide grounds for invoking a waiver.
- **Long-Term Effectiveness and Permanence** – Refers to the magnitude of residual risk and to the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.
- **Reduction of Toxicity, Mobility, or Volume Through Treatment** – Refers to the anticipated performance of the treatment options that may be employed in an alternative.
- **Short-Term Effectiveness** – Refers to the speed with which the alternative achieves protection, as well as to the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.
- **Implementability** – Refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the chosen solution.
- **Cost** – Includes capital and operation and maintenance costs. For comparative purposes, provides present-worth values.
- **State Acceptance** – Indicates whether, based on its review of the RI and FS reports and the PRAP, the State concurs with, opposes, or has no comment on the selected alternative.
- **Community Acceptance** – Will be assessed in the ROD following a review of the public comments received on the RI and FS reports, and the PRAP.

Each alternative was evaluated for compliance with applicable or relevant and appropriate Federal and State requirements. The evaluation summarized which requirements are applicable or relevant and appropriate to each alternative. The following items were considered for each alternative:

- Compliance with chemical-specific ARARs (e.g., ambient water quality criteria); this factor addresses whether the ARARs can be met, and, if not, whether a waiver may be appropriate
- Compliance with location-specific ARARs (e.g., preservation of historic sites, regulations relative to activities near wetlands or floodplain, etc.); as with other ARAR-related factors, these involve consideration of whether the ARARs can be met or whether a waiver is appropriate
- Compliance with action-specific ARARs (e.g., RCRA minimum technology standards); it must be determined whether ARARs can be met or must be waived

2.7.2 Primary Balancing Criteria

Long-Term Effectiveness and Permanence

This criterion evaluated alternatives with respect to their long-term effectiveness and to the degree of permanence. The primary focus of this evaluation was the residual risk that will remain at the site and the effectiveness of the controls that will be applied to manage residual risks. The assessment of long-term effectiveness was made considering the following four factors:

- The magnitude of the residual risk to human and environmental receptors remaining from untreated waste or treatment residues at the completion of remedial activities
- An assessment of the type, degree, and adequacy of long-term management (including engineering controls, institutional controls, monitoring, and operation and maintenance) required for untreated waste or treatment residues remaining at the site
- An assessment of the long-term reliability of engineering and/or institutional controls to provide continued protection from untreated waste or treatment residues
- The potential need for replacement of the remedy and the continuing need for repairs to maintain the performance of the remedy

Reduction of Toxicity, Mobility, or Volume Through Treatment

This evaluation criterion addressed the degree to which the alternatives employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances. Alternatives that do not employ treatment technologies do not reduce toxicity, mobility, or volume of COCs through treatment. The evaluation considered the following specific factors:

- The treatment processes, the remedies that will be employed, and the materials that will be treated
- The amount or volume of hazardous materials that will be destroyed or treated
- The degree of expected reduction in toxicity, mobility, or volume, including how the principal threat is addressed through treatment
- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment

Short-Term Effectiveness

The short-term effectiveness of each alternative was evaluated relative to its effect on human health and the environment during implementation of the response action. Potential threats to human health and the environment associated with handling, treatment, or transportation of

hazardous substances were considered. The short-term effectiveness assessment was based on four key factors:

- Short-term risks that might be posed to the community during implementation of an alternative
- Potential impacts on workers during a response action and the effectiveness and reliability of protective measures
- Potential environmental impacts of the response action and the effectiveness and reliability of mitigating measures during implementation
- Time until remedial response objectives are achieved

Implementability

Implementability considerations included the technical and administrative feasibility of each alternative and the availability of various materials and services required for its implementation.
The following factors were considered during the implementability analysis:

- **Technical Feasibility:** The relative ease of implementing or completing an action based on site-specific constraints, including the use of established technologies, such as the following:
  - Ability to construct the alternative as a whole (constructibility)
  - Operational reliability or the ability of a technology to meet specified process efficiencies or performance goals
  - Ability to undertake future response actions that may be required
  - Ability to monitor the effectiveness of the remedy
- **Administrative Feasibility:** The ability and time required to obtain any necessary approvals and permits from regulatory agencies.
- **Availability of Services and Materials:** The availability of the technologies, materials, or services required to implement an alternative, including the following:
  - Available capacity and location of needed treatment, storage, and disposal services
  - Availability of necessary equipment, specialists, and provisions for necessary additional resources
  - Timing of the availability of prospective technologies under consideration
  - Availability of services and materials, plus the potential for obtaining bids that are competitive (this may be particularly important for innovative technologies)

Cost

For each remedial alternative, a detailed cost analysis was developed based on conceptual engineering and analyses. Unit prices were based on published construction cost data, quotes from vendors and contractors, and/or engineering judgment. Costs are expressed in terms of 1998 dollars. To allow the costs of remedial alternatives to be compared on the basis of a single figure, the estimated net present-worth value of all capital and annual costs was determined for each alternative. The EPA CERCLA RI/FS Guidance Document (EPA, 1988) recommends that a five percent discount rate be used in present-worth analyses.

2.7.3 Modifying Criteria

State Acceptance

State acceptance indicates whether, based on its review of the 1998 RI and FS reports and the PRAP, the State concurs with, opposes, or has no comment on the selected remedy. With respect to State acceptance, the VDEQ concurs with the selected remedy.

Community Acceptance

Community acceptance is assessed based on a review of comments received on the 1998 RI and FS reports and the PRAP. Community relations activities to date for Site 2 include establishment of an administrative record file, briefings to the Restoration Advisory Board regarding findings of the 1998 RI and FS, release of the PRAP for public review and comment on December 28, 1998, and a public meeting conducted on January 21, 1999. No written comments were received during the comment period. The public meeting was conducted on Thursday, January 21, 1999, at the Navy Lodge in Norfolk, Virginia. No one from the local community attended the meeting and no comments or questions were raised.

2.7.4 Comparative Analysis of Subsurface Soil Alternatives

Following is a comparative analysis of the remedial alternatives developed for subsurface soil using the first seven evaluation criteria. State acceptance and community acceptance are discussed in Section 2.7.3 above. Table 2-7 summarizes the comparative analysis for subsurface soil alternatives.

Overall Protection of Human Health and the Environment

The site-specific remedial action objective (RAO) for Site 2 subsurface soil is to prevent or minimize human health exposure to inorganic contaminants in the subsurface soil above health-based criteria.

TABLE 2-7
Summary of Comparative Analysis of Subsurface Soil Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Asphalt and Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 4 Excavation and Off-Site Disposal[1]	Alternative 5 Partial Excavation, Asphalt Cover, Institutional Controls, and Long-Term Monitoring[1]	Alternative 6 *In situ* Stabilization, Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 7 Excavation, On-Site Soil Washing, and On-site Disposal[1]	Alternative 8 Partial Excavation, *In situ* Stabilization, Institutional Controls, and Long-Term Monitoring
Overall Protection of Human Health and the Environment								
Exposure to Contaminated Subsurface Soil	Does not reduce exposure to contaminated subsurface soil and thus does not reduce risk to human health and the environment. Least protective of all the alternatives.	Would limit access and minimize chance of direct exposure but would not provide added protection of treatment or containment of Alternatives 3 through 8.	The asphalt and soil cover and land use controls will prevent exposure to contaminated subsurface soil. If excavation is required (e.g., during maintenance of the sanitary force main on site), necessary precautions would have to be taken to ensure that workers are protected.	Exposure to contaminated subsurface soil will be prevented because all contamination above the PRGs will be excavated and disposed of in an off-site landfill. Alternative 4 would provide the best level of protection.	The asphalt cover and land use controls will prevent exposure to contaminated subsurface soil. Construction workers would be protected (during future maintenance of the sanitary force main on-site), because the contaminated soil around the main will be excavated and disposed of in an off-site landfill.	Stabilization, accompanied by the soil cover and land use controls will prevent exposure to contaminated subsurface soil. If excavation is required (e.g., during maintenance of the sanitary force main on-site), necessary precautions would have to be taken to ensure that workers are protected.	Exposure to contaminated subsurface soil will be prevented because soil contaminants will be treated to at least meet the PRGs.	Exposure to contaminated subsurface soil will be prevented because the contaminated soil above the groundwater table will be excavated and disposed of in an off-site landfill, and the contaminated soil below the groundwater table will be stabilized (accompanied by land use controls). If excavation is required (e.g., during the maintenance of the sanitary force main on-site), necessary precautions would have to be taken to ensure that workers are protected.
Compliance with ARARs								
Chemical-Specific ARARs	Does not meet chemical-specific ARARs	Same as Alternative 1	Chemical-specific ARARs would be met by covering and land use controls, which would prevent future exposures to subsurface soil contamination.	Chemical-specific ARARs would be met because contaminant concentration above PRGs would be excavated and disposed of off-site.	Chemical-specific ARARs would be met by excavation, covering, and land use controls because exposures would be prevented.	Chemical-specific ARARs likely would be met by stabilization and land use controls because exposures would be prevented. Treatability studies would be required to ensure the treatment technology can cost-effectively meet the PRGs.	Chemical-specific ARARs likely would be met because soil washing will reduce contaminants to below PRGs. Treatability studies would be required to ensure the treatment technology can cost-effectively meet the PRGs.	Chemical-specific ARARs likely would be met because contaminant concentrations above PRGs above the groundwater table would be excavated and disposed of in an off-site landfill, and contaminated soil below the groundwater table would be stabilized. Treatability studies would be required to ensure the treatment technology can cost-effectively meet the PRGs.
Location-Specific ARARs	Not applicable, no action undertaken	Does not meet location-specific ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs
Action Specific ARARs	Not applicable, no action undertaken	Not applicable	Complies with ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs	Complies with ARARs
Long-Term Effectiveness and Permanence								
Residual Risk Remaining from Any untreated Waste or Treatment Residues at Completion of Remedial Activities	Source not remediated, risk remains	Remaining residual risk is reduced if institutional controls are enforced consistently by NSN.	Risk associated with contact would be reduced because the asphalt and soil cover will serve as a barrier between the subsurface soil contamination and potential receptors.	There will be no residual risk associated with subsurface soil contamination because it will be excavated and disposed of off-site.	Risk associated with contact would be reduced. Risk associated specifically with a construction worker maintaining the sanitary force main on-site would be eliminated.	Residual risk would be minimal because soil would be stabilized and covered, preventing exposure.	Residual risk would be eliminated because the soil would be treated, and residual contaminant concentrations will at least meet the PRGs.	There will be no residual risk associated with subsurface soil contamination above the groundwater table because it will be excavated and disposed of in an off-site landfill. Residual risk associated with stabilized soil below the groundwater table should be minimal.
Long-Term Reliability of Remedial Action to Provide Continued Protection from Any Untreated Waste or Treatment Residues	Source not remediated, risk remains	Reliability of institutional controls depends on how well they are enforced by NSN	Reliability of cover can be high if it is maintained. Failure to maintain cover can increase potential for direct contact with contaminants remaining on-site. Risk associated with contact would be reduced long-term, because land use controls will be	There will be no residual risk associated with subsurface soil contamination because it will be excavated and disposed of off-site.	Reliability of cover can be high if it is maintained. Failure to maintain cover can increase potential for direct contact with contaminants remaining on-site. Risk associated with contact would be	Reliability of stabilization can be high (will depend on treatability studies). Reliability of cover can be high if it is maintained. Failure to maintain cover can increase potential for	Reliability of on-site soil washing can be high (will depend on treatability studies)	Reliability of stabilization can be high (will depend on treatability studies). Reliability of institutional controls depends on how well they are enforced by NSN.

TABLE 2-7
Summary of Comparative Analysis of Subsurface Soil Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Asphalt and Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 4 Excavation and Off-Site Disposal[1]	Alternative 5 Partial Excavation, Asphalt Cover, Institutional Controls, and Long-Term Monitoring[1]	Alternative 6 *In situ* Stabilization, Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 7 Excavation, On-Site Soil Washing, and On-site Disposal[1]	Alternative 8 Partial Excavation, *In situ* Stabilization, Institutional Controls, and Long-Term Monitoring
			incorporated into the Navy planning documents to maintain the integrity of the asphalt and soil cover. Reliability of institutional controls depends on how well they are enforced by NSN.		reduced long-term, because land use controls will be incorporated into the Navy planning documents to maintain the integrity of the asphalt cover. Reliability of institutional controls depends on how well they are enforced by NSN.	direct contact with contaminants remaining on-site. Risk associated with contact would be reduced long-term, because land use controls will be incorporated into the Navy planning documents to maintain the integrity of the stabilized soil and soil cover. Reliability of institutional controls depends on how well they are enforced by NSN.		
Need for 5-Year Review	Not Applicable	Review would be required to ensure that adequate protection of human health and the environment is maintained (consisting of visual inspections and qualitative risk analysis) because contaminated material remains on site.	Same as Alternative 2	No review will be required because soil will be excavated and disposed of off-site.	Same as Alternative 2	Same as Alternative 2	No review will be required because soil will be treated, and contaminant concentrations will at least meet the PRGs.	Same as Alternative 2
Reduction of Toxicity, Mobility, or Volume Through Treatment								
Degree to Which the Toxicity, Mobility, or Volume of Hazardous Substances Are Reduced Through Treatment	None	None	None	None	None	For stabilized soil, mobility and exposure (toxic contaminants still will remain on-site, but will be stabilized and will not be available for exposure) will be significantly reduced, and volume will increase.	Toxicity, mobility, and volume will be reduced by the soil washing process	For stabilized soil, mobility and exposure (toxic contaminants still will remain on-site, but will be stabilized and will not be available for exposure) will be reduced significantly, and volume will increase.
Irreversible Treatment	No treatment performed	No treatment performed	No treatment performed	No treatment performed	No treatment performed	Stabilization is not easily reversed.	Soil washing is irreversible	Stabilization is not easily reversed.
Type and Quantity of Residuals Remaining After Remediation	No treatment undertaken, therefore, all contaminants remain on-site.	No treatment undertaken, therefore, all contaminants remain on-site.	All contaminated soil would remain on-site beneath the asphalt and soil cover.	No soil contamination above the PRGs would remain at Site 2.	No soil contamination above the PRGS would remain surrounding the sanitary force main on-site. Some contaminated soil would remain on-site beneath the asphalt cover.	Stabilized soil would remain on-site beneath the soil cover.	No soil contamination above the PRGS would remain at Site 2 (the soil washing solution would undergo on-site treatment and would be reused or disposed of at a local POTW).	Stabilized soil would remain on-site above the water table.
Statutory Preference for Treatment	Does not satisfy preference	Does not satisfy preference	Does not satisfy preference	Does not satisfy preference	Does not satisfy preference	Partially satisfies treatment preference	Satisfies treatment preference.	Partially satisfies treatment preference
Short-Term Effectiveness								
Short-Term Risks to the Community and Impacts on Workers and the Environment During Implementation of Remedial Action	No remedial action implemented.	Remedy implementation does not add to risk.	Increased risk to workers during installation of asphalt and soil cover. Temporary increase in fugitive dust emissions during installation of asphalt and soil cover.	Temporary increase in fugitive dust emissions during excavation and transport of contaminated soil.	Risk to community and workers because of temporary increase in fugitive dust emissions during excavation and transport of contaminated soil, and during installation of asphalt cover. Increased risk to workers during installation of asphalt cover.	Temporary increase in fugitive dust emissions during stabilization and installation of soil cover. Increased risk to workers during installation of soil cover.	Temporary increase in fugitive dust emissions during excavation and soil washing.	Temporary increase in fugitive dust emissions during excavation, transport, and stabilization.

TABLE 2-7
Summary of Comparative Analysis of Subsurface Soil Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Asphalt and Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 4 Excavation and Off-Site Disposal[1]	Alternative 5 Partial Excavation, Asphalt Cover, Institutional Controls, and Long-Term Monitoring[1]	Alternative 6 *In situ* Stabilization, Soil Cover, Institutional Controls, and Long-Term Monitoring	Alternative 7 Excavation, On-Site Soil Washing, and On-site Disposal[1]	Alternative 8 Partial Excavation, *In situ* Stabilization, Institutional Controls, and Long-Term Monitoring
Expected Time Until Action Is Complete	No time required.	1 month	1 month	3 months	1 month	2 ½ months	8 ½ months	3 months
Implementability								
Technical Feasibility – The Ability to Construct and Operate the Remedial Action	No construction or operation required.	No construction or operation required.	No difficulties in construction of the asphalt and soil cover, which requires conventional construction techniques.	Excavation and off-site disposal are implemented easily. Care would have to be exercised to avoid damaging the sanitary force main on-site.	Excavation and off-site disposal are implemented easily. Care would have to be exercised to avoid damaging the sanitary force main on-site. No difficulties in constructing the asphalt cover, which requires conventional construction techniques.	A treatability study is required for the stabilization process. Care would have to be exercised to avoid damaging the sanitary force main on-site. No difficulties in constructing the soil cover, which requires conventional construction techniques.	A treatability study is required for the soil washing process. Care would have to be exercised to avoid damaging the sanitary force main on-site.	Excavation and off-site disposal are implemented easily. A treatability study is required for the stabilization process. Care would have to be exercised to avoid damaging the sanitary force main on-site.
Ease of Doing More Action if Needed	Very easy to implement additional action.	Very easy to implement additional action.	Easy to implement additional action.	Difficult to implement additional action for the soil that will be disposed of in an off-site landfill. Easy to implement additional action at the site.	Difficult to implement additional action for the soil that will be disposed of in an off-site landfill. Relatively easy to implement additional action for the contaminated soil remaining on-site.	Difficult to implement additional action because of the nature of the stabilized material (forms a solidified matrix)	Easy to implement additional action for soil-washed material.	Difficult to implement additional action because soil above the groundwater table will be disposed of in an off-site landfill, and soil below the groundwater table will be stabilized, forming a solidified matrix.
Ability to Monitor Effectiveness	Easily monitored	Easily monitored. Evaluated during the five-year site reviews.	Easily monitored. Evaluated during the five-year site reviews.	No need for monitoring because no contamination above PRGs will remain.	Easily monitored. Evaluated during the five-year site reviews.	Easily monitored. Evaluated during the five-year site reviews.	No need for monitoring because no contamination above PRGs will remain.	Easily monitored. Evaluated during the five-year site reviews.
Administrative Feasibility – The Ability To Obtain Any Approvals and Permits from, and to Coordinate with, Other Agencies	Not applicable	Not applicable	Not applicable	Requires coordination with off-site disposal facility.	Requires coordination with off-site disposal facility.	Not applicable	Not applicable	Requires coordination with off-site disposal facility.
Availability of Services, Equipment, and Materials	Not applicable	Not applicable	Services, equipment, and materials are readily available for all aspects of remediation.	Services, equipment, and materials are readily available for all aspects of remediation.	Services, equipment, and materials are readily available for all aspects of remediation.	Specialty contractor required for stabilization. Many contractors are available.	Specialty contractor required for soil washing. Many contractors are available.	A variety of capable contractors are available for the excavation. Specialty contractor required for the stabilization process. Many contractors are available.
Cost								
Estimated Capital Cost	$0	$0	$437,000	$2.44 million – $8.19 million	$762,000 - $1.1 million	$2.93 million	$5.24 million	$2.44 million – $6.65 million
Estimated Annual O&M Cost[3]	$0	$3,400	$14,000	$0	$14,000	$8,000	$0	$8,000
Estimated Net Present Worth Cost	$0	$9,500	$573,000	$2.44 million – $8.19 million[2 4]	$898,000 - $1.24 million[2]	$2.98 million	$5.24 million	$2.49 million – $6.70 million[2]

[1] Alternative Nos 4, 5, and 7 – Since part (1.5 to 2 feet) of contaminated soil lies beneath the groundwater table, a component of these alternatives would include a form of dewatering. Either an absorbent material can be used to absorb the excess water (e.g., lime or Liquisorb®; the area can be dewatered using wellpoints (including filtration and discharge of the extracted water to the Site 2 drainageway); or the soil can be excavated in the July-through-November period when the groundwater table is lowest, depending on site conditions at the time of remediation. The cost estimate incorporates the cost for wellpoint installation and filtration of the extracted groundwater (conservative approach).

[2] The magnitude of the estimated net present-worth ranges for Alternative Nos 4, 5, and 8 depends on whether the excavated waste is hazardous. The higher cost for hazardous waste disposal is attributed to both the higher transportation and treatment/disposal costs. The cost range assumes that either 100 percent of the waste is hazardous (resulting in the higher estimated net present worth) or 100 percent of the waste is nonhazardous (resulting in the lower estimated net present worth).

[3] Assumes duration of 30 years, for cost-estimating purposes.

[4] For Alternative 4, the estimated net present-worth cost assumes that either 100 percent of the excavated waste is nonhazardous or 100 percent of the excavated waste is hazardous. In fact, the actual conditions likely are to be that some material is hazardous, and some is not. If the assumption is made that ¼ of the excavated waste is hazardous, ¼ of the excavated waste is nonhazardous, and ½ of the excavated waste can be used as backfill, the estimated net present-worth cost would be $2,509,000. If the assumption is made that 1/3 of the excavated waste is hazardous, 1/3 of the excavated waste is nonhazardousk and 1/3 of the excavated waste can be used as backfill, the estimated present worth cost would be $3,166,000. The costs for these last two sub-alternatives incorporate the costs for an extensive *in situ* (prior to excavation) characterization study, which would take an additional 1.5 months to complete.

Alternative 1 will not meet the RAO, since no action will be implemented to prevent exposure to the contaminated subsurface soil. Alternative 2 also will not meet the RAO for subsurface soil, since no action except groundwater use restrictions will be implemented. Alternative 3 will meet the RAO for subsurface soil because future exposures to contaminated soil will be prevented by the asphalt and soil cover. In addition, land use controls will be incorporated into the Navy planning documents to prevent future excavation or other disturbance of the asphalt and soil cover. In the event excavation is required in the contaminated area (e.g., for maintenance of the sanitary force main on-site), necessary precautions would need to be taken to ensure that the construction workers are protected adequately.

The remaining alternatives will meet or are expected to meet (in the case of the treatment alternatives that require treatability studies) the RAO for subsurface soil. Alternative 4 will be the most protective of human health and the environment. Alternative 4 will prevent exposure to contaminated subsurface soil because the contaminated soil will be excavated and disposed of appropriately off-site according to the characterization sample analyses. The characterization samples would be analyzed at an off-site laboratory for TCLP metals, ignitability, reactivity, corrosiveness, and total petroleum hydrocarbons (TPH), plus any other analyses required by the disposal facility.

In Alternative 5, part of the contaminated soil (surrounding the sanitary force main) will be excavated and disposed of appropriately off-site according to the characterization sample analyses, and an asphalt cover will be constructed over the area. In addition, Alternative 5 includes implementation of land use controls that will minimize exposure to contaminants in the subsurface soil by prohibiting excavation or other disturbance of the asphalt cover.

In Alternative 6, soil contamination above and below the groundwater table will be stabilized *in situ* by using a mix of inorganic reagents (for example, cement and lime) and the waste to form a chemically and mechanically stable solid. In addition, Alternative 6 includes implementation of land use controls that will minimize exposure to contaminants in the subsurface soil by prohibiting disturbance of the stabilized soil and soil cover.

In Alternative 7, contaminated soil will be soil washed and used as backfill on-site.

In Alternative 8, contaminated soil will be excavated down to the groundwater table and disposed of appropriately according to the characterization sample analyses. The characterization samples would be analyzed at an off-site laboratory for TCLP metals, ignitability, reactivity, corrosiveness, and total petroleum hydrocarbons, plus any other analyses required by the disposal facility. The soil contamination below the groundwater table will be stabilized *in situ* by using a mix of inorganic reagents (for example, cement and lime) and the waste to form a chemically and mechanically stable solid. In addition, Alternative 8 includes implementation of land use controls, which will minimize exposure to contaminants in the subsurface soil by prohibiting disturbance of the stabilized soil.

Compliance with ARARs

All alternatives, except Alternatives 1 and 2, would comply with chemical-, location-, and action specific ARARs. Chemical-specific ARARs are set forth in Section 2.3 and location- and action-

specific ARARs are set forth in Appendix A. Treatability studies would be required for Alternatives 6, 7, and 8 to ensure that the soil washing or in situ stabilization treatment technologies can cost-effectively meet the preliminary remediation goals (PRGs).

Long-Term Effectiveness and Permanence

Alternatives 4 and 7 provide the greatest level and similar degrees of long-term effectiveness and permanence because, under these alternatives, the site could be returned to normal use with few restrictions. These alternatives rely on disposal or treatment. Therefore, part of the overall evaluation of long-term effectiveness must consider the adequacy of the landfill that accepts the material for disposal.

Alternatives 6 and 8 provide a significant measure of permanence and long-term effectiveness. Subsurface soil will be stabilized and remain on-site following remedial action. It is expected that stabilized media will remain effective at immobilizing soil contaminants; however, land use controls and long-term monitoring would be required since the contamination would remain on-site.

Alternatives 3 and 5 provide a lesser degree of permanence than the other alternatives because contaminated soil will not be treated but will be covered. However, the cover will be coupled with land use controls, and a monitoring program will be implemented to assist in tracking contaminant migration. Land use controls under Alternative 3 prohibit excavation or other disturbance of the soil and asphalt cover and prohibit the use of groundwater underlying the site for drinking water. Land use controls under Alternative 5 prohibit excavation or other disturbance of the asphalt cover and prohibit the use of groundwater underlying the site for drinking water. In the event that an excavation is required in the contaminated area (e.g., for maintenance of the sanitary force main on-site), necessary precautions would need to be taken under Alternative 3 to ensure that the construction workers are adequately protected.

Reduction of Toxicity, Mobility, or Volume Through Treatment

At Site 2, transport of subsurface soil contaminants to surface water and sediment of the Site 2 drainage channel (the primary concerns for contaminant transport from Site 2 subsurface soil) will be reduced by stabilizing the west bank of the upstream section of the drainage channel, which is an element of the remedial action selected to address the sediment and surface water. The remainder of this section presents a discussion of the subsurface soil remedial alternatives' effectiveness in reducing contaminant toxicity and volume.

Alternative 7 provides the most significant decrease in contaminant toxicity and volume. In this alternative, soil washing will be used to remediate the soil to the PRGs, reducing toxicity and volume.

In Alternatives 6 and 8, the potential for receptors to be exposed to soil contamination will be reduced significantly because the contaminated soil remaining on-site would be stabilized. Stabilization is designed to limit the mobility of hazardous constituents in the waste and to improve the handling and physical characteristics of the waste. Stabilization uses a mix of inorganic reagents (for example, cement and lime) and the waste to form a chemically and

mechanically stable solid. Exposure to contaminant toxicity would be lower than if no action were to take place. Contaminant volume will increase because of the need to add stabilization agents.

In Alternatives 3 and 5, the cover will act as a physical barrier, preventing future exposures. Contaminant volume on-site will remain unchanged. In Alternative 4, the toxicity and volume of soil contamination will remain the same; however, the soil contamination will be removed from the site and disposed of, eliminating concerns over toxicity and volume at the site.

Short-Term Effectiveness

Alternatives 4 through 8 likely will cause a similar amount of disturbance to the surrounding community during implementation. In all of these alternatives, a significant amount of soil handling will be required, so the potential for fugitive dust and air emissions impacts exists.

Alternative 3 will cause less disturbance than the other alternatives because the remedial action consists primarily of asphalt and soil cover installation.

Implementability

Alternatives 6, 7, and 8 likely are the most technically challenging to implement. Treatability testing is required to validate the use of soil washing and stabilization technologies on NSN soil and to confirm that the technologies can meet the PRGs.

The remaining technologies (Alternatives 3 through 5) rely primarily on excavation and disposal, or installation of an asphalt and soil cover. These are typical construction activities and offer no significant technical challenge.

In addition, extreme care would have to be exercised during implementation of Alternatives 4 through 8 to avoid damaging the sanitary force main running through Site 2. Land use controls and five-year site reviews will be required in Alternatives 3, 5, 6, and 8 because stabilized or contaminated media will remain on-site following remedial action.

Cost

Table 2-7 presents a comparative cost summary of all eight subsurface soil remedial alternatives.

2.7.5 Comparative Analysis of Groundwater Alternatives

Following is a comparative analysis of the remedial alternatives developed for groundwater using the first seven evaluation criteria. State acceptance and community acceptance are discussed in Section 2.7.3 above. Table 2-8 summarizes the comparative analysis for the groundwater alternatives.

TABLE 2-8
Summary of Comparative Analysis of Groundwater Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Installation of an Asphalt and Soil Cover and Institutional Controls	Alternative 3 Asphalt and Soil Cover, Long-Term Monitoring, and Institutional Controls
Overall Protection of Human Health and the Environment			
Preventing Degradation of Groundwater by Reducing the Potential for Dissolved Lead to Leach into the Water table Aquifer at Site 2	No reduction in downward percolation of precipitation (and thereby no reduction of the potential for the leaching of dissolved lead) into the water table aquifer at Site 2.	Installing an asphalt and soil cover over the subsurface soil contamination will limit downward percolation of precipitation (thereby reducing the potential for leaching of dissolved lead) into the water table aquifer at Site 2. If construction activities were to occur where exposure to lead in groundwater were possible, necessary precautions would have to be taken to prevent risk to construction workers. Institutional controls will prohibit the use of groundwater underlying Site 2 for drinking water.	Same as Alternative 2, but includes long-term monitoring of groundwater to ensure that further degradation of groundwater quality does not occur.
Compliance with ARARs			
Chemical-Specific ARARs	Does not meet chemical-specific ARARs.	The chemical-specific ARAR (drinking water action level for lead) will be met in filtered groundwater. Institutional controls will prohibit the use of groundwater underlying Site 2 for drinking water. The chemical-specific ARAR for lead will not be met in unfiltered groundwater, since the lead levels in unfiltered groundwater at Site 2 are comparable to levels in unfiltered groundwater from background upgradient wells. In addition, lead levels in unfiltered groundwater are used in determining risks from accidental exposures to shallow groundwater during excavation/construction activities, and not for evaluating risks from potable use of groundwater. If construction activities were to occur where exposure to lead in groundwater were possible, necessary precautions would have to be taken to prevent risk to construction workers.	Same as Alternative 2.
Location-Specific ARARs	Not applicable; no action undertaken.	Complies with ARARs.	Same as Alternative 2.
Action-Specific ARARs	Not applicable; no action undertaken.	Complies with ARARs.	Same as Alternative 2.

TABLE 2-8
Summary of Comparative Analysis of Groundwater Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Installation of an Asphalt and Soil Cover and Institutional Controls	Alternative 3 Asphalt and Soil Cover, Long-Term Monitoring, and Institutional Controls
Long-Term Effectiveness and Permanence			
Residual Risk Remaining from Any Untreated Waste or Treatment Residues at Completion of Remedial Activities	No controls are in place to prevent the potential for dissolved lead to leach into the water table aquifer at Site 2.	There is no human health risk associated with filtered groundwater at the site; therefore, no residual risk from filtered groundwater will remain by implementing this alternative. Covering the land surface will reduce the potential for dissolved lead to leach into the water table aquifer at Site 2. No procedure will be implemented under this alternative to confirm whether contaminant levels are within protective levels.	There is no human health risk associated with filtered groundwater at the site; therefore, no residual risk from filtered groundwater will remain by implementing this alternative. Covering the land surface will reduce the potential for dissolved lead to leach into the water table aquifer at Site 2. Long-term monitoring will be implemented under this alternative to confirm whether contaminant levels are within protective levels.
Long-Term Reliability of Response Action To Provide Continued Protection from Any Untreated Waste or Treatment Residues	No controls are in place to prevent the potential for dissolved lead to leach into the water table aquifer at Site 2, therefore this is not reliable in the long-term.	No residual risk from filtered groundwater will remain by implementing this alternative. Covering the land surface will reduce the long-term potential for dissolved lead to leach into the water table aquifer at Site 2.	No residual risk from filtered groundwater will remain by implementing this alternative. Covering the land surface will reduce the long-term potential for dissolved lead to leach into the water table aquifer at Site 2. Long-term monitoring also will be implemented under this alternative to confirm whether contaminant levels are within protective levels.
Need for Five-Year Review	Not applicable.	Five-year reviews would be conducted to ensure that adequate protection of human health and the environment is maintained, and that degradation of groundwater does not occur.	Five-year site reviews would be conducted to ensure that adequate protection of human health and the environment is maintained, and that degradation of groundwater does not occur.
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Degree To Which the Toxicity, Mobility, or Volume of Hazardous Substances Are Reduced Through Treatment	None.	No treatment performed.	Same as Alternative 2.
Irreversible Treatment	Not applicable.	No treatment performed.	Same as Alternative 2.

TABLE 2-8
Summary of Comparative Analysis of Groundwater Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Installation of an Asphalt and Soil Cover and Institutional Controls	Alternative 3 Asphalt and Soil Cover, Long-Term Monitoring, and Institutional Controls
Type and Quantity of Residuals Remaining After Remediation	Lead in unfiltered groundwater may pose a risk to construction workers; however, the lead levels at Site 2 are comparable to levels in upgradient wells (therefore, treatment of Site 2 groundwater will not reduce the potential risk). If construction activities were to occur where exposure to lead in groundwater were possible, necessary precautions would have to be taken to prevent risk to construction workers.	Same as Alternative 1.	Same as Alternative 1.
Statutory Preference for Treatment	There is no human health risk in filtered groundwater, and lead levels in unfiltered groundwater are comparable to levels in upgradient wells; therefore, treatment alternatives were not evaluated.	Same as Alternative 1.	Same as Alternative 1.
Short-Term Effectiveness			
Short-Term Risks To the Community and Impacts on Workers and the Environment During Implementation of Remedial Action	No remedial action implemented.	Adds minimal risk because response action primarily consists of installing asphalt and soil cover.	Same as Alternative 2.
Time Until Action Is Complete	No time required.	Expected to take 1 month.	Same as Alternative 2.

TABLE 2-8
Summary of Comparative Analysis of Groundwater Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Installation of an Asphalt and Soil Cover and Institutional Controls	Alternative 3 Asphalt and Soil Cover, Long-Term Monitoring, and Institutional Controls
Implementability			
Technical Feasibility — The Ability to Construct and Operate the Remedial Action	No construction or operation required.	No difficulties in constructing the asphalt and soil cover.	Same as Alternative 2.
Ease of Doing More Action if Needed	Very easy to implement additional action.	Additional action can be implemented, easily if required.	Same as Alternative 2.
Ability to Monitor Effectiveness	Easily monitored.	Easily monitored. Evaluated during the five-year site reviews.	Easily monitored. Long-term monitoring would consist of collecting unfiltered and filtered groundwater samples from the six existing monitoring wells on-site annually for the first five years, and every five years thereafter. Samples would be analyzed for inorganics. Evaluated during the five- year site reviews.
Availability of Services, Equipment, and Materials	Not applicable.	Services, equipment, and materials are readily available for all aspects of remediation.	Same as Alternative 2.
Administrative Feasibility —The Ability and Time Required To Obtain Any Approvals and Permits from Regulatory Agencies	Not applicable.	Not applicable.	Not applicable.
Cost			
Estimated Capital Cost	$0	$437,000	$437,000
Estimated Annual O&M Costs[1]	$0	$9,400	$14,000
Estimated Net Present-Worth Cost	$0	$523,000	$573,000

[1] Assumes a duration of 30 years, for cost estimating purposes.

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Protection of Human Health and the Environment

The site-specific RAO for groundwater is to prevent degradation of groundwater quality by limiting downward percolation of precipitation (and thereby reducing the potential for the leaching of dissolved lead) into the water table aquifer at Site 2.

Alternative 1 will not meet the RAO, since no action will be implemented to limit downward percolation of precipitation into the water table aquifer. Alternatives 2 and 3 will meet the RAO. The RAO will be met because installing an asphalt and soil cover over the contaminated subsurface soil would limit downward percolation of precipitation into the water table aquifer at Site 2.

Compliance with ARARs

The chemical-specific ARAR (drinking water action level for lead) is being met for lead in filtered groundwater; however, no controls would be implemented to prevent degradation of groundwater quality under Alternative 1.

Under both Alternatives 2 and 3, the chemical-specific ARAR (drinking water action level for lead) will be met in filtered groundwater. Alternatives 2 and 3 include institutional controls which prohibit the use of groundwater underlying Site 2 for drinking water. The chemical-specific ARAR will not be met for lead in unfiltered groundwater, since the lead levels in unfiltered groundwater at Site 2 are comparable to levels in unfiltered groundwater from background upgradient wells. In addition, lead levels in unfiltered groundwater are used in determining risks from accidental exposures to shallow groundwater during excavation/construction activities, and not for evaluating risks from potable use of groundwater. If construction activities were to occur where exposure to lead in groundwater were possible, necessary precautions would have to be taken to prevent risk to a construction worker.

Long-Term Effectiveness and Permanence

There are no human health risks associated with filtered groundwater at the site; therefore, no residual risk from filtered groundwater will remain by implementing any of the developed alternatives. Under Alternatives 2 and 3, the soil and asphalt cover will reduce the potential for dissolved lead to leach into the water table aquifer at Site 2. No procedure would be in place under Alternative 2 to monitor contamination levels in the groundwater over time. Alternative 3 includes incorporation of a long-term monitoring program; therefore, it is more reliable than the other alternatives in providing continued protection from site contaminants.

Reduction of Toxicity, Mobility, or Volume through Treatment

None of the alternatives reduces the toxicity, mobility, or volume of hazardous substances in the groundwater through treatment. Reduction in toxicity and volume of lead is not an issue for filtered groundwater, since there is no risk to human health from filtered groundwater. Lead in unfiltered groundwater may pose a risk to a construction worker; however, the lead levels at Site 2 are comparable to levels in upgradient wells (therefore treatment of Site 2 groundwater will not reduce the potential risk). If construction activities were to occur where exposure to lead

in groundwater were possible, necessary precautions would have to be taken to prevent risk to a construction worker.

Short-Term Effectiveness

Alternatives 2 and 3 will cause a minimal amount of disturbance to the surrounding community during implementation since the remedial action consists primarily of installing a soil and asphalt cover.

Implementability

Alternatives 2 and 3 rely primarily on installing a soil and asphalt cover. This involves typical construction activities and presents no significant technical challenge.

Cost

Table 2-8 presents a comparative cost summary of all three groundwater alternatives.

2.7.6 Comparative Analysis of Sediment and Surface Water Alternatives

Following is a comparative analysis of the remedial alternatives developed for sediment and surface water using the first seven evaluation criteria. State acceptance and community acceptance are discussed in Section 2.7.3 above. Table 2-9 summarizes the comparative analysis of the sediment and surface water alternatives.

Overall Protection of Human Health and the Environment

The site-specific RAO for Site 2 sediment and surface water is to minimize, to the extent practical, the current risk to ecological receptors posed by lead-contaminated sediment and surface water, and to prevent further migration of contaminated sediment from the site.

Alternative 1 will not meet the RAO, since no action will be implemented to prevent exposure to the contaminated sediment and surface water. Alternative 2 also will not meet the RAO, since it only includes implementing institutional controls to prohibit the use of groundwater underlying the site for drinking water.

The remaining alternatives will meet the RAOs. In Alternative 3, contaminated sediment will be excavated and disposed of appropriately off-site according to the characterization sample (TCLP) analyses. In Alternative 4, contaminated sediment will undergo phytoremediation until the lead cleanup level is met (assume one growing season). Residual contamination that may be left in place under both alternatives will be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill. Remediation of Site 2 sediment under both Alternatives 3 and 4 will result in a reduction of contaminant levels in the surface water.

Compliance with ARARs

Alternatives 3 and 4, but not Alternatives 1 and 2, would comply with location-, action-, and chemical-specific ARARs. Treatability studies would be required for Alternative 4 to ensure the phytoremediation treatment technologies can meet the lead cleanup level (TBC criteria) for the sediment cost-effectively. Remediation of Site 2 sediment under both Alternatives 3 and 4 will result in a reduction of contaminant levels in the surface water because surface water in the

drainage channel no longer will come into contact with contaminated sediments. Surface water and sediment will be sampled under Alternatives 3 and 4, and surface water sampling results will be compared with ambient water quality criteria for lead.

Long-Term Effectiveness and Permanence

Alternatives 3 and 4 provide similar degrees of long-term effectiveness and permanence because, in these alternatives, the contaminated sediment would be removed, treated, or covered, and the site could be returned to normal use with certain restrictions. These alternatives rely on disposal or treatment. Part of the overall evaluation of long-term effectiveness must consider the adequacy of the landfill that accepts the excavated material under Alternative 3. It is expected there will be no residual risk remaining in the surface water under both alternatives, since surface water in the drainage channel no longer will come into contact with contaminated sediment.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 4 is the only alternative that involves treatment. Alternative 4 has the potential to provide a significant decrease in contaminant toxicity and volume in sediment through treatment. In this alternative, phytoremediation will be used to remediate the sediment to the lead clean-up level, reducing toxicity and volume. Arsenic, 4,4'-DDD, and 4,4'-DDE cannot be treated through phytoremediation; therefore, the toxicity and volume of those contaminants will not be reduced.

Residual contamination that may be left in place under this alternative will be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill.

Short-Term Effectiveness

Alternatives 3 and 4 will cause a similar amount of disturbance to the surrounding community during implementation. In both of these alternatives, a significant amount of sediment handling will be required, so the potential for fugitive dust and air emissions impacts exists. Depending on the effectiveness of dewatering of sediment, there is a potential for downstream contaminant transport.

Implementability

Alternative 4 is the most technically challenging alternative to implement. Treatability testing is required to validate using the phytoremediation technologies on NSN Site 2 sediment and to confirm the technologies can meet the lead clean-up level.

Dewatering sediment may pose some significant implementation challenges under both Alternatives 3 and 4.

Cost

Table 2-9 presents a comparative cost summary of all four alternatives

TABLE 2-9
Summary of Comparative Analysis of Sediment and Surface Water Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Excavation, Off-Site Disposal, and Monitoring	Alternative 4 Excavation, On-Site Phytoremediation, and Monitoring
Overall Protection of Human Health and the Environment				
Exposure to contaminated Sediment and Surface Water	Does not reduce exposure to contaminated sediment and surface water and thus does not reduce risk to human health and the environment. This remedy is not protective.	Does not reduce exposure to contaminated sediment and surface water and thus does not reduce risk to human health and the environment. This remedy is not protective.	Exposure to contaminated sediment will be prevented because sediment contamination above the lead clean-up level will be excavated and disposed of in an off-site landfill. In locations where it is too deep to excavate, the sediment contamination will be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill. The cover layer will reduce exposure to any remaining contaminated sediment. Remediation of Site 2 sediment will result in reduced contaminant levels in the surface water.	Exposure to contaminated sediment will be prevented because sediment contaminants will be excavated and treated to at least meet the lead clean-up level. Access restrictions may be required during remediation to protect ecological and human receptors from coming into contact with the excavated sediment while it is undergoing on-site treatment. In locations where it is too deep to excavate, the sediment contamination will be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill. The cover layer will reduce exposure to any remaining contaminated sediment. Remediation of Site 2 sediment will result in reduced contaminant levels in the surface level.
Compliance with ARARs/ TBCs				
Chemical-Specific TBCs	Does not meet chemical-specific TBCs.	Does not meet chemical-specific TBCs.	Chemical-specific TBCs for the sediment would be met because contaminant concentrations above lead clean-up level would be excavated and disposed of off-site or covered with an engineered cover layer. Remediation of Site 2 sediment will result in reduced contaminant levels in the surface water.	Chemical-specific TBCs for the sediment would be met because excavation and phyto-remediation will reduce concentrations to below the lead clean-up level. Treatability studies would be required to ensure the treatment technology can meet the lead clean-up level cost-effectively. Deeper contamination may be covered with an engineered cover layer. Remediation of Site 2 sediment will result in reduced contaminant levels in the surface water.
Location-Specific ARARs	Not applicable; no action undertaken	Not applicable.	Compliance with ARARs.	Compliance with ARARs.
Action-Specific ARARs	Not applicable; no action undertaken.	Not applicable.	Compliance with ARARs.	Compliance with ARARs.

TABLE 2-9
Summary of Comparative Analysis of Sediment and Surface Water Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Excavation, Off-Site Disposal, and Monitoring	Alternative 4 Excavation, On-Site Phytoremediation, and Monitoring
Long-Term Effectiveness and Permanence				
Residual Risk Remaining from Any Untreated Waste or Treatment Residues at Completion of Remedial Activities	Source not remediated; risk remains.	Source not remediated; risk remains.	There may be some residual risk associated with sediment contamination in locations where it is too deep to excavate; however, such sediment contamination will be covered with an engineered cover layer. Residual risk will be reduced in the surface water, since surface water in the drainage channel will not come into contact with contaminated sediment.	Residual risk will be reduced because the sediment would be treated, and residual contaminant concentrations will at least meet the lead clean-up level. There may be residual risk from arsenic, 4,4'-DDD, and 4,4'-DDE, which cannot be treated through phytoremediation. In addition, there may be some residual risk associated with sediment contamination in locations where it is too deep to excavate; however, such sediment contamination will be covered with an engineered cover layer. Residual risk will be reduced in the surface water, since surface water in the drainage channel will not come into contact with contaminated sediment.
Long-Term Reliability of Remedial Action To Provide Continued Protection from Any Untreated Waste or Treatment Residues	Source not remediated; long-term risk remains.	Source not remediated; long-term risk remains.	The long-term reliability of the remedial action is high, since the contaminated sediment would be excavated and disposed of off-site. The engineered cover layer will provide long-term protection from any contaminated sediment that remains on-site, provided that the cover layer is maintained. Failure to maintain the cover layer can increase potential for direct contact with contaminants remaining on-site.	The long-term reliability of the remedial action is high, since the contaminated sediment would be excavated and treated. The engineered cover layer will provide long-term protection from any contaminated sediment that remains on-site, provided that the cover layer is maintained. Failure to maintain the cover layer can increase potential for direct contact with contaminants remaining on-site.
Need for Five-Year Review	Not applicable.	Because contaminated material remains on-site, five-year reviews would be required to ensure that adequate protection of human health and the environment is maintained.	Five-year reviews will need to be conducted to ensure that the channel has not been re-contaminated by soil from the west bank of the upstream section of the drainage channel adjacent to the NM slag pile area.	Monitoring will be required during phytoremediation treatment. In addition, five-year reviews would need to be conducted to ensure that the channel has not been re-contaminated by soil from the west bank of the upstream section of the drainage channel immediately adjacent to the NM slag pile area.

TABLE 2-9
Summary of Comparative Analysis of Sediment and Surface Water Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Excavation, Off-Site Disposal, and Monitoring	Alternative 4 Excavation, On-Site Phytoremediation, and Monitoring
Reduction of Toxicity, Mobility, or Volume Through Treatment				
Degree to which the Toxicity, Mobility, or Volume of Hazardous Substances Are Reduced Through Treatment	None.	None.	No treatment of contaminants in the sediment or surface water will be performed.	Toxicity and volume of contaminants in sediment will be reduced by phytoremediation, with the exception of arsenic, 4,4'-DDD, and 4,4'-DDE.
Irreversible Treatment	Not applicable.	Not applicable.	Not applicable.	Phytoremediation is irreversible.
Type and Quantity of Residuals Remaining After Remediation	No treatment undertaken; therefore, all contaminants will remain on-site.	No treatment undertaken; therefore, all contaminants will remain on-site.	Sediment contamination above the lead-clean-up level may remain at Site 2 in locations where it is too deep to excavate; however, any such sediment contamination will be covered with an engineered cover layer. Contaminants in the surface water will be reduced, since surface water in the drainage channel will not come into contact with contaminated sediment after it has been excavated or covered.	Sediment contamination may remain at Site 2, because arsenic, 4,4'-DDD, and 4,4'-DDE cannot be treated through phytoremediation. In addition, sediment contamination may remain in locations where it is too deep to excavate; however, any such sediment contamination will be covered with an engineered cover layer. Contaminants in the surface water will be reduced, since surface water in the drainage channel will not come into contact with contaminated sediment after it has been excavated or covered.
Statutory Preference for Treatment	Does not satisfy preference	Does not satisfy preference	Does not satisfy preference	Satisfies treatment preference.
Short-Term Effectiveness				
Short-Term Risks to the Community and Impacts on Workers and the Environment During Remediation Implementation	No action undertaken.	This remedy does not add to risk.	Temporary increase in fugitive dust emissions during excavation and transport of sediment. Also, potential for downstream contamination transport, depending on the effectiveness of dewatering of sediment.	Temporary increase in fugitive dust emissions during excavation of sediment. Also, potential for downstream contamination transport, depending on the effectiveness of dewatering of sediment.
Expected Time Until Action Is Complete	No time required.	1 month.	2 months.	9 months (anticipated total time for on-site treatment of the sediment is one growing season).
Implementability				
Technical Feasibility — The Ability to Construct and Operate the Remedial Action	No construction or operation required.	No construction or operation required.	Excavation and off-site disposal are easy to implement; however, both access and dewatering may pose significant challenges because of the close proximity of the adjacent jurisdictional wetlands.	A treatability study is required for the phytoremediation process. Excavation is easy to implement; however, both access and dewatering may pose significant challenges because of the close proximity of the adjacent jurisdictional wetlands.

TABLE 2-9
Summary of Comparative Analysis of Sediment and Surface Water Alternatives
NM Slag Pile (Site 2), Naval Station Norfolk, Norfolk, Virginia

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Institutional Controls	Alternative 3 Excavation, Off-Site Disposal, and Monitoring	Alternative 4 Excavation, On-Site Phytoremediation, and Monitoring
Ease of Doing More Action if Needed	Very easy to implement additional action.	Very easy to implement additional action.	Difficult to implement additional action for the soil that will be disposed of in an off-site landfill. Easy to implement additional action at the site.	Easy to implement additional action for treated material.
Ability to Monitor Effectiveness	Easily monitored.	Easily monitored.	Easily monitored. Monitoring would be required because contamination in the sediment above the lead clean-up level may remain on-site.	Easily monitored during the duration of phytoremediation treatment. Monitoring also would be required because contamination in the sediment above the lead clean-up level may remain on-site.
Administrative Feasibility—The Ability and Time Required To Obtain Any Approvals and Permits from Regulatory Agencies	Not applicable.	Not applicable.	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed. No permitting is anticipated.	Same as Alternative 3.
Availability of Services, Equipment, and Materials	Not applicable.	Not applicable.	Services, equipment, and materials are readily available for all aspects of remediation, including bank stabilization.	Specialty contractor required for phytoremediation. Contractors are available for both phytoremediation and bank stabilization.
Cost				
Estimated Capital Cost	$0	$0	$270,000 - $590,000	$300,000
Estimated Annual O&M Costs[1]	$0	$10,400	$10,400	$10,400
Estimated Net Present-Worth Cost	$0	$29,000	$320,000 - $630,000[2]	$340,000[3]

[1] Monitoring assumed to occur annually for five years after the sediment is excavated.

[2] The magnitude of the estimated net present-worth range for Alternative No. 3 depends on whether the excavated waste is hazardous. The higher cost for hazardous waste disposal is attributed to the higher transportation and treatment/disposal costs. The cost range assumes that 100 percent of the waste is hazardous (resulting in the higher estimated net present worth) or 100 percent of the waste is nonhazardous (resulting in the lower estimated net present worth). Monitoring assumed to occur annually for a duration of five years, for cost-estimating purposes.

[3] The cost for Alternative No. 4 assumes that treated sediment can be left in place on-site after lead levels are reduced below 218 mg/kg. Monitoring assumed to occur annually for a duration of five years, for cost-estimating purposes.

2.8 The Selected Remedy

The selected remedy for Site 2 is identified below:

Subsurface Soil – Alternative 3: Asphalt and Soil Cover, Institutional Controls, and Long-term Monitoring

Groundwater – Alternative 3: Asphalt and Soil Cover, Long-term Monitoring, and Institutional Controls

Sediment and Surface Water – Alternative 3: Excavation, Off-site Disposal, and, Monitoring

A description of the selected remedy is presented below. Monitoring programs and institutional controls associated with each media are described in Section 2.8.4.

2.8.1 Selected Subsurface Soil Remedy

The selected subsurface soil remedy for Site 2 is Alternative 3, consisting of constructing an asphalt and soil cover, long-term monitoring, and implementing institutional controls.

The major components of the selected subsurface soil remedy are the following:

Asphalt and Soil Cover – The Navy shall construct an asphalt and soil cover over the contaminated soil area, as shown in Figure 2-3. The soil will be compacted and graded to act as a proper subbase. The asphalt cover will be constructed over the existing gravel parking lot and will consist of asphalt pavement. The asphalt cover will be gently sloped to prevent surface water ponding. The extent of the asphalt cover will provide for continued use as a parking lot. The soil cover will be constructed over the remainder of the contaminated area, which is vegetated by grass.

Long-term (Groundwater) Monitoring Program –The Navy shall conduct a groundwater monitoring program to track future contaminant migration. The groundwater monitoring requirements are described in Section 2.8.4, Performance Standards, below.

Institutional Controls – The selected subsurface soil remedy shall include implementing land use controls, as described in Section 2.8.4, below.

2.8.2 Selected Groundwater Remedy

The selected groundwater remedy for Site 2 is Alternative 3, consisting of constructing an asphalt and soil cover, long-term monitoring, and institutional controls. The major components of the selected groundwater remedy are the following:

Asphalt and Soil Cover – The asphalt and soil cover is described in Section 2.8.1, above.

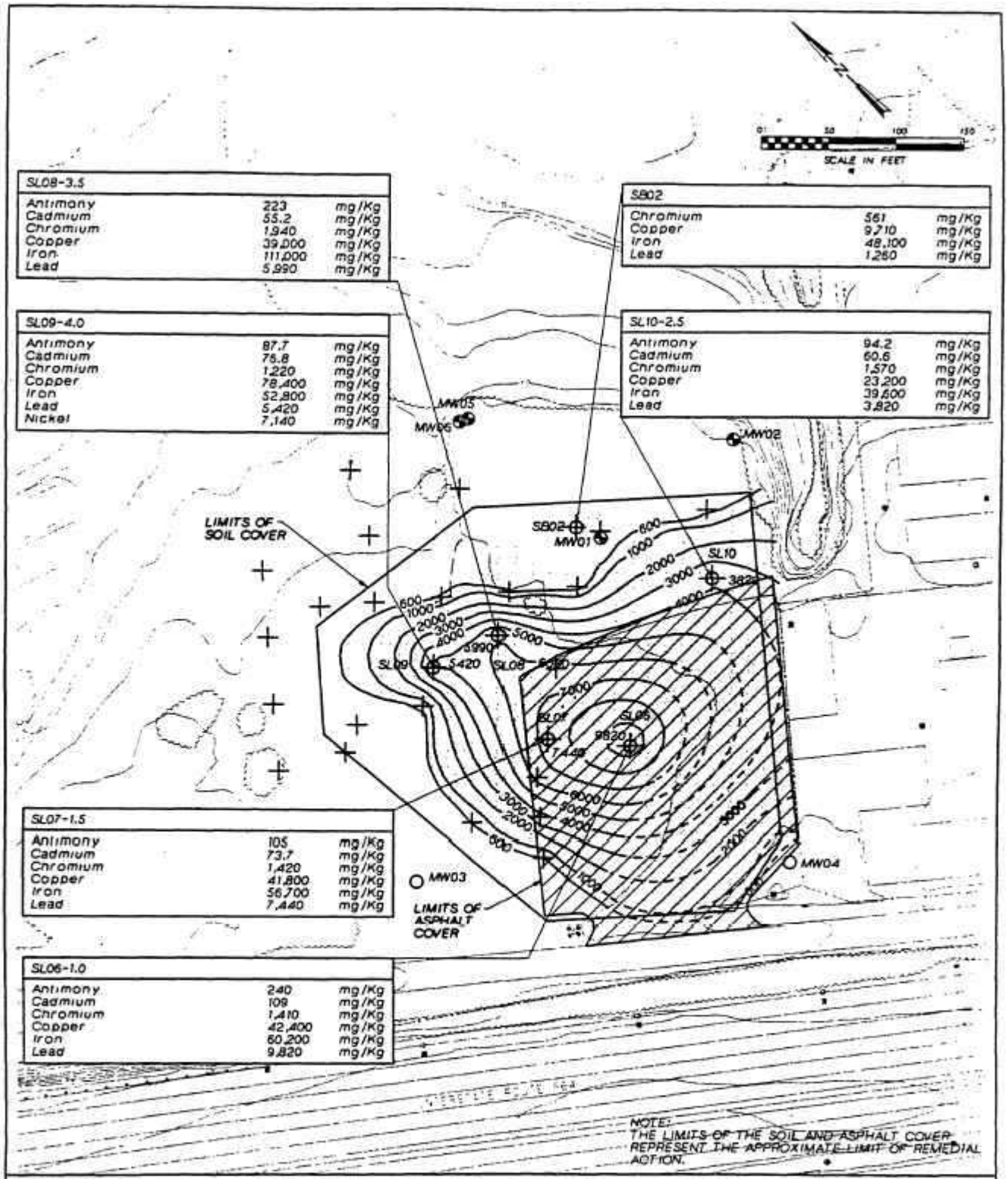

Figure 2-3

AERIAL EXTENT OF ASPHALT & SOIL COVER, CONTOUR PLOT OF LEAD CONCENTRATIONS IN SUBSURFACE SOIL SAMPLES, LOCATIONS OF PRG® EXCEEDANCES, AND LOCATIONS OF GROUNDWATER MONITORING WELLS, NM SLAG PILE (Site 2), Naval Station, Norfolk

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Long-Term (Groundwater) Monitoring Program – The Navy shall conduct a groundwater monitoring program to track future contaminant migration. The groundwater monitoring requirements are described in Section 2.8.4, Performance Standards, below.

Institutional Controls – The selected groundwater remedy shall include implementing land use controls, as described in Section 2.8.4, below.

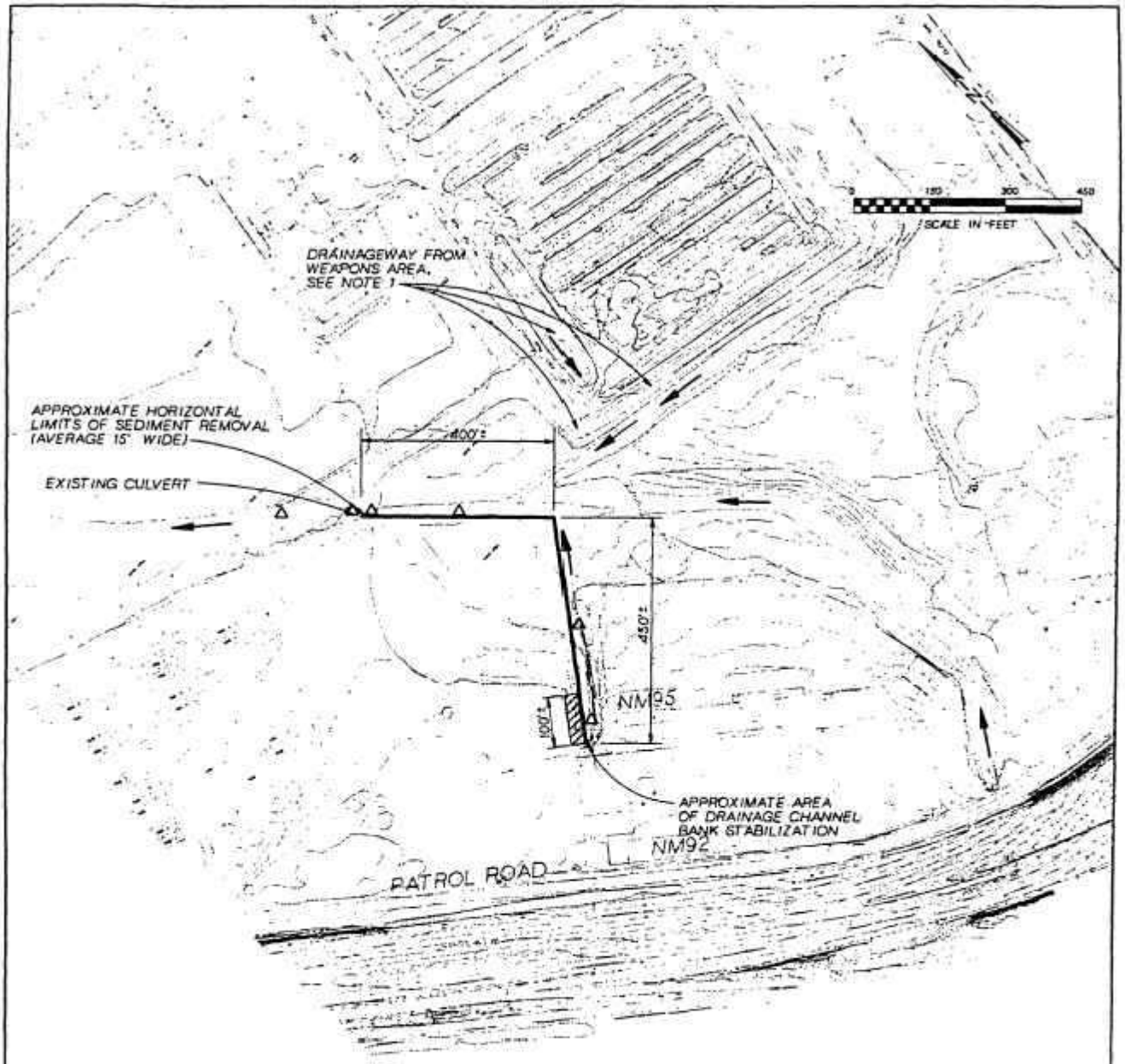
This selected groundwater remedy will provide overall protection through long-term monitoring of contaminant levels and through preventing potential consumption of groundwater.

2.8.3 Selected Sediment and Surface Water Remedy

The selected sediment and surface water remedy for Site 2 is Alternative 3, consisting of excavation and off-site disposal of sediments, bank stabilization, and monitoring. Figure 2-4 shows the approximate horizontal limits of excavation, area of drainage channel bank stabilization, and sediment and surface water monitoring locations. The major components of the selected sediment and surface water remedy are as follows:

Excavation and Off-site Disposal – The contaminated sediment in the drainage channel adjacent to the slag pile will be excavated to a depth of its interface with the underlying soil. A minimum of ten confirmatory samples will be collected and analyzed. If the confirmatory samples indicate that lead levels in the remaining sediment in sections of the drainage channel are above the remediation level of 218 mg/kg, additional sediment will be removed until a minimum of two feet of sediment has been excavated. If compliance with the cleanup level is not demonstrated following excavation of two feet of sediment, a design alternative has been developed to avoid over-excavating potentially contaminated material and handling and disposing of excessive quantities of sediment. If, following excavation of two feet of sediment, contamination above the cleanup level for lead is present in the sediment, the area may be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill. Portions of the channel may be excavated to native soil, and portions may be covered with the engineered cover alternative after a minimum two-foot excavation. The decision will be made by the Navy based on actual field conditions during construction.

The excavated sediment will be dried (dewatered) and tested to determine if it is hazardous by characteristic in accordance with the RCRA regulations at 40 CFR Part 261, Subpart C. If the excavated sediment is determined to be hazardous waste by characteristic, it will be stored on-site in accordance with 40 CFR Part 264, Subpart I, prior to being transported to an appropriate off-site disposal facility permitted under Subtitle C of RCRA, 42 U.S.C § 6925, and in compliance with the RCRA regulations at 40 CFR Part 264. If the sediment is determined not to be hazardous by characteristic, it will be transported to an off-site RCRA Subtitle D solid waste disposal facility.



NOTES:

1. DRAINAGE CHANNELS FROM WEAPONS AREA HAVE BEEN SAMPLED AND WERE BELOW CLEAN-UP CRITERIA.

LEGEND

- SURFACE WATER FLOW DIRECTION
- HORIZONTAL LIMIT OF SEDIMENT REMOVAL
- AREA OF DRAINAGE CHANNEL BANK STABILIZATION
- △ PROPOSED SEDIMENT AND SURFACE WATER MONITORING LOCATIONS

Figure 2-4
APPROXIMATE LIMITS OF SEDIMENT EXCAVATION, AREA OF BANK STABILIZATION, AND MONITORING LOCATIONS
NM AREA SLAG PILE
(SITE 2), Naval Station, Norfolk

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Bank Stabilization – The west bank of the upstream section of the drainage channel immediately adjacent to the NM slag pile area will be stabilized to prevent contaminated soil from migrating into the drainage channel and to prevent further migration of contaminated sediment from Site 2. The bank will be re-graded and protected from future erosion by seeding and by installing erosion control matting or riprap for a distance of about 100 feet as shown in Figure 2-4.

Sediment and Surface Water Monitoring Program – The Navy shall conduct a sediment and surface water monitoring program to confirm that the drainage channel has not been recontaminated. The sediment and surface water monitoring requirements are described in Section 2.8.4, below.

2.8.4 Performance Standards

Asphalt and Soil Cover Design Criteria – The asphalt cover will be constructed over the existing gravel parking lot (one acre in area) as shown in Figure 2-3, and shall include construction of durable, flexible pavement that resists cracking. The asphalt cover will be a minimum of two inches thick. The soil cover, consisting of clean fill, will be constructed over the grassy field as shown in Figure 2-3, and will be a minimum of one foot thick. The asphalt and soil cover shall prevent direct contact with the underlying slag pile soil, and shall control surface water runon and runoff.

Sediment Excavation Design Criteria – The excavation design shall include the following performance standards:

- Excavate contaminated sediment in the drainage channel adjacent to the slag pile to meet the remediation level of 218 mg/kg for lead. If, after two feet of sediment have been excavated, compliance with the remediation level is not demonstrated, a design alternative has been developed to avoid over-excavating potentially contaminated material and handling and disposing of excessive quantities of sediment. At the direction of the Navy, if two feet of sediment has been excavated and the remediation level of 218 mg/kg for lead has not been reached, then the area may be backfilled with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill to prevent future migration of sediment. Portions of the channel may be excavated to native soil, and portions may be covered with the engineered cover alternative after a minimum two-foot excavation. The decision will be made by the Navy based on actual' field conditions during construction. Figure 2-4 shows the approximate horizontal limits of excavation.

During the course of remedial action, the following steps will be taken to minimize impacts on the environment:

- The removal of larger trees will be avoided, where possible.

- Fixed routes of ingress and egress will be established and maintained during the remedial action.

- Work will be conducted such that, to the extent practical, only the north and east sides of the channel are disturbed.

Bank Stabilization – The west bank of the upstream section of the drainage channel immediately adjacent to the NM slag pile area will be re-graded and protected from future erosion by seeding and by installing erosion control matting or riprap, for a distance of about 100 feet as shown in Figure 2-4.

Groundwater Monitoring – The groundwater monitoring program shall start after the asphalt and soil cover is constructed, and shall include the following:

- Annual unfiltered and filtered groundwater sampling for inorganics analysis for the first five years, to ensure that inorganic contamination is not increasing over time.

- Collecting samples from the following six existing groundwater monitoring wells: MW01, MW02, MW03, MW04, MW05, and MW06 (shown in Figure 2-3).

- After an analysis of the first five years of groundwater monitoring data, changing the sampling frequency to collecting unfiltered and filtered groundwater samples for inorganics analysis once every five years thereafter.

Sediment and Surface Water Monitoring – The sediment and surface water monitoring program shall start after the contaminated sediment is excavated. Sediment and surface water samples will be collected at six representative locations ,every year for the first 5 years (after the sediment is excavated) and analyzed for inorganics: Sample locations were determined based on past analytical results. Sample locations are within and downgradient of the remedial action. Locations were chosen such that they can be sampled over time (to conduct a trend analysis).

Land Use Controls (Institutional Controls) – The Navy will limit the uses of Site 2 to reduce to the greatest extent practical the risk that contaminants of concern (COCs) left in place may cause a threat to human health or the environment. The following land use control (LUC) objectives for Site 2 have been selected. The Navy will prohibit: 1) excavating or disturbing the asphalt and soil covers, provided the sewage main traversing the site may be maintained from time to time, as necessary or appropriate; 2) the use of groundwater underlying the site for drinking water; and 3) any other activity that would disturb the integrity of the asphalt and soil covers or impair the function of groundwater monitoring systems.

Within 270 days of the execution of this ROD, the Navy, in consultation with the Commonwealth of Virginia and with the concurrence of the EPA, Region III, will develop a land use control implementation plan (LUCIP) for the site. The LUCIP will include the following:

1. A description of the site, including information on prior use, approximate size, and COCs remaining in the ground;

2. The location of Site 2;

3. The LUC objectives set out above;

4. The actual LUCs the Navy will implement;

5. A reference to this ROD; and

6. Any other pertinent information.

The Navy, in consultation with the Commonwealth of Virginia and with the concurrence of the EPA, Region III, will develop a land use control assurance plan memorandum of agreement (MOA) for Naval Station Norfolk. The MOA will contain Station-wide inspection, certification, and notification procedures designed to effect the LUCIP. The MOA will provide reasonable assurances to EPA, Region III and the Commonwealth of Virginia that the Navy will maintain the chosen LUCs indefinitely, or until such time as they are no longer required to protect human health or the environment.

Although the terms and conditions of the MOA will not be specifically incorporated or made enforceable in this or any other ROD, it is understood and agreed by the Navy, EPA, and the Commonwealth of Virginia, that the contemplated permanence of the remedy selected herein depends upon the Navy's good-faith compliance with its commitment to implement and maintain LUCs appropriate to the land use control objectives stated above. Should such compliance not occur or should the MOA herein contemplated be terminated, the EPA, Region III and the Commonwealth of Virginia may reconsider the adequacy of the remedy herein selected and may prescribe additional measures to' protect human health and the environment.

2.9 Statutory Determinations

A selected remedy must satisfy the statutory requirements of Section 121 of CERCLA, 42 U.S.C. § 9621, which include the following:

- Overall protection of human health and the environment
- Compliance with ARARs (or justification of a waiver)
- Cost-effectiveness
- Use of permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable
- Preference for treatment that reduces toxicity, mobility, or volume as a principal element, or explanation as to why this preference is not satisfied

The evaluation of how the selected remedy for Site 2 satisfies these requirements is presented below.

2.9.1 Overall Protection of Human Health and the Environment

The selected remedy will protect human health and the environment. The asphalt and soil cover and land use controls will prevent direct contact with contaminated soil at Site 2. If excavation is required (e.g., during maintenance of the sanitary force main on-site), necessary precautions would have to be taken to ensure the workers are protected. In addition, installing an asphalt and soil cover over the subsurface soil contamination will limit downward percolation of precipitation into the water table aquifer at Site 2. Groundwater monitoring at Site 2 will provide a warning mechanism for potential groundwater contamination and ensure the asphalt and soil cover is effective in protecting human health. Since the remedy will leave contaminated soil at the site, the remedial action will be reviewed no less often than every five years after its initiation to ensure continued protection of human health and the environment.

Contact with contaminated sediment will be prevented because contamination above the lead cleanup level will be excavated and disposed of in an off-site landfill. In locations where it is too deep to excavate, contact with contaminated sediment will be prevented because the contaminated sediment will be covered with an engineered cover layer consisting of a bi-directional geogrid material and clean backfill. Remediation of Site 2 sediment will result in a reduction of contaminant levels in the surface water since surface water in the drainage channel will no longer come into contact with contaminated sediment. Monitoring of sediment and surface water will be conducted annually for the first five years after excavation of the sediment to confirm that the channel has not been re-contaminated.

2.9.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with applicable or relevant and appropriate requirements. Chemical-specific ARARs/TBCs are identified in Section 2.3 and location- and action-specific ARARs are presented in Appendix A.

2.9.3 Cost-Effectiveness

The selected remedy provides overall cost-effectiveness compared with all the alternatives developed for soil, with the exception of the no-action alternative. However, the no-action alternative does not meet all the NCP criteria. The estimated total net present-worth cost of the selected subsurface soil remedy in this ROD is $573,000. Since the selected remedy for groundwater is the same as the selected remedy for subsurface soil, there will be no additional costs to implement the groundwater remedy.

The estimated total net present-worth cost range of the selected sediment and surface water remedy in this ROD is $320,000 (assuming that the sediment is characterized as nonhazardous) to $630,000 (assuming that the sediment is characterized as hazardous), which also provides overall cost-effectiveness compared with all the alternatives developed for sediment and surface water, with the exception of the no action alternative. However, the no action alternative does not meet all the NCP criteria. The estimated net present-worth cost range of the entire selected remedy for the site is $893,000 to $1,203,000, depending on whether the excavated sediment is characterized as nonhazardous or hazardous, respectively.

2.9.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy uses permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable at Site 2. The selected asphalt and soil cover and sediment excavation with off-site disposal are permanent solutions; however, treatment of the soil is not practicable because of the large volume of contaminated soil (which resulted in treatment alternatives that were not cost-competitive with the selected remedy).

Alternative 4 for sediment and surface water, which includes treatment of contaminated sediment by phytoremediation, was not selected for sediment remediation because arsenic, 4,4'-DDD, and 4,4'-DDE cannot be treated through phytoremediation.

2.9.5 Preference for Treatment as a Principal Element

The selected remedy does not satisfy the preference for remedies using, as a principal element, treatment that permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants. The selected remedy represents a better balance of trade-offs under the evaluation criteria than the alternatives using treatment. The large volume of contaminated soil resulted in treatment alternatives that were not cost-competitive with the selected remedy.

Alternative 4 for sediment and surface water, which includes treatment of contaminated sediment by phytoremediation, was not selected for sediment remediation because arsenic, 4,4'-DDD, and 4,4'-DDE cannot be treated through phytoremediation.

2.10 Documentation of Significant Changes

Although the Selected Remedy for Site 2 set forth in this ROD is the same as the Preferred Alternatives set forth in the PRAP, except for the significant changes noted below, the numbering of the remedial alternatives for (a) subsurface soil and (b) sediment and surface water, changed from the PRAP to this ROD. In the PRAP, Remedial Alternative 1 for both (a) subsurface soil and (b) sediment and surface water was a "No Action" alternative; however, the PRAP described the "No Action" alternative as including land use restrictions. An alternative that includes land use restrictions (institutional controls) is considered to include an action; therefore, it cannot be considered a "No Action" alternative. Consequently, the list and numbering of alternatives for (a) subsurface soil and (b) sediment and surface water has been revised in this ROD so that Alternative 1 is a "No Action" alternative and Alternative 2 is an "Institutional Controls" alternative for these media. This, in turn, resulted in a re-numbering of the other alternatives, so that Remedial Alternative 2 (the Preferred Alternative) for subsurface soil in the PRAP became Remedial Alternative 3 (the Selected Remedy) for subsurface soil in this ROD, and Remedial Alternative 2 (the Preferred Alternative) for sediment and surface water in the PRAP became Remedial Alternative 3 (the Selected Remedy) for sediment and surface water in this ROD. The other alternatives for these media were re-numbered accordingly. This matter did not affect the remedial alternatives for groundwater.

The selected remedy for Site 2 set forth in this ROD is the same as the preferred alternatives presented in the PRAP, with two exceptions. The first change concerns the type of cover being placed over the contaminated soil. The Navy, EPA, and VDEQ discussed the need for an asphalt cover over the entire area (Alternative 2 for subsurface soil in the PRAP), and agreed to a technical change in the cover requirements. The requirement for an asphalt cover over the existing gravel parking area remains, but a soil cover will be provided instead of the asphalt cover over the grassy field, as presented in Alternative 3, Asphalt and Soil Cover, Institutional Controls, and Long-Term Monitoring, in this ROD. The purpose of the cover is to reduce exposure to site contaminants, and a soil cover provides the same amount of protection as an asphalt cover by limiting access to the surface soils. A soil cover, which also serves as a grassy field, is more attractive and environmentally friendly than a paved area. It also provides a cost savings over an asphalt cover in that part of the site.

The second change concerns the frequency of sediment and surface water monitoring. The PRAP stated that such monitoring would be conducted every year for the first five years, and every five years thereafter for the full 30-year study period. As part of the selected remedy, contaminated sediments will be removed and the eroding bank will be stabilized. The only contamination that may be left in place will be in subsurface soil beneath the soil and asphalt cover. Because of this, the selected remedy set forth in this ROD includes sediment and surface water monitoring annually for the first five years, but does not include monitoring beyond the first five years. An evaluation of sediment and surface water contamination will be made at the five-year review.

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3.0 Responsiveness Summary

The final component of this ROD is the responsiveness summary. A notice of availability of the 1998 RI, FS, and PRAP was published in the Virginian Pilot from December 28, 1998, to December 30, 1998. The notice requested that written comments, concerns, and questions about the site be submitted during the public comment period, which was held from December 28, 1998, to January 28, 1999. A public meeting was conducted on January 21, 1999, at the Navy Lodge in Norfolk, Virginia, to formally present the PRAP and to answer questions and receive comments. No one from the local community attended the meeting and no comments or questions were raised. This responsiveness summary is divided into the following sections:

- Overview
- Background on Community Involvement
- Summary of Comments Received During the Public Comment Period and Agency Responses

3.1 Overview

At the time of the public meeting on January 21, 1999, the Department of the Navy had endorsed the preferred alternatives in the PRAP to address the contamination in the subsurface soil, groundwater, sediment, and surface water. The preferred alternative in the PRAP for subsurface soil required construction of an asphalt cover over the contaminated soil area, institutional controls to prevent excavation or disturbance of the covered area, and long-term groundwater monitoring. The preferred alternative for groundwater required the same components as the preferred alternative for the subsurface soil. The preferred alternative for sediment and surface water required excavation and off-site disposal of the contaminated sediment, stabilizing the west bank of the upstream section of the drainage channel adjacent to the NM slag pile area, and sediment and surface water monitoring. The preferred alternative for the sediment and surface water also included an option to construct an engineered cover layer of a geogrid material over the remaining sediment if the clean-up level is not reached after two feet of sediment have been excavated. EPA Region III and the Commonwealth of Virginia concurred with the preferred alternatives presented in the PRAP.

No comments were received during the public comment period (held from December 28, 1998, to January 28, 1999) or at the public meeting (held on January 21, 1999).

3.2 Background on Community Involvement

The Community Relations Plan (CRP) for NSN was finalized in May 1993. Before the CRP was finalized, community interviews were conducted to provide information on site activities and to encourage community involvement. The Navy has established a Restoration Advisory Board (RAB) for NSN to provide a forum for cooperation between the Navy, EPA, and the local community. The RAB is composed of agency representatives, technical and business persons, and members of the community. Meetings are held regularly and proposed actions are described to the community. The community is given site tours of new treatment facilities as these facilities are placed in operation. An information brochure describing recent cleanup activities was prepared in 1997 for members of the RAB and other interested persons in the local community. This brochure described project highlights and cost and time savings achieved through team partnering at the NSN.

3.3 Summary of the Comments Received During the Public Comment Period and Agency Responses

The public comment period on the 1998 RI, FS, and PRAP was held from December 28, 1998, to January 28, 1999. No comments were received from the public during the public comment period.

4.0 References

CH2M HILL, August 1998. Final Remedial Investigation (RI) of the NM Slag Pile, Naval Base, Norfolk, Norfolk, Virginia.

CH2M HILL, September 1998. Final Feasibility Study, NM Slag Pile, Naval Base, Norfolk, Norfolk, Virginia.

Long, E.R., D.D. MacDonald, S.L. Smith and F.D. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management 19 (1): 81-97.

Naval Base, Norfolk, Partnership Human Health Consensus Agreement No. 6.C, August 1997.

Naval Base, Norfolk, 2010 Land Use Plan, August 1995.

EPA. June 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, U.S. Environmental Protection Agency.

EPA. December 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. Technical Review Workgroup for Lead, U.S. Environmental Protection Agency.

A.T. Kearney, Inc. March 1992. Revised Final Phase II RCRA Facility Assessment of the Norfolk Naval Base — Sewell's Point, Norfolk, Virginia.

EPA. 1989. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA - Interim Final. OSWER Directive 9355.3-01. EPA/540/G-89/004.

Malcolm Pirnie, Inc. March 1988. Installation Restoration Program Remedial Investigation Interim, Report, Naval Base, Norfolk, Norfolk, Virginia.

ESE. February 1983. Initial Assessment Study of the Sewell's Point Naval Complex, Norfolk, Virginia.

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Appendix A

Location- and Action-Specific Applicable or Relevant and Appropriate Requirements

Table A-1a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
National Archaeological and Historic Preservation Act					
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Construction on previously undisturbed land would require an archaeological survey of the area.	Alteration of terrain that threatens significant scientific, prehistoric, historic, or archaeologic data.	36 CFR 65; 16 USC 469	Not applicable	Construction will not be occurring on previously undisturbed land. No known buildings or archaeological sites have been documented for this area. If archaeological artifacts are found, the Navy will stop construction.
Endangered Species Act of 1973*					
Critical habitat upon which endangered species or threatened species depend	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior. Reasonable mitigation and enhancement measures must be taken, including live propagation, transplantation, and habitat acquisition and improvement.	Determination of the effect on endangered or threatened species or its habitat by conducting biological assessments.	16 USC 1531; 16 USC 1536(a); 50 CFR 81, 225, 402	Not applicable	Although no endangered or threatened animal species have been observed within the area of Site 2, if a determination is made during design or construction that the work will impact any endangered or threatened species, then work will be halted or modified until a biological assessment is conducted.
Migratory Bird Treaty Act of 1972*					
Migratory bird area	Protects almost all species of native birds in the U.S. from unregulated "taking" which can include poisoning at hazardous waste sites.	Presence of migratory birds.	16 USC Section 703	Applicable	Migratory birds have been located at Site 2. The requirements of this regulation will be incorporated into the response action and if any species of migratory birds are identified then the construction sequence will be modified for their protection.
Fish and Wildlife Coordination Act, Fish and Wildlife Improvement Act of 1978, Fish and Wildlife Conservation Act of 1980*					
Area affecting stream or other water body	Provides protection for actions that would affect streams, wetlands, other water bodies, or protected habitats. Any action taken should protect fish or wildlife.	Diversion, channeling, or other activity that modifies a stream or other water body and affects fish or wildlife.	16 USC 661; 16 USC 662; 16 USC 742(a); 16 USC 2901; 50 CFR 83.	Applicable	Remedial activities occurring at Site 2 will incorporate the requirements of this regulation (for the protection of fish and wildlife) and any action taken should be designed to protect any natural habitat. This will include relocating fish or other habitat to an undisturbed section of the stream

Table A-1a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Procedures for Implementing the Requirements of the Council of Environmental Quality on the National Environmental Policy Act and Executive Order 11990, Protection of Wetlands*					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands. Wetlands of primary ecological significance must not be altered so that ecological systems in the wetlands are unreasonably disturbed.	Wetland as defined by Executive Order 11990 Section 7.	40 CFR 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302	Not applicable	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. Precautions will be taken so that the small wetland area adjacent to the site will not be disturbed.
Clean Water Act, Section 404*					
Wetland	The degradation Section requires degradation or destruction of wetlands and other aquatic sites be avoided to the extent possible. Dredged or fill material must not be discharged to navigable waters if the activity: contributes to the violation of the Virginia water quality standards; CWA Sec. 307; jeopardizes endangered or threatened species; or violates the requirements of Title III of the Marine Protection, Research, and Sanctuaries Act of 1972.	Wetland as defined by Executive Order 11990 Section 7.	40 CFR 230.10; 40 CFR 231 (231.1, 231.2, 231.7, 231.8)	Not applicable	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.
Coastal Zone Management Act*					
Within the coastal zone	Regulates activities affecting the coastal zone, including lands thereunder and adjacent shoreland. The coastal zone is rich in a variety of natural, commercial, recreational, ecological, industrial, and aesthetic resources of immediate and potential value to the present and future well-	Activities affecting the coastal zone, including lands thereunder and adjacent shoreland.	Section 307(c) of 16 USC 1456(c); 16 USC 1451 et seq.; 15 CFR 930; 15 CFR 923.45	Applicable	Site 2 is located within Virginia's coastal zone, therefore the requirements of this regulation will be incorporated into the response actions. The remedial action will be conducted c onsistent with State of Virginia management programs.

Table A-1a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
	being of the Nation. Must conduct activities in a manner consistent with approved State management programs.				

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that DON accepts the entire statues or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

ARARs - Applicable or relevant and appropriate requirements.
CFR - Code of Federal Regulations.
CWA - Clean Water Act.
EO - Executive Order.
EPA - Environmental Protection Agency.
FR - Federal Register
RCRA - Resource Conservation and Recovery Act.
USC - United States Code.

Table A-2a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisite	Citation	ARAR Determination*	Comments
Resource Conservation and Recovery Act (RCRA) 42 USC 6901 et seq.					
Onsite waste generation	Waste generator shall determine if that waste is hazardous was te.	Generator of hazardous waste.	40 CFR 262.10(a); 262.11	Not applicable	Applicable for any operation where waste is generated. Excavated materials were determined not to be RCRA hazardous waste.
Hazardous waste accumulation	Generator may accumulate waste on-site for 90 days or less or must comply with requirements for operating a storage facility.	Accumulate hazardous waste.	40 CFR 262.34	Not applicable	Waste generated at Site 2 was determined not to be hazardous. Accumulation of wastes onsite for longer than 90 days would not be subject to the substantive RCRA requirements for storage facilities.
Recordkeeping	Generator must keep records.	Generate hazardous waste.	40 CFR 262.4	Not applicable	Administrative requirements are not ARARs for onsite CERCLA actions.
Excavation	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for the excavated waste or closure requirements for the unit in which the waste is being placed.	Material containing RCRA hazardous wastes subject to land disposal restrictions are placed in another unit.	40 CFR 268.40	Not applicable	Excavated wastes determined not to be hazardous.
Placement of waste in land disposal unit	Attain land disposal treatment standards before putting waste into landfill in order to comply with land disposal restrictions.	Placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, or underground mine or cave.	40 CFR 268.40	Not applicable	Excavated wastes determined not to be hazardous.
Clean Water Act (CWA), 33 USC 1251 et seq.*					
Discharge to POTW	Pretreatment standards. Control the introduction of pollutants into POTWs so as to: prevent interference with the operation of a POTW; prevent pass through of pollutants through a treatment works; and improve opportunities to recycle and reclaim municipal and industrial wastewater and sludges.	Discharge to a POTW.	40 CFR 403	Not applicable	TBC for unpermitted section of landfill. However, entire landfill will be closed in accordance Virginia solid waste landfill regulations.

Table A-2a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Discharge of treatment system effluent	Water quality standards.	Point source discharge to waters of the United States.	40 CFR 122.44(a)	Relevant and appropriate	Discharge of treatment system effluent is not planned as part of the response action at Site 2. Regulation is relevant and appropriate to potential discharge to the drainageway (from dewatering during the sediment excavation).
	Best Management Practices. Develop and implement a Best Management Practice program to prevent the release of toxic constituents to surface waters.				
	Best available technology. Use of Best Available Technology (BAT) economically achievable is required to control toxic and nonconventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants.		40 CFR 125.100		
	Monitoring Requirements: Discharge must be monitored to assure compliance. Comply with additional substantive requirements such as: mitigate any adverse effects of any discharge, and proper operation and maintenance of treatment systems.		40 CFR 122.41(i), (j)		

Table A-2a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Criteria for Classification of Solid Waste Disposal Facilities and Practices, 40 CFR Part 257*					
Solid waste dispos al	A facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary or a court-or State-established alternative.	Solid waste disposal facility and practices except agricultural wastes, overburden resulting f rom mining operations, land application of domestic sewage, location and operations of septic tanks, solid or dissolved materials in irrigation return flows, industrial discharges that are point sources subject to permits under CWA, source special nuclear or by-product material as defined by the Atomic Energy Act, hazardous waste disposal facilities that are subject to regulation under RCRA Subtitle C, disposal of solid waste by underground injection, and municipal solid waste landfill units.	40 CFR 257.3-4 and Appendix I	Not applicable	Groundwater in the area of remediation is not a drinking water source.
	A facility shall not cause a discharge of pollutants into waters of the U.S. that is in violation of the substantive requirements of the NPDES under CWA Section 402, as amended.		40 CFR 257.3-3(a)	Not applicable	No discharge to the drainage channel is planned as part of the response action.
	A facility shall not cause discharge of dredged material or fill material to waters of the U.S. that is in violation of the substantive requirements of CWA Section 404.		40 CFR 257-3.3	Not applicable	The response action at Site 2 will not include the disposal of dredge or fill material into waters of the U.S.

Table A-2a
Potential Federal Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Solid waste disposal (continued)	A facility or practice shall not cause nonpoint source pollution of waters of the U.S. that violates applicable legal substantive requirements implementing an area wide or Statewide water quality management plan approved by the Administrator under CWA Section 208, as amended.	Solid waste disposal facility and practices except agricultural wastes, overburden resulting from mining operations, land application of domestic sewage, location and operations of septic tanks, solid or dissolved materials in irrigation return flows, industrial discharges that are point sources subject to permits under CWA, source special nuclear or by-product material as defined by the Atomic Energy Act, hazardous waste disposal facilities that are subject to regulation under RCRA Subtitle C, disposal of solid waste by underground injection, and municipal solid waste landfill units.	40 CFR 257-3.3(c)	Applicable	The response action may include the disposal of wastes in a solid waste disposal facility. Substantive requirements would be applicable to an onsite disposal facility for nonhazardous wastes.
	The facility or practice shall not engage in open burning of residential, commercial, institutional, or industrial solid waste.	No open burning is planned as part burning of agricultural wastes in the field, silvicultural wastes for forest management purposes, land clearing debris from emergency cleanup operations, and ordnance.	40 CFR 257.3-7(a)	Not applicable	No open burning is planned as part of the response action at site 2.
	The facility shall not violate applicable requirements developed under a SIP approved or promulgated by the Administrator pursuant to CAA Section 110, as amended.		40 CFR 257.3-7(B)	Not applicable	No solid waste management units that would impact the SIP are planned.

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that DON accepts the entire statues or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

ACLs – Alternate concentration limits.

APEN – Air Pollution Emission Notice

ARAR - Applicable or relevant and appropriate requirement.

BACT – Best available control technology.

BDAT – Best demonstrated control technology.

CAA – Clean Air Act.

CAMU – Correction action management unit.

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act.

CFR - Code of Federal Regulations

CWA – Clean Water Act

DOT – Department of Transportation.

EPA – Environmental Protection Agency

LAER – Lowest achievable emission rate.

MCL – Maximum contaminant level.

MCLG – Maximum contaminant level goal.

NAAOS – National ambient air quality standards (primary and secondary).

NCP – National Contingency Plan.

NESHAP – National emission standards for hazardous air pollutant.

NPDES- National pollutant discharge elimination system.

OSHA – Occupational Safety and Health Administration.

PCB – Polychlorinated biphenyls.

POTW - Publicly owned treatment work.

ppm – parts per million.

ppmw – parts per million by weight.

RACT – Reasonably available control technology.

RCRA – Resource Conservation and Recovery Act.

SDWA – Safe Drinking Water Act.

SIP – State Implementation Plan.

SMCL – Secondary maximum contaminant level.

TBC – To be considered

TSCA – Toxic Substances Control Act.

UIC -– Underground injection control.

USC – United States Code.

UNDO – Underground source of drinking water.

VOC – Volatile organic compound.

Table A-2b
Potential Virginia Action-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment, and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Air Pollution Control Board Statute, Ambient Air Quality Standards*					
Air emissions (particulate matter, sulfur oxides, carbon monoxide, ozone, nitrogen dioxide, and lead)	Establishes the primary and secondary air quality standards for particulate matter, sulfur oxides, carbon monoxide, ozone, nitrogen dioxide, and lead.	Operations generating air emissions.	Va. Code Ann. 10.1-1300 to 1326; 9 VAC 30-10 et seq.	Not applicable	No air emissions are expected to occur as part of the response actions at Site 2 (i.e. particulate matter, lead). If these emissions occur, the substantive requirements of this regulation will be applicable
Standards of Performance for Visible Emissions and Fugitive Dust/Emissions (Rule 5-1)	The term "fugitive emissions" refers to unintended emissions that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening. Mandates that reasonable precautions be taken to prevent particular matter from becoming airborne during: handling, transporting, storing, using, constructing, altering, or repairing any materials; demolition, construction modification, or operation of any stationary source or any other bridling, structure, facility, or installation. Examples of reasonable precautions (§120-05-0104) include dust suppression during demolition (water or chemical); dust suppression on roads, material stockpiles, or other surfaces; paving/ cleaning roads; equipment installation (e.g., vents, hoods, fans, fabric filters) to enclose and vent dusty materials; use of containment methods during sandblasting or similar operations; and covering of transportation/conveyance equipment. Testing is required and the standard to be met is that visible emissions cannot exceed 20 percent opacity, except for one 6-minute period in any 1 hour of not more than 30 percent opacity. Continuous monitoring systems and other monitoring devices shall be installed, calibrated, maintained, and operated in accordance with 120-05-04 and Appendix J.	Operations generating visible emissions and fugitive dust/ air emissions (described under the requirement).	9 VAC 5-50-60 to 120	Applicable	These regulations are applicable at Site 2 in connection with activities that remove/transport/ convey debris and/or excavated materials; disturb the soil or sediment during excavation; disturb soil or other exposed surfaces during construction of haul roads.
Standards of Performance for	Visible Emissions and Fugitive Dust/Emissions. Provisions of 9 VAC	Operations generating visible emissions and fugitive dust/ air emissions (described under	9 VAC 5-50-240	Applicable	See 9 VAC 5-50-60 to 120 above.

Table A-2b
Potential Virginia Action-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment, and SurfaceWater
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAB Determination*	Comments
Stationary Sources (Rule 5-4)	5-50-60 to 120 (above) apply.	the requirement).			
Virginia Air Pollution Control Regulations, Chapter 60*					
Air emissions (hazardous air pollutants)	Incorporates EPA's standards for Hazardous Air Pollutants under §112 of the CAA, as amended in 1990 (40 CFR 61). Section 112 requires EPA to identify source categories for 189 toxic pollutants listed in the statute and to set Maximum Available Control Technology (MACT) limits for each category. EPA has published a list of 174 source categories of major and area sources that will be regulated. Lists of the 189 HAPs and the deadlines for issuing regulations for the 174 categories are attached. National Emission Standards for Hazardous Air Pollutants (NESHAPs) pertain to both existing and new/major modification sources. In addition to requiring MACT, the Federal and State regulations requiring testing, specify the test methods, and set monitoring requirements.	Operations generating air emissions.	9 VAC 5-60-60 to 110	Not applicable	See below for specific Rules that may apply to response actions at Site 2.
Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants (Rule 6-1)	Incorporates EPA's NESHAPs (40 CFR 61), requiring the use of MALT for regulated pollutants from regulated source categories. EPA has identified sources categories within the waste treatment industry group for HAP regulation including: POTWs, municipal landfills, hazardous waste incineration, sewage sludge incineration, site remediation, solid waste treatment, storage and disposal facilities. The rule for POTWs is scheduled for final promulgation in March 1997. The others will not be final until at least the year 2000.	Operations generating air emissions.	9 VAC 5-60-60 to 110	To be considered	HAPs for the waste treatment industry are likely tobe applicable to disposal of soil, treatment, storage, and disposal facilities. If they are proposed, they will be TBCs.

Table A-2b
Potential Virginia Action-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment, and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination'	Comments
Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants for Source Categories (Rule 6-2)	This regulation incorporates by reference most of the federal NESHAPs promulgated under 40 CFR Part 63 requiring the use of MACT standards for various source categories. [Note: See the Virginia regulations at 9 VAC 5-60-100 for a listing of those 40 CFR Part 63 provisions incorporated by reference.]		9 VAC 5-60-60 to 110	Not applicable	This regulation is a potential ARAR for remedial actions which may involve the release of hazardous air emissions from equipment leaks (e.g. pumps, compressors, pressure relief devices, valves).
Solid Waste Management Regulation, Virginia Waste Management Act					
Solid Waste Management (nonhazardous waste)	Establishes standards and procedures pertaining to siting, design, construction, operation, maintenance, closure, and post-closure care of solid waste management facilities.	Solid waste management activities	Va. Code Ann 10.1-1400 et seq.; 9 VAC 20-80-10 to 790	Relevant and Appropriate	The substantive requirements of this regulation may be relevant and appropriate for the response actions at the NBN Site 2, if the excavated soil is nonhazardous. The regulation is relevant and appropriate since Site 2 stopped managing wastes prior to December 21, 1988.
Handling of special solid wastes	Contains regulations for the disposal of special wastes. Special wastes are wastes that require special handling and precautions. Regulations require that facilities may receive special wastes for processing or disposal only with the specific prior approval of the VDEQ or by specific provisions with the facility permit.	Handling of special solid wastes.			The requirements of this regulation may be relevant and appropriate for wastes generated as a result of removal actions at NBN Site 2, including IDW, if the wastes are considered nonhazardous and are special wastes. The regulation is relevant and appropriate since Site 2 stopped managing wastes prior to December 21, 1988.
Hazardous Waste Regulation, Virginia Waste Management Act *					
Management of hazardous wastes	Provides for the control of all hazardous wastes that are generated within, or transported to the Commonwealth for the purposes of storage, treatment, or disposal or for the purposes of resource conservation or recovery, including requirements for manifest regulations, notification of hazardous waste management activity, transportation of hazardous waste and land disposal. Wastes are defined as hazardous either because they exhibit a hazardous characteristic (i.e.. ignitability, corrosivity, reactivity, or toxicity) or because the waste is "listed" as hazardous.	Transport, generation, handling, and storage of hazardous wastes generated within, or transported to the Commonwealth of Virginia.	Va. Code Ann 10.1-1400 et seq.; 9 VAC 20-60-10 to 420; 9 VAC 20-60-740 to 950; and 9 VAC 20-60-1430-1480	Not applicable	The substantive requirements of this regulation may be applicable for the response actions at Site 2, if the wastes (excavated soil, sediment, or IDW) exhibit hazardous waste characteristics. However, waste has been determined to be nonhazardous.

Table A-2b
Potential Virginia Action-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment, and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Virginia Regulations Governing the Transportation of Hazardous Materials, Virginia Waste Management Act *					
Transportation of hazardous materials	Regulates the transportation of hazardous materials in Virginia. Every person who transports or offers for transportation hazardous materials within or through the Commonwealth of Virginia shall comply with the federal regulations governing the transportation of hazardous materials promulgated by the United States Secretary of Transportation with amendments promulgated and in effect as of March 18, 1994 (except as otherwise specified in this section) pursuant to the Hazardous Materials Transportation Act, and located at Title 49 of the Code of Federal Regulations as set forth in this section.	Transportation of hazardous materials in Virginia.	Va. Code Ann 10.1-1400 et seq.; 9 VAC 20-110-10 to 130	Applicable or Relevant and Appropriate	All offsite transport (off NBN proper) of hazardous materials generated as a result of removal/remedial actions, including IDW, at NBN must comply with the substantive and administrative requirements of this section. In addition, the substantive regulations in this section may be relevant and appropriate for onsite (on NBN) transport of hazardous materials.
Transportation of Hazardous Materials through Bridge-Tunnel Facilities*					
Transportation of hazardous materials	Establishes the rules by which all interstate, intrastate, and public and private transporters of hazardous materials are governed while traveling through state-owned bridge-tunnel facilities in the Commonwealth of Virginia.	Transportation of hazardous materials through bridge-tunnel facilities.	24 VAC 30-61-10 et seq.	Not applicable	The substantive requirements of this regulation may be applicable for the disposal of excavated soil or sediment at NBN Site 2, if the excavated waste or IDW is hazardous. However, waste has been determined to be nonhazardous.
Virginia Water Protection Permit Regulations, State Water Control Law*					
Dredging and filling activities	Delineates the procedures and requirements associated with dredging and filling activities that cause a discharge of any pollutants into, or adjacent to surface waters, or which impact the physical, chemical, or biological properties of surface waters.	Activities that require a Part 404 permit from the Corps of Engineers.	Va. Code Ann. 62.1-44.2, et seq.; 9 VAC 25-210-10 et seq.	Applicable	The regulations are applicable for dredge and/or fill activities (and any other activitie's which require a Part 404 permit from the Corps of Engineers) that cause a discharge of pollutants into, or adjacent to, surface waters, or which change the physical, chemical, or biological properties of the surface waters. At Site 2, such activities may include excavation of soil.

Table A-2b
Potential Virginia Action-Specific ARARs
NM Slag Pile - Site 2 Soil, Groundwater, Sediment, and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulations*					
Discharge of Treated Water to Surface Waters, and certain storm water discharges	Restores and maintains the quality of surface waters. Controls the direct discharge of pollutants to surface waters through the Virginia Pollutant Discharge Elimination System (VPDES) program. Direct discharges of wastewater to surface waters must meet the effluent discharge limits established by this section. These limits are established on a case-by-case basis.	Discharge of all pollutants into state waters.	Va. Code Ann. 62.1-44.2, et seq.; 9 VAC 25-31-10 to 120; 9 VAC 25-31-180; 9 VAC 25-31-190 to 240; 9 VAC 25-31-900 and 910	Not applicable	At Site 2, these regulations are potentially applicable for Superfund actions that involve direct discharges to surface waters (i.e., decontamination water, or other wastewater to be discharged directly to surrounding surface waters).
Virginia Pollutant Abatement (VPA) Permit Regulation*					
Discharge adjacent to state waters, pollution management	Except in compliance with a VPA permit, or another permit, issued by the board, cannot discharge noxious or deleterious substances into state waters, or alter the physical, chemical, or biological properties of such state waters. A VPA permit authorizes pollutant management activities including, but not limited to, animal feeding operations, storage or land application of sewage, sludge, industrial waste or other waste.	Discharge of noxious or deleterious substances into state waters, storage or land application of wastes.	Va. Code Ann. 62.1-44.2, et seq.; 9 VAC 32-10 et seq.	Not applicable	The substantive portions of this regulation is a potential ARAR for all remediation activities that involve non-point source discharges to surfac., waters from pollutant management activities as defined in this section (i.e. sediment drying activities at the site). The VPA permitting and administrative requirements are not potential ARARs for on-site activities.

Table A-2b
Potential Virginia Action-Specific ARARs
NM Slag Pile - Site 2 Soil, Groundwater, Sediment, and Surface Water
Naval Base, Norfolk, Virginia

Action	Requirement	Prerequisites	Citation	ARAR Determination*	Comments
Stormwater Management Regulations, Virginia Stormwater Management Act*					
Actions affecting stormwater runoff (activities that disturb the land)	Inhibits deterioration of existing waters and waterways by requiring that post development stormwater runoff characteristics, including water quality and quantity, are maintained, to the extent practicable, equal to or better than pre-development runoff characteristics. Establishes minimum acceptable criteria to control non-point pollution, localized flooding, and stream channel erosion. Requires that all land development projects have a stormwater management plan that specifies how stormwater will be controlled such that the post-development runoff rate will not exceed the pre-development runoff rate. Also contains specific methods for calculating runoff rates, standards for water volume control facilities (e.g., detention basins, infiltration facilities), and requires compliance with the Virginia Erosion and Sediment Control Regulations (see below).	Potential for an alteration in the stormwater runoff patterns. Does not apply to land development projects that disturb less than one acre of land area, except that the governing body of a locality that has adopted a local stormwater management program may exempt a smaller area of disturbed land or may qualify the conditions under which this exemption shall apply.	Va. Code Ann. 10.1-603.1-603.15; VR 215-02-00; VR 625-02-00; 4 VAC 50-30-10	Applicable	This regulation is applicable for "land development projects" (a manmade change to the land surface that potentially changes its runoff characteristics, i.e.. excavation of soils) undertaken as part of a removal or remedial action, and would require that such projects develop an erosion and sediment control plan. Specifically applicable to pumping of surface water out of the drainageway to dry the excavated sediment.
Erosion and Sediment Control Law and Erosion and Sediment Control Regulations *					
Actions resulting in sediment erosion, sediment deposition, and runoff (activities that disturb the land)	Establishes minimum standards for the control of sediment erosion, sediment deposition, and runoff, and requires that an erosion and sediment control plan be prepared and submitted for activities that disturb the land. Specific requirements include: minimum standards for sediment basins and traps; sediment stabilization procedures; protection of waterways and properties from erosion, sediment deposition, and damage due to increased volume, velocity or peak flow rate of stormwater runoff.	Potential for sediment erosion, sediment deposition, or runoff. Does not apply to development projects that disturb less than one acre of land area, except that the governing body of a locality that has adopted a local stormwater management program may exempt a smaller area of disturbed land or may qualify the conditions under which this exemption shall apply.	Code of Virginia 10.1-560 et seq; 4 VAC 50-30-10 to 110	Applicable	This regulation is applicable for "land development projects" (a manmade change to the land surface that potentially changes its runoff characteristics, i.e.. excavation of soils) undertaken as part of a removal or remedial action, and would require that such projects develop an erosion and sediment control plan. Specifically applicable to pumping of surface water out of the drainageway to dry the excavated sediment.

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that DON accepts the entire statues or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

ARAR - Applicable or relevant and appropriate requirement.
BACT - Best Available Control Technology.
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act.
CFR - Code of Federal Regulations
IDW - Investigation-derived waste.
LAER - Lowest Achievable Emission Rate.
NESHAP - National Emission Standards for Hazardous Air Pollutants.
TCLP - Toxicity Characteristic Leachate Procedure.
USC - United States Code.
VAC - Virginia Administrative Code.
VDEQ - Virginia Department of Environmental Quality.
VPA - Virginia Pollution Abatement.
VPDES - Virginia Pollution Discharge Elimination System.

Table A-1b
Potential Virginia Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Endangered Species Act*					
Habitat upon which endangered species or threatened species depend	The taking, transportation, processing, sale, or offer for sale within the Commonwealth of any threatened or endangered species published by the United States Secretary of the Interior is prohibited, except as provided in Part 29.1-568. Species are listed both by the Department of the Interior and by the Department of Game and Inland Fisheries.	Determination of effect upon endangered or threatened species or its habitat.	Code of Virginia Sections 29.1-563 through 568; 4 VAC 15-20-130 to 140	Not applicable	There are no endangered or threatened animal species at Site 2.
Virginia Endangered Plant and Insect Species Act*					
Habitat upon which endangered or threatened species depend	The agency may make regulations to declare species to be threatened or endangered and may establish programs for their preservation and to prohibit the taking of endangered species as they are defined in this regulation.	Determination of effect upon endangered or threatened species or its habitat.	Code of Virginia 3.1-1020 et seq; 2 VAC 5-320-10	Not applicable	There are no endangered or threatened plant or animal species at Site 2,
Virginia Historic Resource Law, Virginia Antiquities Act*					
Area of historic properties, antiquities on state-controlled lands	Relates to the nomination of sites to the National Register by the Commonwealth. Prohibits the taking of antiquities on state-controlled lands.	Adverse affect on historical properties, antiquities on state-controlled lands	Code of Virginia 10.1-2200 et seq; 10.1-2300 et seq.	Not applicable	There are no historic properties on Site 2.

Table A-1b
Potential Virginia Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Hazardous Waste Facility Siting Criteria*					
Environmentally sensitive locations (locations where the placement of a hazardous waste facility increases the risk to health and the environment).	Hazardous waste treatment, storage and disposal facilities should not be placed in certain specific locations of the state, for example: in wetlands, 100-year floodplain, or such larger area which the flood of record may have inundated, areas prone to flooding due to dam failure, underground (injection), over a sinkhole or less than 100 feet above a solution cavern beneath the facility associated with karst topography, areas designated by the National Park Service in the Registry of Natural Landmarks or sites listed on the National Register of Historic Places, and the Virginia Landmarks Register (unless exceptions provided in the statute), state, county and municipal parks, units of the National Park System, national recreation areas, state forests, state game lands, national wildlife refuges or national fish hatcheries (unless exceptions have been provided in the statute)..	Placement of hazardous waste treatment, storage, and disposal facilities.	9 VAC 20-50-70	To be considered	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.

Table A-1b
Potential Virginia Location-Specific ARARs
NM Slag Pile — Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Environmentally sensitive locations (locations where the placement of a hazardous waste facility increases the risk to health and the environment).	The water resources of the state (surface water and groundwater) should be afforded the maximum protection reasonably possible. Siting of a facility must take into account air quality problems which may result from the operation of the facility or accidental fires and explosions which may occur. A hazardous waste facility shall not be sited in locations where the siting, construction and operation of the proposed facility would occupy or threaten the known habitat or an endangered or threatened plant, insect, fish or wildlife species to the extent that the contin ued existence of the species is threatened, in proximity to publicly designated areas, active faults, or in subsurface mining areas. Consideration should be given to the effect of the slope of the proposed site and adjacent lands with respect to waste management facilities. Must evaluate the risk associated with the transportation of hazardous waste to the proposed site. The linear distance from the facility boundary to major structures must be considered (e.g., residence, airport, school, hospital, church, commercial centers, nursing home). The facility shall be considered for consistency with the local master land use plan or the pattern of already existing land uses or zoning ordinance of the host community where no comprehensive plan has been adopted.	Placement of hazardous waste treatment, storage, and disposal facilities.	9 VAC 20-50-80	Applicable	The requirements of this regulation will be incorporated for response actions at Site 2 (i.e. for surface water protection, and fish and wildlife protection of the Site 2 drainageway).

Table A-1 b
Potential Virginia Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
State Water Control Law, Virginia Water Protection Permit Regulation, Virginia Pollution Discharge Elimination System Permit Regulation,Virginia Pollution Abatement *					
Surface waters and the adjacent land	No person shall dredge, fill or discharge any pollutant into, or adjacent to surface waters, or otherwise alter the physical, chemical, or biological properties of surface waters, except as authorized pursuant to a Virginia Water Protection Permit, a Virginia Pollution-Discharge System Elimination System Permit, or a Virginia Pollution Abatement Permit.	Dredging, filling, or discharging of pollutants.	Virginia Code Ann. 62.1-44.2 to 44.4; 9 VAC 25-210-10; 9 VAC 25-31-10 to 940; 9 VAC 25-32-10 to 300	Applicable	Remedial activities occurring at Site 2 will incorporate the requirements of this regulation.
Special Designations in Surface Waters*					
Scenic Rivers	Must provide for identification, preservation, and protection of certain rivers which possess natural beauty of high quality to assure their use and enjoyment for their scenic, recreational, geologic, fish and wildlife, historic, cultural or other values.	Activities affecting the quality of scenic rivers.	9 VAC 25-260-320	Not applicable	There are no scenic rivers on Site 2.
Wetlands Policy*					
Wetlands	Must minimize alteration in the quantity or quality of the natural flow of water that nourishes wetlands and to protect wetlands from adverse dredging or filling practices, solid was te management practices, siltation, or the addition of pesticides, salts, or toxic materials arising from non-point source wastes and through construction activities, and to prevent violation of applicable water quality standards from such environmental insults.	Activities affection the stability of wetlands.	9 VAC 25-380-10 et seq.	To be considered	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.

Table A-1b
Potential Virginia Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
General Provisions Relating to Marine Resources Commission, Wetlands Mitigation Compensation Policy*					
Wetlands	Requires that any activity that impacts a wetland meet the provisions of the Virginia Wetlands Act and regulations. Wetlands of primary ecological s ignificance must not be altered so that ecological systems in the wetlands are unreasonably disturbed. Apply to both vegetated (lands lying between and contiguous to mean low water and an elevation above mean low water equal to the factor one and one-half times the mean tide range and upon which is growing a species of vegetation) and nonvegetated wetlands (unvegetated lands lying contiguous to mean low water and between mean low water and mean high water).	Activities impacting either a vegetated or nonvegetated wetland.	4 VAC 20-390-10 to 50	Applicable	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.
Water Resources Policy*					
Wetlands	Requires protec tion of wetlands (spoils produced from original dredging and channel maintenance projects should not be disposed of in any manner that would in itself adversely modify circulation in wetlands, both tidal and nontidal). The long-term protection of the environment shall be the guiding criterion in decisions relating to water and related land resources. In the flood plain, construction of facilities designed to store substances which might be hazardous to the stream environment is discouraged.	Activities affecting the stability of wetlands, water or land resources, construction in floodplain zones.	9 VAC 25-390-10 et seq.	To be considered	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.

Table A-1 b
Potential Virginia Location-Specific ARARs
NM Slag Pile – Site 2 Soil, Groundwater, Sediment and Surface Water
Naval Base, Norfolk, Virginia

Location	Requirement	Prerequisite	Citation	ARAR Determination	Comments
Virginia State Water ControlLaws and Virginia Wetlands Regulations*					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland as defined by Virginia statutory provision.	Virginia Code Sections 62.1-44.15:5	Not applicable	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.
Chesapeake Bay Preservation Act and Chesapeake Bay Preservation Area Designation and Management Regulations (CBPA Regulations)*					
Chesapeake Bay areas	Under these requirements, certain locally designated tidal and nontidal wetlands, as well as other sensitive land areas, may be subject to limitations regarding land-disturbing activities, removal of vegetation, use of impervious cover, erosion and sediment control, stormwater management, and other aspects of land use that may have effects on water quality. Developments exceeding 2,500 square feet must comply with the requirements of any local erosion and sediment control ordinances.	Federally owned area designated as a Chesapeake Bay Preservation area.	9 VAC 10-20-10 to 280	Applicable	The Site 2 drainageway is a man-made, upland ditch and is not considered to be a wetland. The small wetland area adjacent to the site will not be disturbed.

*Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader. Listing the statutes and policies does not indicate that Navy accepts the entire statues or policies as potential ARARs. Specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs.

ARARs - Applicable or relevant and appropriate requirements.
EPA - Environmental Protection Agency.
VAC - Virginia Administrative Code.

Appendix B

Final Remedial Investigation Results

TABLE 3

MONITORING WELL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNDWATER STANDARDS
NBN SITE 2, SEPTEMBER 1996

ORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Trichloroethene	1.6	RBC Tap	1/2	NBS2-MW01	2.1		1	1.31

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Arsenic	0 045	RBC Tap	2/4	NBS2-MW02	11.9		9	264.44
				NBS2-MW01	14.4		9	320.00
Cadmium	0.4	VAGS	1/4	NBS2-MW01	2.9	J	1	7.25
Iron	300	VAGS	4/4	NBS2-MW02F	937		27	3.12
				NBS2-MW02	5720		27	19.07
				NBS2-MW01F	11300		27	37.67
				NBS2-MW01	15700		27	52.33
Manganese	50	VAGS	4/4	NBS2-MW02F	452		1	9.04
				NBS2-MW01	527		1	10.54
				NBS2-MW02	533		1	10.66
				NBS2-MW01F	590		1	11.80
Selenium	10	VAGS	2/4	NBS2-MW01	19.6		5	1.96
				NBS2-MW01F	26.5		5	2.65
Thallium	2	MCL	4/4	NBS2-MW01	9	L	9	4.50
				NBS2-MW01F	9	L	9	4,50
				NBS2-MW02	9	L	9	4.50
				NBS2-MW02F	9	L	9	4.50

TABLE 3-1

MONITORING WELL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNDWATER STANDARDS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE[2]	LOCATION OF EXCEEDENCE[3]	ANALYTICAL RESULT (ug/L)	DV QUAL[4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Zinc	50	VAGS	2/4	NBS2-MW01F	70.2		2	1.40
				NBS2-MW01	97	K	2	1.94

Footnotes:
1 - The most conservative screening level was used to determine exceedences. "RBC Tap" indicates that the RBC Tap Water screening level was used, "VAGS" Indicates that the Virginia Groundwater Standard was used, and "MCL" indicates that the Maximum Contaminant Level was used.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-2

IN-SITU GROUNDWATER SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNDWATER STANDARDS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE[2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	37000	RBC Tap	4/14	GW-05-9	52400		6	1.42
				GW-01-9	61900		6	1.67
				GW-04-9	236000		6	6.38
				GW-06-9	346000		6	9.35
Antimony	6	MCL	3/14	GW-01-9	8	J	4	1.33
				GW-02-9	8.3	J	4	1.38
				GW-04-9	11.8	J	4	1.97
Arsenic	0.045	RBC Tap	13/14	GW-02-9D	6.8	J	4	151.11
				GW-06-9F	8.1	J	4	180.00
				GW-02-9DF	8.7	J	4	193.33
				GW-04-9F	13.3		4	2.95.56
				GW-02-9	14.1	J	4	313.33
				GW-03-9	14.4	J	4	320.00
				GW-03-9F	18.9		4	420.00
				GW-01-9F	19		4	422.22
				GW-05-9F	29.9		4	664.44
				GW-01-9	44.4	J	4	986.67
				GW-05-9	47.5	J	4	1055.56
				GW-06-9	86	J	4	1911.11
				GW-04-9	225	J	4	5000.00
Beryllium	0.016	RBC Tap	4/14	GW-01-9	2.6	J	1	162.50
				GW-05-9	4.2	J	1	262.50
				GW-04-9	8.5		1	531.25
				GW-06-9	9.4		1	587.50
Cadmium	0.4	VAGS	1/14	GW-02-9	1.2	J	1	3.00
Chromium	50	VAGS	4/14	GW-05-9	116		2	2.32
				GW-01-9	128		2	2.56
				GW-04-9	527			10.54

TABLE 3-2

IN-SITU GROUNDWATER SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNDWATER STANDARDS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Chromium	50	VAGS	4/14	GW-06-9	675		2	13.50
Iron	300	VAGS	14/14	GW-06-9F	4690		18	15.63
				GW-04-9F	8860		18	29.53
				GW-02-9F	10200		18	34.00
				GW-02-9DF	10700		18	35.67
				GW-02-9D	11600		18	38.67
				GW-02-9	18100		18	60.33
				GW-03-9F	20800		18	69.33
				GW-03-9	21600		18	72.00
				GW-01-9F	31500		18	105.00
				GW-05-9F	63700		18	212.33
				GW-01-9	95000		18	316.67
				GW-06-9	99700		18	332.33
				GW-05-9	116000		18	386.67
				GW-04-9	248000		18	826.67
Lead	15	MCL	7/14	GW-03-9	16.1		2	1.07
				GW-05-9	69.3		2	4.62
				GW-02-9D	106		2	7.07
				GW-06-9	224		2	14.93
				GW-02-9	241		2	16.07
				GW-01-9	284		2	18.93
				GW-04-9	357		2	23.80
Manganese	50	VAGS	14/14	GW-06-9F	79.9		1	1.60
				GW-04-9F	135		1	2.70
				GW-05-9F	232		1	4.64
				GW-03-9	273		1	5.46
				GW-03-9F	296		1	5.92
				GW-05-9	377		1	7.54

TABLE 3-2

IN-SITU GROUNDWATER SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNWATER STANDARDS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Manganese	50	VAGS	14/14	**GW-01-9F**	**381**		**1**	**7.62**
				GW-02-9DF	**812**		**1**	**16.24**
				GW-02-9	**861**		**1**	**17.22**
Nickel	100	MCL	1/14	**GW-06-9**	**105**		**3**	**1.05**
Selenium	10	VAGS	2/14	**GW-06-9**	**15.8**		**5**	**1.58**
				GW-02-9F	**18.5**		**5**	**1.85**
Thallium	2	MCL	1/14	**GW-04-9**	**9.9**	**J**	**5**	**4.95**
Vanadium	260	RBC Tap	2/14	**GW-06-9**	**689**		**1**	**2.65**
				GW-04-9	**1070**		**1**	**4.12**
Zinc	50	VAGS	5/14	**GW-01-9**	**102**		**2**	**2.04**
				GW-05-9	**107**		**2**	**2.14**
				GW-02-9	**211**		**2**	**4.22**
				GW-06-9	**227**		**2**	**4.54**
				GW-04-9	**271**		**2**	**5.42**

Footnotes:
1 - The most conservative screening level was used to determine exceedences. "RBC" indicates that the RBC Tap Water screening level was used, "VAGS" indicates that the Virginia groundwater standard was used, and "MCL" Indicates that the Maximum Contaminant level was used.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-3

MONITORING WELL SAMPLING RESULTS
SUMMARY OF DETECTED CHIMICALS THAT EXCEED RBS SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNDWATER STANDARDS
NBS SITE, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Arsenic	0.045	RBC Tap	10/14	**MW05F**	**5.2**	**J**	**4**	**115.56**
				MW04F	**9.8**	**J**	**4**	**217.78**
				MW06F	**10**		**4**	**222.22**
				MW06	**11**		**4**	**244.44**
				MW04FP	**11.3**		**4**	**251.11**
				MW04	**16.5**		**4**	**366.67**
				MW04P	**16.9**		**4**	**375.56**
				MW01	**17.2**		**4**	**382.22**
				MW05	**20.2**		**4**	**448.89**
				MW06F	**22.3**		**4**	**495.56**
Beryllium	0.016	RBC Tap	2/14	**MW03**	**1.3**	**J**	**1**	**81.25**
				MW03F	**1.3**	**J**	**1**	**81.25**
Iron	300	VAGS	11/14	**MW03F**	**2140**		**18**	**7.13**
				MW01F	**2360**		**18**	**7.87**
				MW02F	**8400**		**18**	**28.00**
				MW06F	**9620**		**18**	**32.07**
				MW01	**10700**		**18**	**35.67**
				MW05	**13500**		**18**	**45.00**
				MW06	**14800**		**18**	**49.33**
				MW04FP	**15300**		**18**	**51.00**
				MW04F	**16800**		**18**	**56.00**
				MW04	**22700**		**18**	**75.67**
				MW04P	**2310**		**18**	**77.00**
Lead	15	MCL	1/14	**MW06**	**71.4**	**J**	**2**	**4.76**
Manganese	50	VAGS	10/14	**MW05F**	**64.7**		**1**	**1.29**
				MW04F	**138**		**1**	**2.76**
				MW04FP	**142**		**1**	**2.84**
				MW06F	**186**		**1**	**3.72**

TABLE 3-3

MONITORING WELL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC SCREENING LEVELS, MCLs,
OR VIRGINIA GROUNDWATER STANDARDS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (ug/L) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/L)	DV QUAL [4]	DETECTION LIMIT (ug/L) [5]	EXCEEDENCE QUOTIENT [6]
Manganese	50	VAGS	10/14	**MW01F**	**210**		**1**	**4.20**
				MW05	**293**		**1**	**5.86**
				MW06F	**406**		**1**	**8.12**
				MW06	**523**		**1**	**10.46**
				MW02F	**583**		**1**	**11.66**
				MW01	**713**		**1**	**14.26**
Selenium	10	VAGS	1/14	**MW02F**	**11.5**		**5**	**1.15**
Thallium	2	MCL	2/14	**MW02F**	**6.3**	**J**	**5**	**3.15**
				MW06F	**7.9**	**J**	**5**	**3.95**

Footnotes:
1 - The most conservative screening level was used to determine exceedences. "RBC Tap" indicates that the RBC Tap Water screening level was used, "VAGS" indicates that the Virginia groundwater standard was used, and "MCL" Indicates that the Maximum Contaminant level was used.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-4

SURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED RBC INDUSTRIAL SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE SCREENING LEVEL OR REGULATORY STANDARD (mg/kg)		FREQUENCY OF EXCEEDENCE [1]	LOCATION OF EXCEEDENCE [2]	ANALYTICAL RESULT (mg/kg)	DV QUAL [3]	DETECTION LIMIT (mg/kg) [4]	EXCEEDENCE QUOTIENT [5]
Arsenic	3.8	RBC IND	3/4	**NBS2-SS02**	**14.4**		**1.8**	**3.79**
				NBS2-SS02P	**14.8**		**1.9**	**3.89**
				NBS2-SS03	**18.7**		**1.9**	**4.92**

Footnotes:
1 – Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
2 – An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
3 – Data Validation Qualifiers: "J" = Analyte present – reported value may not be accurate or precise. "K" = Analyte present – reported value may be biased high. "L" = Analyte present – reported value may be reported low. No code = Confirmed identification.
4 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.

TABLE

SURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

ORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL(ug/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/kg)	DV QUAL [4]	DETECTION LIMIT (ug/kg) [5]	EXCEEDENCE QUOTIENT [6]
Benzo[a]anthracene	100	BOTH	1/4	**NBS2-SB01**	**140**	J	180	1.40
Benzo[a]pyrene	100	FN	1/4	**NBS2-SB01**	**130**	J	180	1.30
Benzo[b]fluoranthene	100	BOTH	1/4	**NBS2-SB01**	**160**	J	180	1.60
Chrysene	100	BOTH	1/4	**NBS2-SB01**	**140**	J	180	1.40
Fluoranthene	100	BOTH	2/4	**NBS2-SB02P**	**140**	J	180	1.40
				NBS2-SB01	**250**	J	180	2.50
Phenanthrene	100	BOTH	1/4	**NBS2-SB02P**	**130**	J	180	1.30
Pyrene	100	BOTH	2/4	**NBS2-SB02P**	**120**	J	180	1.20
				NBS2-SB01	**200**	J	180	2.00

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	1	FL	4/4	**NBS2-SS02P**	**3940**		2.3	3940.00
				NBS2-SS03	**4900**		2.3	4900.00
				NBS2-SS01	**5150**		2.4	5150.00
				NBS2-SS02	**5260**		2.2	5260.00
Beryllium	0.02	FL	4/4	**NBS2-SS01**	**0.28**	K	0.22	14.00
				NBS2-SS03	**0.47**	K	0.21	23.50
				NBS2-SS02	**0.49**	K	0.2	24.50
				NBS2-SS02P	**0.6**	K	0.21	30.00
Chromium	0.0075	FN	4/4	**NBS2-SS01**	**9.4**		0.22	1253.33
				NBS2-SS02P	**11**		0.21	1466.67
				NBS2-SS02	**14.2**		0.2	1893.33
				NBS2-SS03	**14.8**		0.21	1973.33

TABLE 3-5

SURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Copper	15	FL	4/4	**NBS2-SS01**	**18.7**		0.22	1.25
				NBS2-SS02P	**27.8**		0.21	1.85
				NBS2-SS02	**32.3**		0.2	2.15
				NBS2-SS03	**55.7**		0.21	3.71
Iron	12	FN	4/4	**NBS2-SS01**	**6610**		5.9	550.83
				NBS2-SS02P	**11200**		5.7	933.33
				NBS2-SS03	**11500**		5.6	958.33
				NBS2-SS02	**16800**		5.5	1400.00
Lead	0.01	FN	4/4	**NBS2-SS02P**	**54.2**		0.63	5420.00
				NBS2-SS02	**60.6**		0.61	6060.00
				NBS2-SS03	**82.8**		0.62	8280.00
				NBS2-SS01	**87.3**		0.65	8730.00
Nickel	2	FL	4/4	**NBS2-SS01**	**8**	K	0.65	4.00
				NBS2-SS02P	**9.8**		0.63	4.90
				NBS2-SS02	**10.2**		0.61	5.10
				NBS2-SS03	**10.4**	K	0.62	5.20
Vanadium	0.5	FL	4/4	**NBS2-SS02P**	**15.8**	K	0.21	31.60
				NBS2-SS02	**19.4**	K	0.2	38.80
				NBS2-SS03	**19.5**	K	0.21	39.00
				NBS2-SS01	**27**		0.22	54.00
Zinc	10	FL	4/4	**NBS2-SS01**	**56.9**		0.43	5.69
				NBS2-SS02P	**93.1**		0.42	9.31
				NBS2-SS02	**99.8**		0.41	9.98
				NBS2-SS03	**143**		0.41	14.30

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.

TABLE

3 - An “F” at the end of a sample ID indicates that the sample was filtered during collection. A “P” or a “D” at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: “J” = Analyte present - reported value may not be accurate or precise. “K” = Analyte present - reported value may be biased high.
“L” Analyte present - reported value may be reported low. No code = Confirmed identification.
5 - For organic analyses Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-6

SURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg)[1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL[4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	1	FL	1/1	SS-01	5460		1.4	5460.00
Antimony	0.48	FL	1/1	SS-01	1.3	J	0.94	2.71
Beryllium	0.02	FL	1/1	SS-01	0.25	J	0.24	12.50
Cadmium	2.5	FL	1/1	SS-01	2.6		0.24	1.04
Chromium	0.0075	FN	1/1	SS-01	24.8		0.47	3306.67
Copper	15	FL	1/1	SS-01	148		0.47	9.87
Iron	12	FN	1/1	SS-01	3450		4.2	287.50
Lead	0.01	FN	1/1	SS-01	164		0.47	16400.00
Nickel	2	FL	1/1	SS-01	13.2		0.71	6.60
Silver	0.0000098	FL	1/1	SS-01	1.2	J	0.47	122448.98
Vanadium	0.5	FL	1/1	SS-01	13.9		0.24	27.80
Zinc	10	FL	1/1	SS-01	202		0.47	20.20

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" Analyte present - reported value may be reported low. No code = Confirmed identification.
5 - For organic analyses Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used. For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	RBC INDUSTRIAL SOIL SCREENING LEVEL (mg/Kg)		FREQUENCY OF EXCEEDENCE [1]	LOCATION OF EXCEEDENCE [2]	ANALYTICAL RESULT (mg/Kg)	DV QUAL [3]	DETECTION LIMIT (ug/Kg) [4]	EXCEEDENCE QUOTIENT [5]
Arsenic	3.8	RBC IND	4/9	SB05	5		2.4	1.32
				SB02	7		2.1	1.84
				SB09	7.1		2	1.87
				SB04	7.8		1.9	2.05
Beryllium	1.3	RBC IND	1/9	SB02	7.2		0.23	5.54

Footnotes:
1 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
2 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
3 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high.
"L" = Analyte present - reported value may be reported low. No code =Confirmed Identification.
4 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit (CRDL) for EPA CLP SOW is used.
5 Exceedence Quotient = analytical result / screening level.

TABLE 3-8

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

ORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (ug/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/kg)	DV QUAL [4]	DETECTION LIMIT (ug/kg) [5]	EXCEEDENCE QUOTIENT [6]
Benzo[a]anthracene	100	BOTH	4/9	NBS2-SB01	130	J	180	1.30
				NBS2-SB02	210	J	200	2.10
				NBS2-SB06	280	J	200	2.80
				NBS2-SB09	280	J	180	2.80
Benzo[a]pyrene	100	FN	4/9	NBS2-SB01	120	J	180	1.20
				NBS2-SB02	160	J	200	1.60
				NBS2-SB06	170	J	200	1.70
				NBS2-SB09	330	J	180	3.30
Benzo[b]fluoranthene	100	BOTH	5/9	NBS2-SB04	120	J	180	1.20
				NBS2-SB01	140	J	180	1.40
				NBS2-SB02	170	J	200	1.70
				NBS2-SB06	180	J	200	1.80
				NBS2-SB09	420	J	180	4.20
Benzo[k]fluoranthene	100	BOTH	4/9	NBS2-SB04	130	J	180	1.30
				NBS2-SB02	170	J	200	1.70
				NBS2-SB06	270	J	200	2.70
				NBS2-SB09	420	J	180	4.20
Chrysene	100	BOTH	5/9	NBS2-SB01	120	J	180	1.20
				NBS2-SB04	170	J	180	1.70
				NBS2-SB02	200	J	200	2.00
				NBS2-SB06	300	J	200	3.00
				NBS2-SB09	310	J	180	3.10
Fluoranthene	100	BOTH	6/9	NBS2-SB05	140	J	220	1.40
				NBS2-SB04	190	J	180	1.90
				NBS2-SB01	260	J	180	2.60
				NBS2-SB02	420		200	4.20
				NBS2-SB09	440		180	4.40
				NBS2-SB06	640		200	6.40

TABLE 3-8

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

ORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (ug/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/kg)	DV QUAL [4]	DETECTION LIMIT (ug/kg) [5]	EXCEEDENCE QUOTIENT [6]
Phenanthrene	100	BOTH	2/9	**NBS2-SB06**	**110**	J	200	**1.10**
				NBS2-SB02	**140**	J	200	**1.40**
Pyrene	100	BOTH	6/9	**NBS2-SB05**	**130**	J	220	**1.30**
				NBS2-SB04	**180**	J	180	**1.80**
				NBS2-SB01	**270**	J	180	**2.70**
				NBS2-SB02	**400**		200	**4.00**
				NBS2-SB09	**590**		180	**5.90**
				NBS2-SB06	**620**		200	**6.20**

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	1	FL	9/9	**NBS2-SB04**	**3310**		2.3	**3310.00**
				NBS2-SB03	**3560**		2.6	**3560.00**
				NBS2-SB06	**4320**		3	**4320.00**
				NBS2-SB08	**5490**		2.4	**5490.00**
				NBS2-SB09	**5650**		2.4	**5650.00**
				NBS2-SB01	**5670**		2.3	**5670.00**
				NBS2-SB05	**6130**		2.9	**6130.00**
				NBS2-SB07	**6330**		2.4	**6330.00**
				NBS2-SB02	**85800**		2.5	**85800.00**

TABLE 3-8

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Antimony	0.48	FL	3/9	**NBS2-SB01**	**2.6**	K	1.9	**5.42**
				NBS2-SB07	**4.9**	J	2	**10.21**
				NBS2-SB02	**31**		2.1	**64.58**
Beryllium	0.02	FL	4/9	**NBS2-SB04**	**0.23**	J	0.21	**11.50**
				NBS2-SB09	**0.23**	J	0.22	**11.50**
				NBS2-SB07	**0.38**	J	0.22	**19.00**
				NBS2-SB02	**7.2**		0.23	**360.00**
Cadmium	2.5	FL	2/9	**NBS2-SB05**	**3.3**		0.26	**1.32**
				NBS2-SB02	**28.5**		0.23	**11.40**
Chromium	0.0075	FN	9/9	**NBS2-SB03**	**8.6**		0.24	**1146.67**
				NBS2-SB08	**9.6**		0.22	**1280.00**
				NBS2-SB04	**12**		0.21	**1600.00**
				NBS2-SB09	**14.1**		0.22	**1880.00**
				NBS2-SB06	**15.6**		0.28	**2080.00**
				NBS2-SB05	**17.7**		0.26	**2360.00**
				NBS2-SB01	**18.1**		0.21	**2413.33**
				NBS2-SB07	**35**		0.22	**1666.67**
				NBS2-SB02	**561**		0.23	**47800.00**
Copper	15	FL	9/9	**NBS2-SB08**	**23.3**		0.22	**1.55**
				NBS2-SB04	**26.9**		0.21	**179**
				NBS2-SB09	**56.4**		0.22	**3.76**
				NBS2-SB06	**56.8**		0.28	**3.79**
				NBS2-SB01	**167**		0.21	**11.13**
				NBS2-SB05	**179**		0.26	**11.93**
				NBS2-SB07	**531**		0.22	**35.40**
				NBS2-SB02	**9710**		0.23	**647.33**

TABLE 3-8

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Iron	12	FN	9/9	**NBS2-SB03**	**3260**		6.4	**271.67**
				NBS2-SB07	**4530**		6	**377.50**
				NBS2-SB06	**4990**		7.4	**415.83**
				NBS2-SB08	**5240**		6	**436.67**
				NBS2-SB01	**5670**		5.6	**472.50**
				NBS2-SB04	**6850**		5.8	**570.83**
				NBS2-SB05	**7050**		7.1	**587.50**
				NBS2-SB09	**7530**		5.9	**627.50**
				NBS2-SB02	**48100**		6.3	**4008.33**
Lead	0.01	FN	9/9	**NBS2-SB03**	**7.2**		0.71	**720.00**
				NBS2-SB08	**27.1**		0.67	**2710.00**
				NBS2-SB09	**37.9**		0.66	**3790.00**
				NBS2-SB06	**39.8**		0.83	**3980.00**
				NBS2-SB04	**42.6**		0.64	**4260.00**
				NBS2-SB05	**69.4**		0.78	**6940.00**
				NBS2-SB01	**98.6**		0.62	**9860.00**
				NBS2-SB07	**160**		0.67	**16000.00**
				NBS2-SB02	**1260**		0.7	**126000.00**
Manganese	330	BOTH	1/9	**NBS2-SB02**	**477**		0.23	**1.45**
Nickel	2	FL	9/9	**NBS2-SB08**	**3.4**	J	0.67	**1.70**
				NBS2-SB03	**4.6**	K	0.71	**2.30**
				NBS2-SB04	**6.5**	J	0.64	**3.25**
				NBS2-SB06	**6.6**	J	0.83	**3.30**
				NBS2-SB09	**8.9**		0.66	**4.45**
				NBS2-SB05	**10.4**	J	0.78	**5.20**
				NBS2-SB01	**18.2**		0.62	**9.10**
				NBS2-SB07	**37.9**		0.67	**18.95**
				NBS2-SB02	**1140**		0.7	**570.00**

TABLE 3-8

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg)[1]		FREQUENCY OF EXCEEDENCE[2]	LOCATION OF EXCEEDENCE[3]	ANALYTICAL RESULT (mg/kg)	DV QUAL[4]	DETECTION LIMIT (mg/kg)[5]	EXCEEDENCE QUOTIENT[6]
Selenium	1.8	BOTH	1/9	**NBS2-SB02**	**13.5**		1.2	**7.50**
Silver	0.0000098	FL	5/9	**NBS2-SB09**	**0.51**	J	0.44	**52040.82**
				NBS2-SB05	**1.4**	J	0.52	**142857.14**
				NBS2-SB01	**1.5**	K	0.41	**153061.22**
				NBS2-SB07	**6.2**		0.45	**632653.06**
				NBS2-SB02	**88.2**		0.46	**9000000.00**
Vanadium	0.5	FL	9/9	**NBS2-SB07**	**8.9**	J	0.22	**17.80**
				NBS2-SB06	**9.3**	J	0.28	**18.60**
				NBS2-SB03	**9.4**	K	0.24	**18.80**
				NBS2-SB05	**10.6**	J	0.26	**21.20**
				NBS2-SB01	**11.4**	K	0.21	**22.80**
				NBS2-SB04	**13**		0.21	**26.00**
				NBS2-SB08	**14.3**		0.22	**28.60**
				NBS2-SB09	**15.7**		0.22	**31.40**
				NBS2-SB02	**23.5**		0.23	**47.00**
Zinc	10	FL	9/9	**NBS2-SB08**	**20.3**		0.44	**2.03**
				NBS2-SB03	**47.3**		0.47	**4.73**
				NBS2-SB06	**62.9**		0.55	**6.29**
				NBS2-SB09	**91.1**		0.44	**9.11**
				NBS2-SB07	**130**		0.45	**13.00**
				NBS2-SB05	**140**		0.52	**14.00**
				NBS2-SB04	**145**		0.43	**14.50**
				NBS2-SB01	**165**		0.41	**16.50**
				NBS2-SB02	**2350**		0.46	**235.00**

TABLE

Footnotes:
1 - The most conservative screening level was used to determine exceedences. "FN" indicates that the BTAG fauna screening level was used, FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-9

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	RBC INDUSTRIAL SOIL SCREENING LEVEL (mg/kg)		FREQUENCY OF EXCEEDENCE[1]	LOCATION OF EXCEEDENCE[2]	ANALYTICAL RESULT (mg/kg)	DV QUAL[3]	DETECTION LIMIT (mg/kg)[4]	EXCEEDENCE QUOTIENT[5]
Arsenic	3.8	RBC IND	5/5	**SL-7-1.5**	**9.3**		1	**2.45**
				SL-10-2.5	**9.4**		1.2	**2.47**
				SL-9-4.0	**10.7**		1.1	**2.82**
				SL-6-1.0	**12.2**		0.97	**3.21**
				SL-8-3.5	**18.2**		1	**4.79**
Beryllium	1.3	RBC IND	5/5	**SL-7-1.5**	**4.6**		0.25	**3.54**
				SL-6.1.0	**5.3**		0.24	**4.08**
				SL.8-3.5	**9.9**		0.25	**7.62**
				SL-10-2.5	**10.3**		0.29	**7.92**
				SL-9-4.0	**31.6**		0.28	**24.31**

Footnotes:
1 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
2 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
3 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed identification.
4 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used. For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
5 - Exceedence Quotient = analytical result / screening level.

TABLE 3-10

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	1	FL	**5/5**	**SL-8-3.5**	**147000**		1.5	**147000.00**
				SL-10.2.5	**152000**		1.7	**152000.00**
				SL-9-4.0	**155000**		1.7	**155000.00**
				SL-6-1.0	**168000**		1.5	**168000.00**
				SL-7-1.5	**176000**		1.5	**176000.00**
Antimony	0.48	FL	**5/5**	**SL-9-4.0**	**87.7**		1.1	**182.71**
				SL-10-2.5	**94.2**		1.2	**196.25**
				SL-7-1.5	**105**		1	**218.75**
				SL-8-3.5	**223**		1	**464.58**
				SL-6-1.0	**240**		0.97	**500.00**
Barium	440	BOTH	**1/5**	**SL-9.4.0**	**476**		0.28	**1.08**
Beryllium	0.02	FL	**5/5**	**SL-7-1.5**	**4.6**		0.25	**230.00**
				SL-6-1.0	**5.3**		0.24	**265.00**
				SL-8-3.5	**9.9**		0.25	**495.00**
				SL-10-2.5	**10.3**		0.29	**515.00**
				SL-9-4.0	**31.6**		0.28	**1580.00**
Cadmium	2.5	FL	**5/5**	**SL-8-3.5**	**55.2**		0.25	**22.08**
				SL-10-2.5	**60.6**		0.29	**24.24**
				SL-7-1.5	**73.7**		0.25	**29.48**
				SL-9-4.0	**76.8**		0.28	**30.72**
				SL-6.1.0	**109**		0.24	**43.60**
Chromium	0.0075	FN	**5/5**	**SL-9-4.0**	**1220**		0.55	**162666.67**
				SL-6-1.0	**1410**		0.49	**188000.00**
				SL-7-1.5	**1420**		0.51	**189333.33**
				SL-10-2.5	**1570**		0.58	**209333.33**
				SL-8-3.5	**1940**		0.5	**258666.67**
Cobalt	100	FL	**1/5**	**SL-10-2.5**	**145**		0.29	**1.45**

TABLE 3-10

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Copper	15	FL	**5/5**	**SL-10.2.5**	**23200**		0.58	**1546.67**
				SL-8-3.5	**39000**		0.5	**2600.00**
				SL-7-1.5	**41800**		0.51	**2786.67**
				SL-6-1.0	**42400**		0.49	**2826.67**
				SL-9-4.0	**78400**		0.55	**5226.67**
Iron	12	FN	**5/5**	**SL-10-2.5**	**39600**		5.2	**3300.00**
				SL-9-4.0	**52800**		5	**4400.00**
				SL-7-1.5	**56700**		4.6	**4725.00**
				SL-6-1.0	**60200**		4.4	**5016.67**
				SL-8-3.5	**111000**		4.5	**9250.00**
Lead	0.01	FN	**5/5**	**SL-10-2.5**	**3820**		0.58	**382000.00**
				SL-9-4.0	**5420**		0.55	**542000.00**
				SL-8-3.5	**5990**		0.5	**599000.00**
				SL-7-1.5	**7440**		0.51	**744000.00**
				SL-6.1.0	**9820**		0.49	**982000.00**
Manganese	330	BOTH	**5/5**	**SL-9.4.0**	**964**		0.28	**2.92**
				SL-10.2.5	**977**		0.29	**2.96**
				SL-7.1.5	**1180**		0.25	**3.58**
				SL-6.1.0	**1300**		0.24	**3.94**
				SL-8.3.5	**1390**		0.25	**4.21**
Mercury	0.058	BOTH	**1/5**	**SL-10-2.5**	**0.45**		0.15	**7.76**
Nickel	2	FL	**5/5**	**SL-7-1.5**	**1630**		0.76	**815.00**
				SL-8-3.5	**1710**		0.76	**855.00**
				SL-6.1.0	**2010**		0.73	**1005.00**
				SL-10-2.5	**2220**		0.87	**1110.00**
				SL-9-4.0	**7140**		0.83	**3570.00**
Selenium	1.8	BOTH	**5/5**	**SL-6-1.0**	**11.2**		1.2	**6.22**
				SL-8-3.5	**13.6**		1.3	**7.56**

TABLE 3-10

SUBSURFACE SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Selenium	1.8	BOTH	5/5	**SL-9-4.0**	**15.8**		1.4	**8.78**
				SL-7-1.5	**16.7**		1.3	**9.28**
				SL-10-2.5	**27.3**		1.5	**15.17**
Silver	0.0000098	FL	5/5	**SL-7-1.5**	**144**		0.51	**14693877.55**
				SL-9-4.0	**156**		0.55	**15918.67.35**
				SL-8-3.5	**168**		0.5	**17142857.14**
				SL-10-2.5	**187**		0.58	**19081632.65**
				SL-6-1.0	**289**		0.49	**29489795.92**
Thallium	0.001	FL	2/5	**SL-7-1.5**	**1.3**	J	1.3	**1300.00**
				SL-9-4.0	**1.7**	J	1.4	**1700.00**
Vanadium	0.5	FL	5/5	**SL-6-1.0**	**20.8**		0.24	**41.60**
				SL-7-1.5	**22.4**		0.25	**44.80**
				SL-9-4.0	**24.2**		0.28	**48.40**
				SL-8-3.5	**26.8**		0.25	**53.60**
				SL-10-2.5	**35.3**		0.29	**70.60**
Zinc	10	FL	5/5	**SL-8-3.5**	**4260**		0.5	**426.00**
				SL-10-2.5	**4600**		0.58	**460.00**
				SL-7-1.5	**8500**		0.51	**850.00**
				SL-6-1.0	**8940**		0.49	**894.00**
				SL-9-4.0	**11500**		0.55	**1150.00**

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high.

TABLE 3-10

"L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW Is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-11

SURFACE BACKGROUND SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, ARPIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	1	FL	5/5	**SL03-.5**	**4350**		1.4	**4350.00**
				SL02-.5	**6060**		1.3	**6060.00**
				SL01-.5	**7860**		1.4	**7860.00**
				SL05-.5	**8240**		1.4	**8240.00**
				SL05-.5D	**8620**		1.5	**8620.00**
Beryllium	0.02	FL	2/5	**SL05-.5D**	**0.28**	**J**	0.25	**14.00**
				SL05-.5	**0.44**	**J**	0.23	**22.00**
Chromium	0.0075	FN	5/5	**SL03-.5**	**5.2**		0.46	**693.33**
				SL02-.5	**7**		0.44	**933.33**
				SL05-.5	**8.3**		0.47	**1106.67**
				SL05-.5D	**8.8**		0.5	**1173.33**
				SL01-.5	**9.4**		0.48	**1253.33**
Copper	15	FL	1/5	**SL01-.5**	**20.8**		0.48	**1.39**
Iron	12	FN	5/5	**SL03-.5**	**1710**		4.2	**142.50**
				SL02-.5	**3480**		3.9	**290.00**
				SL05-.5	**3920**		4.2	**326.67**
				SL05-.5D	**4010**		4.5	**334.17**
				SL01-.5	**4670**		4.3	**389.17**
Lead	0.01	FN	5/5	**SL03-.5**	**9.9**		0.46	**990.00**
				SL02-.5	**10.3**		0.44	**1030.00**
				SL05-.5D	**12.1**		0.5	**1210.00**
				SL05-.5	**16**		0.47	**1600.00**
				SL01-.5	**16.7**		0.48	**1670.00**
Nickel	2	FL	4/5	**SL02-.5**	**2.9**	**J**	0.65	**1.4500**
				SL05-.5	**3.4**	**J**	0.7	**1.7000**
				SL05-.5D	**3.8**	**J**	0.74	**1.9000**
				SL01-.5	**4.1**	**J**	0.72	**2.0500**

TABLE 3-11

SURFACE BACKGROUND SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, ARPIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Vanadium	5	FL	**5/5**	**SL03-.5**	**7.6**	**J**	0.23	**1.5200**
				SL02-.5	**10.9**		0.22	**2.1800**
				SL05-.5	**14.7**		0.23	**2.9400**
				SL01-.5	**14.9**		0.24	**2.9800**
				SL05-.5D	**15.3**		0.25	**3.0600**
Zinc	10	FL	**5/5**	**SL02-.5**	**25.8**		0.44	**2.5800**
				SL05-.5D	**27.6**		0.5	**2.7600**
				SL05-.5	**37.1**		0.47	**3.7100**
				SL01-.5	**40.9**		0.48	**4.0900**
				SL03-.5	**42**		0.46	**4.2000**

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora s creening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-12

SUBSURFACE BACKGROUND SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, ARPIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Aluminum	1	FL	**5/5**	**SL01-1.5**	**1290**		1.5	**1290.00**
				SL04-1.5	**3220**		1.4	**3220.00**
				SL02-1.5	**3460**		1.4	**3460.00**
				SL03-1.5	**3930**		1.4	**3900.00**
				SL05-1.5	**12900**		1.3	**12900.00**
Chromium	0.0075	FN	**5/5**	**SL01-1.5**	**2.4**	**J**	0.51	**320.00**
				SL04-1.5	**3.2**		0.48	**426.67**
				SL03-1.5	**4.2**		0.45	**560.00**
				SL02-1.5	**4.4**		0.46	**586.67**
				SL05-1.5	**14.4**		0.43	**1920.00**
Iron	12	FN	**5/5**	**SL01-1.5**	**803**		4.6	**66.92**
				SL04-1.5	**981**		4.3	**81.75**
				SL03-1.5	**1510**		4.1	**125.83**
				SL02-1.5	**1730**		4.1	**144.17**
				SL05-1.5	**6600**		3.9	**550.00**
Lead	0.01	FN	**5/5**	**SL03-1.5**	**3.3**		0.45	**330.00**
				SL05-1.5	**7.4**		0.43	**740.00**
				SL02-1.5	**7.5**		0.46	**750.00**
				SL04-1.5	**9**		0.48	**900.00**
				SL01-1.5	**9.5**		0.51	**950.00**
Nickel	2	FL	**1/5**	**SL05-1.5**	**4.7**	**J**	0.65	**2.35**

TABLE 3-12

SUBSURFACE BACKGROUND SOIL SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, ARPIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SOIL SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Vanadium	0.5	FL	**5/5**	**SL01-1.5**	**3.4**	J	0.26	**6.80**
				SL04-1.5	**4.7**	J	0.24	**9.40**
				SL02-1.5	**5.8**	J	0.23	**11.60**
				SL03-1.5	**6.1**	J	0.23	**12.20**
				SL05-1.5	**20.1**		0.22	**40.20**
Zinc	10	FL	**5/5**	**SL03-1.5**	**19.3**		0.45	**1.93**
				SL04-1.5	**21**		0.48	**2.10**
				SL01-1.5	**22.5**		0.51	**2.25**
				SL05-1.5	**23.2**		0.43	**2.32**
				SL02-1.5	**24**		0.46	**2.40**

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitation Limit (CROW for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-13

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SOIL SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

ORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
4,4'-DDE	2.2	BOTH	**3/9**	**NBS2-SD04**	**3.9**	J	4.1152	**1.77**
				NBS2-SD07	**9.4**		7.0922	**4.27**
				NBS2-SD06	**13**		6.8027	**5.91**

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENINGLEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Arsenic	0.057	FN	**8/9**	**NBS2-SD04**	**2.2**	J	5.5	**38.60**
				NBS2-SD07	**7.3**		5.5	**128.07**
				NBS2-SD06	**7.8**		5.4	**136.84**
				NBS2-SD05	**9.7**		5.4	**170.18**
				NBS2-SD01	**14**		6.3	**245.61**
				NBS2-SD01P	**14**		6.3	**245.61**
				NBS2-SD03	**20.9**		7.7	**366.67**
				NBS2-SD08	**25.3**		7.7	**443.86**
Cadmium	1.2	FN	**9/9**	**NBS2-SD04**	**4.4**		0.24	**3.67**
				NBS2-SD06	**7.2**		0.41	**6.00**
				NBS2-SD08	**7.8**		0.85	**6.50**
				NBS2-SD03	**8.3**		0.69	**6.92**
				NBS2-SD01	**9.1**		0.61	**7.58**
				NBS2-SD01P	**9.4**		0.6	**7.83**
				NBS2-SD07	**10.7**		0.43	**8.92**
				NBS2-SD02	**16**		0.7	**13.33**
				NBS2-SD05	**28.8**		0.83	**24.00**

TABLE 3-13

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Chromium	0.005	FL	**9/9**	**NBS2-SD04**	**33.7**		0.24	**6740.00**
				NBS2-SD06	**33.7**		0.41	**6740.00**
				NBS2-SD07	**40.2**		0.43	**8040.00**
				NBS2-SD08	**55.7**		0.85	**11140.00**
				NBS2-SD03	**65.4**		0.69	**13080.00**
				NBS2-SD01 P	**73.5**		0.6	**14700.00**
				NBS2-SD01	**73.8**		0.61	**14760.00**
				NBS2-SD02	**79.8**		0.7	**15960.00**
				NBS2-SD05	**97**		0.83	**19400.00**
Copper	34	FN	**9/9**	**NBS2-SD07**	**189**	J	0.43	**5.56**
				NBS2-SD08	**263**		0.85	**7.74**
				NBS2-SD06	**273**		0.41	**8.03**
				NBS2-SD03	**295**		0.69	**8.68**
				NBS2-SD01	**335**		0.61	**9.85**
				NBS2-SD01 P	**335**		0.6	**9.85**
				NBS2-SD04	**461**		0.24	**13.56**
				NBS2-SD02	**830**		0.7	**24.41**
				NBS2-SD05	**1150**		0.83	**33.82**
Lead	46.7	FN	**9/9**	**NBS2-SD04**	**129**		0.73	**2.76**
				NBS2-SD07	**271**		1.3	**5.80**
				NBS2-SD08	**280**		2.6	**6.00**
				NBS2-SD06	**334**		1.2	**7.15**
				NBS2-SD03	**336**		2.1	**7.19**
				NBS2-SD01P	**425**		1.8	**9.10**
				NBS2-SD01	**433**		1.8	**9.27**
				NBS2-SD02	**455**		2.1	**9.74**
				NBS2-SD05	**549**		2.5	**11.76**

TABLE 3-13

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) 1		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Nickel	20.9	BOTH	**7/9**	**NBS2-SD08**	**26.5**	**J**	2.6	**1.27**
				NBS2-SD03	**28.4**		2.1	**1.36**
				NBS2-SD01	**29.8**		1.8	**1.43**
				NBS2-SD01P	**30.4**		1.8	**1.45**
				NBS2-SD04	**33.5**		0.73	**1.60**
				NBS2-SD02	**46.5**		2.1	**2.22.**
				NBS2-SD05	**62.7**		2.5	**3.00**
Silver	1	FN	**9/9**	**NBS2-SD07**	**2.6**	**J**	0.86	**2.60**
				NBS2-SD03	**3.1**	**J**	1.4	**3.10**
				NBS2-SD08	**3.2**	**J**	1.7	**3.20**
				NBS2-SD06	**3.3**	**J**	0.82	**3.30**
				NBS2-SD01	**3.7**	**J**	1.2	**3.70**
				NBS2-SD01P	**3.8**		1.2	**3.80**
				NBS2-SD04	**6**		0.48	**6.00**
				NBS2- SD02	**11.8**		1.4	**11.80**
				NBS2-SD05	**13.4**		1.7	**13.40**
Zinc	150	FN	**9/9**	**NBS2-SD06**	**168**		0.82	**1.12**
				NBS2-SD04	**243**		0.48	**1.62**
				NBS2-SD07	**308**		0.86	**2.05**
				NBS2-SD08	**583**		1.7	**3.89**
				NBS2-SD03	**607**		1.4	**4.05**
				NBS2-SD01	**686**		1.2	**4.57**
				NBS2-SD01P	**698**		1.2	**4.65**
				NBS2-SD02	**772**		1.4	**5.15**
				NBS2-SD05	**1040**		1.7	**6.93**

TABLE 3-13

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" indicates that the BTAG fauna screening level was used, "FL" Indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
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5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-14

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, APRIL 1997

ORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/kg)	DV QUAL [4]	DETECTION LIMIT (ug/kg) [5]	EXCEEDENCE QUOTIENT [6]
4,4'-DDE	16	FN	**2/12**	**NBS2-SD23**	**22**	**J**	4.57	**1.38**
				NBS2-SD14	**140**		12.82	**8.75**
4,4'-DDE	2.2	BOTH	**7/12**	**NBS2-SD11**	**2.8**	**J**	5.85	**1.27**
				NBS2-SD09	**5.7**		5.38	**2.59**
				NBS2-SD12	**11**	**J**	6.94	**5.00**
				NBS2-SD13	**14**	**J**	9.80	**6.36**
				NBS2-SD23	**18**		4.57	**8.18**
				NBS2-SD17	**19**		12.82	**8.64**
				NBS2-SD14	**31**		12.82	**14.09**

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Arsenic	0.057	FN	**17/17**	**NBS2-SD15**	**0.93**	**J**	0.88	**16.32**
				NBS2-SD16	**1.4**		0.86	**24.56**
				NBS2-SD16D	**1.4**	**J**	0.92	**24.56**
				NBS2-SD15D	**1.5**		0.88	**26.32**
				NBS2-SD10	**3.4**		0.81	**59.65**
				NBS2-SD23	**3.8**		0.82	**66.67**
				NBS2-SD11	**5.3**		1.00	**92.98**
				NBS2-SDO9	**5.6**		0.96	**98.25**
				NBS2-SD12	**7.9**		1.20	**138.60**
				NBS2-SD13	**8.9**		1.70	**156.14**
				NBS2-SD14	**9.2**		1.70	**161.40**

TABLE 3-14

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (ug/kg) [1]		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (ug/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) [5]	EXCEEDENCE QUOTIENT [6]
Arsenic	0.057	FN	**17/17**	**NBS2-SD22**	**12.6**		2.30	**221.05**
				NBS2-SD21	**15.8**		2.30	**277.19**
				NBS2-SD19	**17.9**		2.20	**314.04**
				NBS2-SD18	**18.3**		2.20	**321.05**
				NBS2-SD17	**19.4**		2.30	**340.35**
				NBS2-SD20	**20**		3.30	**350.88**
Cadmium	1.2	FN	**13/17**	**NBS2-SD23**	**2.5**		0.14	**2.08**
				NBS2-SD14	**7.7**		0.38	**6.42**
				NBS2-SD18	**8.7**		0.36	**7.25**
				NBS2-SD21	**8.7**		0.39	**7.25**
				NBS2-SD22	**9**		0.37	**7.50**
				NBS2-SD17	**10.3**		0.39	**8.58**
				NBS2-SD19	**11**		0.39	**9.17**
				NBS2-SD20	**12.4**		0.54	**10.33**
				NBS2-SD10	**12.8**		0.13	**10.67**
				NBS2-SD11	**15.2**		0.17	**12.67**
				NBS2-SD12	**21.4**		0.21	**17.83**
				NBS2-SD13	**25.3**		0.29	**21.08**
				NBS2-SD09	**48.1**		0.16	**40.08**
Chromium	0.005	FL	**17/17**	**NBS2-SD15**	**4.4**		0.15	**880.00**
				NBS2-SD15D	**4.5**		0.15	**900.00**
				NBS2-SD16	**5.2**		0.14	**1040.00**
				NBS2-SD16D	**5.8**		0.15	**1160.00**
				NBS2-SD23	**21.8**		0.14	**4360.00**
				NBS2-SD14	**40.7**		0.38	**8140.00**
				NBS2-SD22	**55.7**		0.37	**11140.00**
				NBS2-SD21	**55.8**		0.39	**11160.00**
				NBS2-SD11	**72.4**		0.17	**14480.00**
				NBS2-SD20	**75.8**		0.54	**15160.00**

TABLE 3-14

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) 1		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Chromium	0.005	FL	**17/17**	**NBS2-SD19**	**77.8**		0.39	**15560.00**
				NBS2-SD17	**77.9**		0.39	**15580.00**
				NBS2-SD10	**81**		0.13	**16200.00**
				NBS2-SD18	**83.3**		0.36	**16660.00**
				NBS2-SD12	**87.2**		0.21	**17440.00**
				NBS2-SD13	**89.3**		0.29	**17860.00**
				NBS2-SD09	**292**		0.16	**58400.00**
Copper	34	FN	**13/17**	**NBS2-SD23**	**117**		0.14	**3.44**
				NBS2-SD22	**209**		0.37	**6.15**
				NBS2-SD14	**235**		0.38	**6.91**
				NBS2-SD21	**245**		0.39	**7.21**
				NBS2-SD20	**343**		0.54	**10.09**
				NBS2-SD18	**361**		0.36	**10.62**
				NBS2-SD19	**361**		0.39	**10.62**
				NBS2-SD17	**385**		0.39	**11.32**
				NBS2-SD11	**863**		0.17	**25.38**
				NBS2-SD13	**876**		0.29	**25.76**
				NBS2-SD12	**1040**		0.21	**30.59**
				NBS2-SD10	**1060**		0.13	**31.18**
				NBS2-SDO9	**5510**		0.16	**162.06**
Lead	46.7	FN	**13/17**	**NBS2-SD23**	**153**		0.27	**3.28**
				NBS2-SD14	**203**		0.76	**4.35**
				NBS2-SD21	**232**		0.78	**4.97**
				NBS2-SD22	**232**		0.75	**4.97**
				NBS2-SD11	**277**		0.35	**5.93**
				NBS2-SD10	**303**		0.27	**6.49**
				NBS2-SD20	**400**		1.10	**8.57**
				NBS2-SD12	**408**		0.41	**8.74**
				NBS2-SD17	**418**		0.77	**8.95**

TABLE 3-14

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) 1		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Nickel	20.9	BOTH	**6/17**	**NBS2-SD19**	**426**		0.78	**9.12**
				NBS2-SD13	**438**		0.58	**9.38**
				NBS2-SD18	**457**		0.72	**9.79**
				NBS2-SD09	**3900**		0.32	**83.51**
				NBS2-SD18	**33.6**		0.36	**0.72**
				NBS2-SD11	**39.4**		0.17	**0.84**
				NBS2-SD13	**46.2**		0.29	**0.99**
				NBS2-SD10	**46.3**		0.13	**0.99**
				NBS2-SD12	**47.2**		0.21	**1.01**
				NBS2-SD09	**185**		0.16	**3.96**
Silver	1	FN	**13/17**	**NBS2-SD23**	**1.4**		0.14	**1.40**
				NBS2-SD22	**2.1**	**J**	0.37	**2.10**
				NBS2-SD14	**2.6**	**J**	0.39	**2.60**
				NBS2-SD21	**2.8**	**J**	0.38	**2.80**
				NBS2-SD20	**3.5**	**J**	0.54	**3.50**
				NBS2-SD18	**3.8**	**J**	0.39	**3.80**
				NBS2-SD19	**3.9**		0.36	**3.90**
				NBS2-SD17	**4**		0.39	**4.00**
				NBS2-SD11	**8.4**		0.17	**8.40**
				NBS2-SD13	**9.7**		0.21	**9.70**
				NBS2-SD12	**10.9**		0.29	**10.90**
				NBS2-SD10	**11.1**		0.13	**11.10**
				NBS2-SD09	**34.3**		0.16	**34.30**
Zinc	150	FN	**9/13**	**NBS2-SD10**	**539**		0.40	**3.59**
				NBS2-SD11	**598**		0.52	**3.99**
				NBS2-SD21	**694**		1.20	**4.63**
				NBS2-SD22	**696**		1.10	**4.64**
				NBS2-SD18	**747**		1.10	**4.98**
				NBS2-SD12	**792**		0.62	**5.28**

TABLE 3-14

SEDIMENT SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG SEDIMENT SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG SEDIMENT SCREENING LEVEL (mg/kg) 1		FREQUENCY OF EXCEEDENCE [2]	LOCATION OF EXCEEDENCE [3]	ANALYTICAL RESULT (mg/kg)	DV QUAL [4]	DETECTION LIMIT (mg/kg) 5	EXCEEDENCE QUOTIENT [6]
Zinc	150	FN	**9/13**	**NBS2-SD19**	**798**		1.20	**5.32**
				NBS2-SD13	**951**		0.87	**6.34**
				NBS2-SD09	**1800**		0.48	**12.00**

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the STAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID Indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used. For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

SURFACE WATER SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED AMBIENT WATER QUALITY CRITERIA
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	AMBIENT WATER QUALITY CRITERIA (ug/L)		FREQUENCY OF EXCEEDENCE [1]	LOCATION OF EXCEEDENCE [2]	ANALYTICAL RESULT (ug/L)	DV QUAL [3]	DETECTION LIMIT (mg/kg) 4	EXCEEDENCE QUOTIENT [5]
Cadmium	1.1	AWQC	**2/5**	**NBS2-SW03**	**11.1**		1	**10.09**
				NBS2-SW02	**38.6**		1	**35.09**
Iron	1000	AWQC	**5/5**	**NBS2-SW01**	**2160**		27	**2.16**
				NBS2-SW04	**2690**		27	**2.69**
				NBS2-SW01P	**4530**		27	**4.53**
				NBS2-SW03	**26900**		27	**26.90**
				NBS2-SW02	**49500**		27	**49.50**
Lead	3.2	AWQC	**3/5**	**NBS2-SW04**	**21.6**		3	**6.75**
				NBS2-SW03	**331**		3	**103.44**
				NBS2-SW02	**1190**		3	**371.88**
Silver	0.92	AWQC	**2/5**	**NBS2-SW03**	**4.6**	**J**	2	**5.00**
				NBS2-SW02	**32.9**		2	**35.76**
Zinc	110	AWQC	**2/5**	**NBS2-SW03**	**742**		2	**6.75**
				NBS2-SW02	**1900**		2	**17.27**

Footnotes:
1 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed AWQC / the number of samples collected and analyzed for the chemical.
2 - An "F" at the end of a sample ID Indicates that the sample was filtered during collection. A "P. or a "D" at the end of a sample ID indicates a duplicate sample.
3 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
4 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used. For inorganic analyses - Contract Required Detection Limit (CRDL) for EPA CLP SOW is used.
5 - Exceedence Quotient = analytical result / AWQC.

TABLE 3-16

SURFACE WATER SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG FRESH WATER SCREENING LEVELS
NBN SITE 2, SEPTEMBER 1996

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG FRESH WATER SCREENING LEVEL (ug/L) [1]		FREQUENCY OF EXCEEDENCE [1]	LOCATION OF EXCEEDENCE [2]	ANALYTICAL RESULT (ug/L)	DV QUAL [3]	DETECTION LIMIT (ug/L) [4]	EXCEEDENCE QUOTIENT [5]
Aluminum	25	FN	3/5	NBS2-SW04	519		11	20.76
				NBS2-SW03	12900		11	516.00
				NBS2-SW02	47400		11	1896.00
Cadmium	0.53	FN	3/5	NBS2-SW04	1.1	J	1	2.08
				NBS2-SW03	11.1		1	20.94
				NBS2-SW02	38.6		1	72.83
Chromium	2	FL		NBS2-SW04	2.1	J	1	1.05
				NBS2-SW03	43		1	21.50
				NBS2-SW02	134		1	67.00
Copper	6.5	FN		NBS2-SW02	2120		1	326.15
Lead	3.2	FN		NBS2-SW04	21.6		3	6.75
				NBS2-SW03	331		3	103.44
				NBS2-SW02	1190		3	371.88
Silver	0.0001	FN		NBS2-SW03	4.6	J	2	46000.00
				NBS2-SW02	32.9		2	329000.00
Zinc	30	FL		NBS2-SW03	742		2	24.73
				NBS2-SW02	1900		2	63.33

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" Indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P" or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed identification.
5 - For organic analyses - Contract Required Quantitation Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used. For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW is used.
6 - Exceedence Quotient = analytical result / screening level.

TABLE 3-18

SURFACE WATER SAMPLING RESULTS
SUMMARY OF DETECTED CHEMICALS THAT EXCEED BTAG FRESH WATER SCREENING LEVELS
NBN SITE 2, APRIL 1997

INORGANICS

CHEMICAL	MOST CONSERVATIVE BTAG FRESH WATER SCREENING LEVEL (ug/L) [1]		FREQUENCY OF EXCEEDENCE [1]	LOCATION OF EXCEEDENCE [2]	ANALYTICAL RESULT (ug/L)	DV QUAL [3]	DETECTION LIMIT (ug/L) [4]	EXCEEDENCE QUOTIENT [5]
Aluminum	25	FN	4/16	NBS2-SW10	3500	J	4	140.00
				NBS2-SW12	3930	J	4	157.20
				NBS2-SW14	1730	J	4	69.20
				NBS2-SW20	2680	J	4	107.20
Cadmium	0.53	FN	7/16	NBS2-SW09	1.2	J	1	2.26
				NBS2-SW10	8.1		1	15.28
				NBS2-SW11	3.1	J	1	5.85
				NBS2-SW12	6.9		1	13.02
				NBS2-SW13	1.7	J	1	3.21
				NBS2-SW14	2.3	J	1	4.34
				NBS2-SW20	1.5	J	1	2.83
Chromium	2	FL		NBS2-SW11	2.2	J	1	1.10
				NBS2-SW14	2.9	J	1	1.45
				NBS2-SW20	6.3	J	1	3.15
				NBS2-SW10	11.6		1	5.80
				NBS2-SW12	11.6		1	5.80
Lead	3.2	FN		NBS2-SW12	171		2	53.44
				NBS2-SW10	196		2	61.25
Silver	0.0001	FN		NBS2-SW14	1.1	J	1	11000.00
				NBS2-SW09	1.8	J	1	18000.00
				NBS2-SW10	2.1	J	1	21000.00
				NBS2-SW12	2.4	J	1	24000.00
				NBS2-SW19	3.5	J	1	35000.00

TABLE 3-18

Footnotes:
1 - The most conservative screening level was used to determine exceedences. " FN" Indicates that the BTAG fauna screening level was used, "FL" indicates that the BTAG flora screening level was used, and "BOTH" indicates that the BTAG fauna and flora screening levels are the same.
2 - Frequency of Exceedence = the number of samples with chemical concentrations that exceed the most conservative screening level / the number of samples collected and analyzed for the chemical.
3 - An "F" at the end of a sample ID indicates that the sample was filtered during collection. A "P. or a "D" at the end of a sample ID indicates a duplicate sample.
4 - Data Validation Qualifiers: "J" = Analyte present - reported value may not be accurate or precise. "K" = Analyte present - reported value may be biased high. "L" = Analyte present - reported value may be reported low. No code = Confirmed Identification.
5 - For organic analyses - Contract Required Quantitatlon Limit (CRQL) for EPA Contract Lab Program (CLP) Statement of Work (SOW) is used.
For inorganic analyses - Contract Required Detection Limit for EPA CLP SOW Is used.
6 - Exceedence Quotient = analytical result / screening level.

Appendix C

Summary of Media-Specific Human Health Risks and Hazards

Summary of Media-Specific Risks and Hazards
NBN Slag Pile (Site 2)

Media: Groundwater

Chemical	Receptor 1 (e.g., Site Worker)								Receptor 2 (e.g., Construction Worker)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Trichloroethene	- -	3.4E-03	- -	**3.4E-03**	- -	8.1E-08	- -	**8.1E-08**	- -	- -	3.7E-02	**3.7E-02**	8.2E-13	- -	8.8E-07	**8.8E-07**
Manganese (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	1.3E-02	**1.3E-02**	- -	- -	- -	**- -**
Selenium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	7.6E-04	**7.6E-02**	- -	- -	- -	**- -**
Thallium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	3.1E-02	**3.1E-02**	- -	- -	- -	**- -**
Thallium (F)	- -	8.9E-01	- -	**8.9E-01**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**
Totals	**- -**	**8.9E-01**	**- -**	**8.9E-01**	**- -**	**8.1E-08**	**- -**	**8.1E-08**	**- -**	**- -**	**8.2E-02**	**8.2E-02**	**8.2E-13**	**- -**	**8.8E-07**	**8.8E-07**

Chemical	Receptor 3 (e.g., Agricultural)								Receptor 2 (e.g., Car wash)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Trichloroethene	- -	6.5E-05	1.0E-03	**1.1E-03**	3.2E-15	1.5E-09	2.4E-08	**2.6E-08**	- -	8.4E-05	9.7E-04	**1.1E-03**	1.1E-25	1.9E-09	2.2E-08	**2.4E-08**
Manganese (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**
Selenium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**
Thallium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**
Thallium (F)	- -	1.7E-02	7.5E-04	**1.8E-02**	- -	- -	- -	**- -**	- -	2.2E-02	5.3E-04	**2.2E-02**	- -	- -	- -	**- -**
Totals	**- -**	**1.7E-02**	**1.8E-03**	**1.9E-02**	**3.2E-15**	**1.5E-09**	**2.4E-08**	**2.6E-08**	**- -**	**2.2E-02**	**1.5E-03**	**2.3E-02**	**1.1E-25**	**1.9E-09**	**2.2E-08**	**2.4E-08**

Media: Surface Soil

Chemical	Receptor 1 (e.g., Site Worker)							
	HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Arsenic	- -	2.2E-02	7.8E-02	**1.0E-01**	3.6E-09	3.5E-06	1.3E-05	**1.6E-05**
Totals	**- -**	**2.2E-02**	**7.8E-02**	**1.0E-01**	**3.6E-09**	**3.5E-06**	**1.3E-05**	**1.6E-05**

Chemical	Receptor 5 (e.g., recreational adolescent)								Receptor 6 (e.g., recreational adult)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Benzo[a]pyrene	- -	- -	- -	**- -**	- -	9.0E-08	- -	**9.0E-08**	- -	- -	- -	**- -**	- -	1.6E-07	- -	**1.6E-07**
Arsenic	- -	4.6E-02	5.5E-02	**1.0E-01**	- -	2.7E-06	3.3E-06	**5.9E-06**	- -	2.4E-02	4.7E-02	**7.1E-02**	- -	4.7E-06	9.3E-06	**1.4E-05**
Iron	- -	4.1E-02	- -	**4.1E-02**	- -	- -	- -	**- -**	- -	2.2E-02	- -	**2.2E-02**	- -	- -	- -	**- -**
Totals	**- -**	**8.7E-02**	**5.5E-02**	**1.4E-01**	**- -**	**2.8E-06**	**3.3E-06**	**6.0E-06**	**- -**	**4.6E-02**	**4.7E-02**	**9.3E-02**	**- -**	**4.9E-06**	**9.3E-06**	**1.4E-05**

Summary of Media-Specific Risks and Hazards
NBN Slag Pile (Site 2)

Media: Subsurface Soil

Chemical	Receptor 2 (e.g., Construction Worker)							
	HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Aluminum	2.6E-02	8.3E-01	3.4E-01	**1.2E+00**	- -	- -	- -	**- -**
Antimony	- -	2.8E+00	3.1E+00	**5.9E+00**	- -	- -	- -	**- -**
Arsenic	- -	2.1E-01	7.5E-02	**2.8E-01**	4.2E-10	1.3E-06	5.0E-07	**1.8E-06**
Cadmium	- -	5.1E-01	2.3E+00	**2.8E+00**	1.5E-09	- -	- -	**1.5E-09**
Chromium	5.0E-01	3.0E+00	3.4E+01	**3.7E+01**	1.7E-07	- -	- -	**1.7E-07**
Copper	- -	9.2E+00	1.7E+00	**1.1E+01**	- -	- -	- -	**- -**
Iron	- -	1.6E+00	- -	**1.6E+00**	- -	- -	- -	**- -**
Nickel	- -	1.7E+00	1.9E+00	**3.5E+00**	- -	- -	- -	**- -**
Totals	**5.3E-01**	**2.0E+01**	**4.3E+01**	**6.3E+01**	**1.7E-07**	**1.3E-06**	**5.0E-07**	**2.0E-06**

Media: Surface Water

Chemical	Receptor 5 (e.g., recreational adolescent)								Receptor 6 (e.g., recreational adult)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Antimony	- -	6.0E-03	1.1E-02	**1.7E-02**	- -	- -	- -	**- -**	- -	3.2E-03	9.6E-03	**1.3E-02**	- -	- -	- -	**- -**
Arsenic	- -	8.5E-03	1.6E-03	**1.0E-02**	- -	4.9E-07	9.7E-08	**5.9E-07**	- -	4.5E-03	1.4E-03	**5.9E-03**	- -	8.7E-07	2.8E-07	**1.1E-06**
Cadmium	- -	1.2E-02	4.5E-02	**5.7E-02**	- -	- -	- -	**- -**	- -	6.4E-03	3.8E-02	**4.5E-02**	- -	- -	- -	**- -**
Copper	- -	1.4E-03	4.3E-04	**1.8E-03**	- -	- -	- -	**- -**	- -	7.3E-04	3.7E-04	**1.1E-03**	- -	- -	- -	**- -**
Iron	- -	6.1E-02	- -	**6.1E-02**	- -	- -	- -	**- -**	- -	3.2E-02	- -	**3.2E-02**	- -	- -	- -	**- -**
Manganese	- -	6.2E-03	1.2E-03	**7.4E-03**	- -	- -	- -	**- -**	- -	3.3E-03	9.9E-04	**4.3E-03**	- -	- -	- -	**- -**
Thallium	- -	3.1E-02	5.8E-03	**3.7E-02**	- -	- -	- -	**- -**	- -	1.6E-02	4.9E-03	**2.1E-02**	- -	- -	- -	**- -**
Totals	**- -**	**1.3E-01**	**6.5E-02**	**1.9E-01**	**- -**	**4.9E-07**	**9.7E-08**	**5.9E-07**	**- -**	**6.6E-02**	**5.6E-02**	**1.2E-01**	**- -**	**8.7E-07**	**2.8E-07**	**1.1E-06**

Media: Sediment

Chemical	Receptor 5 (e.g., recreational adolescent)								Receptor 6 (e.g., recreational adult)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Arsenic	- -	2.0E-02	2.4E-02	**4.4E-02**	- -	1.2E-06	1.4E-06	**2.6E-06**	- -	1.1E-02	2.1E-02	**3.1E-02**	- -	2.0E-06	4.0E-06	**6.0E-06**
Totals	**- -**	**2.0E-02**	**2.4E-02**	**4.4E-02**	**- -**	**1.2E-06**	**1.4E-06**	**2.6E-06**	**- -**	**1.1E-02**	**2.1E-02**	**3.1E-02**	**- -**	**2.0E-06**	**4.0E-06**	**6.0E-06**

Summary of Media-Specific Risks and Hazards
NBN Slag Pile (Site 2)

Media: Background Groundwater

Chemical	Receptor 1 (e.g., Site Worker)								Receptor 2 (e.g., Construction Worker)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Aluminum (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	1.4E-02	**1.4E-02**	- -	- -	- -	- -
Antimony (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	7.5E-02	**7.5E-02**	- -	- -	- -	- -
Arsenic (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	3.2E-02	**3.2E-02**	- -	- -	5.1E-06	**5.1E-06**
Cadmium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	7.3E-01	**7.3E-01**	- -	- -	- -	- -
Chromium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	3.8E-01	**3.8E-01**	- -	- -	- -	- -
Copper (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	9.2E-03	**9.2E-03**	- -	- -	- -	- -
Iron (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Manganese (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	5.0E-03	**5.0E-03**	- -	- -	- -	- -
Zinc (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	3.9E-03	**3.9E-03**	- -	- -	- -	- -
Aluminum (F)	- -	4.7E-02	- -	**4.7E-02**	- -	- -	- -	**- -**	- -	- -	- -	- -	- -	- -	- -	- -
Antimony (F)	- -	7.2E-02	- -	**7.2E-02**	- -	- -	- -	**- -**	- -	- -	- -	- -	- -	- -	- -	- -
Arsenic (F)	- -	4.2E-01	- -	**4.2E-01**	- -	6.7E-05	- -	**- -**	- -	- -	- -	- -	- -	- -	- -	- -
Iron (F)	- -	5.5E-01	- -	**5.5E-01**	- -	- -	- -	**- -**	- -	- -	- -	- -	- -	- -	- -	- -
Manganese (F)	- -	9.0E-02	- -	**9.0E-02**	- -	- -	- -	**- -**	- -	- -	- -	- -	- -	- -	- -	- -
Totals	**- -**	**1.2E+00**	**- -**	**1.2E+00**	**- -**	**6.7E-05**	- -	**6.7E-05**	- -	- -	**1.3E+00**	**1.3E+00**	- -	- -	**5.1E-06**	**5.1E-06**

Media: Background Groundwater (continued)

Chemical	Receptor 3 (e.g., Agricultural)								Receptor 4 (e.g., Car Wash)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Aluminum (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Antimony (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Arsenic (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**
Cadmium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Chromium (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Copper (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Iron (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Manganese (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Zinc (UF)	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	**- -**	- -	- -	- -	- -
Aluminum (F)	- -	9.0E-04	1.5E-04	**1.0E-03**	- -	- -	- -	**- -**	- -	1.2E-03	1.1E-04	**1.3E-03**	- -	- -	- -	- -
Antimony (F)	- -	1.4E-03	6.1E-04	**2.0E-03**	- -	- -	- -	**- -**	- -	1.8E-03	4.3E-04	**2.2E-03**	- -	- -	- -	- -
Arsenic (F)	- -	7.9E-03	3.7E-04	**8.3E-03**	- -	1.3E-06	6.0E-08	**1.3E-06**	- -	1.0E-02	2.7E-04	**1.1E-02**	- -	1.6E-06	4.1E-08	**1.6E-06**
Iron (F)	- -	1.0E-02	- -	**1.0E-03**	- -	- -	- -	**- -**	- -	1.4E-02	- -	**1.4E-02**	- -	- -	- -	**- -**
Manganese (F)	- -	1.7E-03	7.6E-05	**1.8E-03**	- -	- -	- -	**- -**	- -	2.2E-03	5.4E-05	**2.3E-03**	- -	- -	- -	**- -**
Totals	**- -**	**2.2E+02**	**1.2E-03**	**1.2E+00**	**- -**	**1.3E-06**	**6.0E-08**	**1.3E-06**	- -	**2.9E-02**	**8.6E-04**	**3.0E-02**	- -	**1.6E-06**	**4.1E-08**	**1.6E-06**

Summary of Media-Specific Risks and Hazards
NBN Slag Pile (Site 2)

Media: Background Surface Soil

Chemical	Receptor 5 (e.g., recreational adolescent)								Receptor 6 (e.g., recreational adult)							
	HQ				CR				HQ				CR			
	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total	Inh	Ing	Der	Total
Aluminum	- -	6.4E-03	8.5E-03	**1.5E-02**	- -	- -	- -	**- -**	- -	3.4E-03	7.2E-03	**1.1E-02**	- -	- -	- -	**- -**
Arsenic	- -	3.9E-03	4.7E-03	**8.6E-03**	- -	2.8E-07	2.8E-07	**5.1E-07**	- -	2.1E-03	4.0E-03	**6.1E-03**	- -	4.0E-07	8.0E-07	**1.2E-06**
Totals	**- -**	**1.0E-02**	**1.3E-02**	**2.3E-02**	**- -**	**2.3E-07**	**2.8E-07**	**5.1E-07**	**- -**	**5.5E-03**	**1.1E-02**	**1.7E-02**	**- -**	**4.0E-07**	**8.0E-07**	**1.2E-06**

UF = Unfiltered groundwater samples, evaluated for construction scenario
F = Filtered groundwater samples, evaluated for site worker, agriculture worker, and car wash scenarios
HQ = Hazard Quotient
CR = Cancer Risk
Ing = Ingestion route of exposure
Inh = Inhalation route of exposure
Der = Dermal route of exposure