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FINAL RECORD OF DECISION SITE 8 NUSC DISPOSAL AREA NS NEWPORT RI
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RECORD OF DECISION

OPERABLE UNIT 7 (SITE 8, THE NAVAL UNDERSEA SYSTEMS CENTER DISPOSAL AREA) OF THE FORMER NAVAL EDUCATION AND TRAINING CENTER

NAVAL STATION NEWPORT, RHODE ISLAND
SEPTEMBER 2012

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ACRONYMS

1,1,1-TCA	1,1,1-trichloroethane
1,1-DCA	1,1-dichloroethane
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below ground surface
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Chemical of concern
COPC	Chemical of potential concern
CS	Confirmation study
CSF	Cancer slope factor
CSM	Conceptual site model
CVOC	Chlorinated volatile organic compounds
DCE	Dichloroethene
DEC	Direct exposure criteria
EBS	Environmental Baseline Study
ELUR	Environmental land use restriction
ENR	Enhanced natural recovery
EPA	U.S. Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
ER, N	Environmental Restoration, Navy
ETPH	Extractable total petroleum hydrocarbons
EU	Exposure units
FFA	Federal Facility Agreement
FS	Feasibility Study
GA	RIDEM GA groundwater classification
GAC	Granular activated carbon
GB	RIDEM GB groundwater classification
GRO	Gasoline range organics
HHRA	Human health risk assessment
HI	Hazard index
HMW	High molecular weight
HQ	Hazard quotient
IAS	Initial assessment survey

ID	Identification
ILCR	Incremental lifetime cancer risk
IR	Installation Restoration
IRIS	Integrated Risk Information System
ISCO	in-situ chemical oxidation
IUR	Inhalation unit risk
LNAPL	Light non-aqueous phase liquid
LOAEL	Low-observed-adverse-effects level
LOEC	Lowest observed effects concentration
LTM	Long-term monitoring
LTTD	Low-temperature thermal desorption
LUC	Land use control
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
mg/kg	Milligrams per kilogram
MNA	Monitored natural attenuation
MW	Monitoring well
NAVSTA	Naval Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NETC	Naval Education and Training Center
NFA	No Further Action
NOAEL	No-observed-adverse-effects level
NOEC	No observed effects concentration
NPL	National Priorities List
NPW	Net present worth
NUSC	Naval Undersea Systems Center
NUWC	Naval Undersea Warfare Center
O&M	Operation and maintenance
OFFTA	Old Fire Fighting Training Area
ORNL	Oak Ridge National Laboratory
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PEC-Q	Probable effects concentration quotient
PGDN	Propylene glycol dinitrate
POTW	Publicly owned treatment works
PRG	Preliminary Remediation Goal
RAB	Restoration Advisory Board

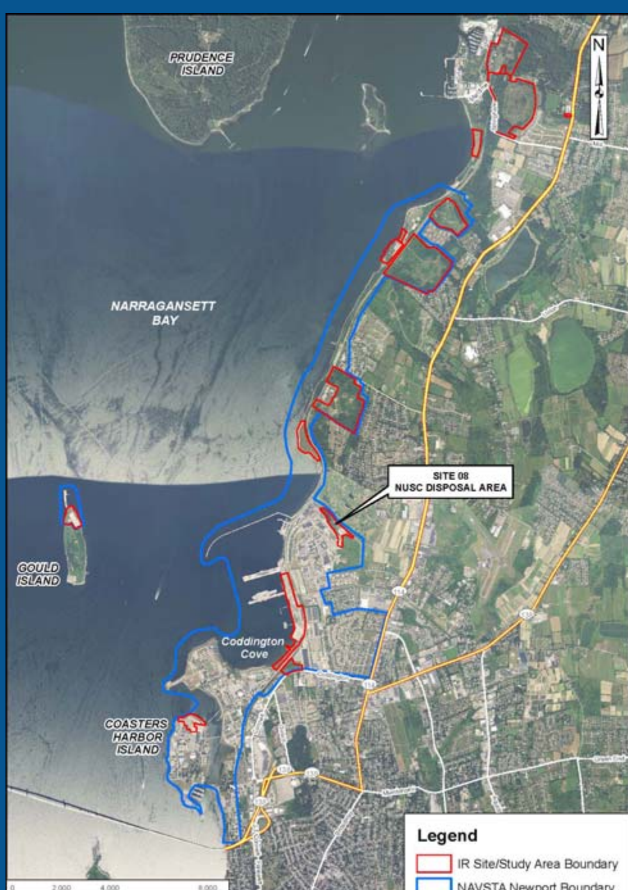
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RfC	Reference concentration
RfD	Reference dose
RG	Remediation Goal
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RME	Reasonable maximum exposure
ROD	Record of Decision
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
SASE	Study Area Screening Evaluation
SF	Slope factor
SMP	Site Management Plan
SRI	Supplemental Remedial Investigation
SVOC	Semivolatile organic compound
TCE	Trichloroethene
TPH	Total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
UCL	Upper Confidence Limit
UST	Underground Storage Tank
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
VOC	Volatile organic compound

1.0 DECLARATION

1.1 Site Name and Location

The Naval Undersea Systems Center (NUSC) Disposal Area, which is also known as Operable Unit 7 (OU7) and Site 8, is located in Middletown, Rhode Island at the Naval Station (NAVSTA) Newport. NAVSTA Newport was formerly called the Naval Education and Training Center (NETC) and has been assigned United States Environmental Protection Agency (EPA) ID number RI6170085470. The location of Site 8 is shown on Figure 1-1.

Figure 1-1. Site 8 Location Map



1.2 Statement of Basis and Purpose

This Record of Decision (ROD) presents the Selected Remedy for Site 8, which was chosen by the Navy and EPA in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on information contained in the Administrative Record for the site. The Rhode Island Department of Environmental Management (RIDEM) concurs with the Selected Remedy as shown in Appendix A.

1.3 Assessment of Site

The response action selected in this ROD is necessary to protect the public health and welfare or the environment from actual or threatened releases of hazardous substances into the environment. A CERCLA action is required because polycyclic aromatic hydrocarbons (PAHs) and metals in soil pose unacceptable risk to human health under current and hypothetical future land use scenarios; volatile organic compounds (VOCs) and metals in groundwater pose unacceptable risk to human health under hypothetical future residential use; and lead in stream sediment poses unacceptable risk to human health. In addition, unacceptable ecological risks are associated with metals in soil and with PAHs, polychlorinated biphenyls (PCBs), and metals concentrations in sediment.

1.4 DESCRIPTION OF SELECTED REMEDY

The major components of the Selected Remedy for Site 8 include the following:

- Excavation and offsite disposal of selected soil volumes (e.g., soil exceeding RIDEM leachability standards).
- Construction of a soil cover over the remaining area of unpaved soils where chemical of concern (COC) concentrations exceed industrial cleanup goals.
- Maintenance of the existing paved area as a Waste Management Area.
- In-situ treatment of the most contaminated portions of groundwater using either enhanced bioremediation or chemical oxidation, as to be determined through pre-design studies.
- Monitored natural attenuation (MNA) of the residual groundwater plume.
- Excavation and offsite disposal of sediment in Deerfield Pond and Deerfield Creek.
- Implementation of land use controls (LUCs) to ensure that future use of the property is limited to industrial activities (residential and unrestricted recreational site use will be prohibited in areas where COC concentrations in soil and sediment exceed residential cleanup goals), to ensure that the soil cover and subsurface soils are not disturbed without appropriate safety precautions, and to prohibit groundwater use until cleanup goals are achieved.
- Long-term monitoring of groundwater and inspection/maintenance of the soil/asphalt cover system.

The Selected Remedy eliminates potential unacceptable human exposure to soil, sediment, and groundwater through a combination of removal, treatment, and LUCs. The Selected Remedy eliminates potential unacceptable ecological exposure to soil and sediment through a combination of removal and capping. The Site 8 remediation will not adversely impact the current and reasonably anticipated future industrial land use. The Selected Remedy is expected to achieve substantial long-term risk reduction and allow the property to be used for the reasonably anticipated future land use. This ROD documents the final remedial action decision for Site 8 and does not include or affect any other sites at NAVSTA Newport. Implementation of this remedy will allow for continued industrial use of the site, which is consistent with current use and the overall cleanup strategy for NAVSTA Newport of restoring sites to support base operations.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. Through implementation of an in-situ groundwater treatment technology, the Selected Remedy partially satisfies the statutory preference for remedies that use treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances, pollutants, and contaminants.

Since this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years of initiation of the remedial action and every 5 years thereafter to ensure that the remedy is, or will continue to be, protective of human health and the environment.

Federal regulations that are relevant and appropriate to the cleanup require a determination that there is no practical alternative to taking federal actions affecting federal jurisdictional wetlands, aquatic habitats and floodplain, per Section 404 of the Clean Water Act and Executive Orders 11990 (Protection of Wetlands) and 11988 (Protection of Floodplains), as incorporated under Federal Emergency Management Agency (FEMA) regulations. In accordance with the Clean Water Act, the Navy has determined that the combination of Alternatives SD4/SO3/GW3/GW4 is the Least Environmentally Damaging Practicable Alternative to protect wetland resources because it provides the best balance of addressing contaminated sediment within and adjacent to wetlands and waterways and minimizes both temporary and permanent alteration of wetlands and aquatic habitats on site. Although each of the sediment cleanup options would impact the wetland and pond areas during cleanup activities, Alternative SD4 will permanently remove COCs in sediment, which will be of long-term benefit to the restored wetland area. Alternative SD4 will also increase the water volume capacity of NUWC Pond, which will benefit the recovery of aquatic life in the pond. Alternative SO3 involves the least disturbance (least excavation) to the wetland soils and the upland areas abutting the wetlands.

In accordance with the Toxic Substances Control Act (TSCA), the status of residual (low level) PCBs to remain in soil at the site was evaluated. The human health and ecological risk evaluations concluded that, at the present concentrations, leaving PCBs in-place (disposal) under a cover along with LUCs and long-term monitoring, does not pose an unreasonable risk to public health or the environment, based on the current and proposed future use. The Selected Remedy includes the construction of a soil cover, which will provide additional protection to possible site receptors. Accordingly, and based on the provisions of 40 CFR § 761.61(c), the Navy and EPA have determined that the in-place management of PCBs in soil will not pose an unreasonable risk to public health or the environment. EPA also has determined that the risk-based Remediation Goal (RG) for PCBs in sediment will meet the no unreasonable risk standard in accordance with § 761.61(c) by removing PCB-contaminated sediment.

The NCP at 40 CFR 300.430(a)(1)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site, wherever practicable. Principal threat wastes are those source materials considered to be highly toxic or highly mobile, that generally cannot be reliably contained, or that would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants, or contaminants that acts as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. At Site 8, the contaminants concentrations are not highly toxic or highly mobile; therefore, principal threat wastes are not present at the site.

1.6 ROD DATA CERTIFICATION CHECKLIST

Table 1-1 provides a summary of the specific ROD information that is presented within the decision summary in Section 2.0 of this document. Additional information can be found in the Administrative Record file for NAVSTA Newport, available online at http://go.usa.gov/Tsy.

TABLE 1-1. ROD DATA CERTIFICATION CHECKLIST

DATA	LOCATION IN ROD
COCs and their respective concentrations	Sections 2.5 and 2.7
Baseline risk represented by the COCs	Section 2.7
Cleanup levels established for COCs and the basis for these levels	Section 2.7 and 2.8
How source materials constituting principal threats are addressed	Section 2.11

TABLE 1-1. ROD DATA CERTIFICATION CHECKLIST

DATA	LOCATION IN ROD
Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the risk assessment	Section 2.6
Potential land and groundwater uses that will be available at the site as a result of the Selected Remedy	Section 2.12.3
Estimated capital, operating and maintenance (O&M), and total net present worth (NPW) costs; discount rate; and number of years over which the remedy costs are projected	Appendix B
Key factors that led to the selection of the remedy	Section 2.12.1

1.7 AUTHORIZING SIGNATURES

The signatures provided below validate the Selected Remedy for OU7 (Site 8, the NUSC Disposal Area at NAVSTA Newport, Rhode Island) by the Navy and EPA. RIDEM concurs with the Selected Remedy, as indicated in Appendix A of this ROD.

Concur and recommend for implementation:

[signature] 9/17/12

CAPT D.W. Mikatarian **Date**
Commanding Officer
Naval Station Newport, RI
U.S. Navy

Human health and ecological risk assessments were conducted using CERCLA risk assessment methods and guidance. The assessments concluded that, at the present concentrations, leaving soil PCBs in-place (disposal), under a cover, along with LUCs and long-term monitoring, does not pose an unreasonable risk to public health or the environment, based on the current and proposed future use. The preferred remedy will include the construction of a soil cover, which will provide additional protection to possible site receptors. Accordingly, and based on the provisions of 40 CFR § 761.61(c), EPA has determined that the in-place management of PCBs in soil at Site 8, as called for in this ROD, will not pose an unreasonable risk to public health or the environment. EPA also has determined that the risk-based RG for PCBs in sediment will meet the no unreasonable risk standard in accordance with § 761.61(c) by removing PCB-contaminated sediment.

Concur and recommend for implementation:

[signature] 9/26/12

James T. Owens, III **Date**
Director, Office of Site Remediation and Restoration
Region 1 – New England
U.S. EPA

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

NAVSTA Newport is located approximately 25 miles south of Providence, Rhode Island, on Aquidneck Island. The facility occupies approximately 1,063 acres, with portions of the facility located in the city of Newport and the towns of Middletown, Portsmouth, and Jamestown, Rhode Island. The facility layout follows the western shoreline of Aquidneck Island for nearly six miles, facing the east passage of Narragansett Bay, as shown on Figure 1-1. The major commands currently located at NAVSTA Newport include the NETC, the Surface Warfare Officers School Command, the Naval Undersea Warfare Center (NUWC), and the Naval War College. Research, development, and training are the primary activities at NAVSTA Newport. NAVSTA Newport has been assigned federal EPA ID number RI6170085470.

Site 8 is located within the NUWC portion of the NAVSTA Newport facility, which lies within Middletown, Rhode Island, as illustrated on Figure 2-1. Site 8 occupies approximately 12.4 acres along the northern boundary of the NUWC grounds and includes the Building 179 Area (research facilities), the Building 185 Complex (a paved storage area), as well as undeveloped open fields and wooded areas, two shallow streams bounded by steep slopes, wetlands, and Deerfield Pond, also known as NUWC Pond. A low, concrete dam is present at the northern end of the 2-acre pond. A chain-link fence separates Site 8 from the Wanumetonomy Golf and Country Club to the northeast. A one-lane crushed gravel roadway runs along the Navy side of the fence and is used as a security patrol road as well as a walking/jogging path by NUWC employees.

Contaminants in soil, groundwater, and sediment have been identified during past environmental assessments at Site 8. Specific records of materials spilled or disposed since site operations began in the early 1950s are not available. However, it is known that the central, upland portion of Site 8 in the Building 185 area was used for equipment storage, temporary hazardous waste storage, and the disposal of miscellaneous materials including scrap lumber, tires, wire, cable, empty paint canisters, and drums containing a tar-like substance. Removal actions have been conducted for the paint canisters and buried drums. Several former NUSC operations also had the potential to generate hazardous materials (e.g., industrial plating, anodizing, and chemical cleaning in a former nearby building, as well as PCB storage at an unknown location). The Building 185 Complex was also used to store torpedo fuels and, in 2004, a release of Otto Fuel, a monopropellant used to drive torpedoes and other weapon systems, was discovered and the impacted soil was removed.

The cause of the groundwater contamination present in the North Meadow is unknown, but is likely associated with the disposal of spent liquid solvents from past facility operations.

Building 179 is a research and development facility and formerly had a 2,000-gallon concrete underground storage tank (UST) used to collect byproducts generated from the torpedo propulsion system tests. This UST likely received wastewater mixed with engine oil, solvent-based cleaners, Otto Fuel, and combustion byproducts. In 1995, it was discovered that the UST had leaked, contaminating soil and groundwater in this area. A removal action was completed under the state's environmental program and residual contaminants are being addressed under the CERCLA program.

Contaminants from these areas entered Deerfield Creek through overland storm water runoff/soil erosion and groundwater transport and resulted in impacts to sediment in the creek and in NUWC Pond.

NAVSTA Newport is an active facility, with environmental investigations and remedial efforts funded under the Environmental Restoration, Navy (ER, N) program. The Navy is conducting its Installation Restoration (IR) Program (i.e., environmental investigation and remediation program) at NAVSTA Newport in accordance with a Federal Facility Agreement (FFA) between the Navy, EPA, and RIDEM. The FFA established the Navy as the lead agency for the investigation and specified cleanup of designated sites within the NAVSTA Newport property, with EPA and RIDEM providing oversight.

FIGURE 2-1. SITE LOCATION

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Previous environmental investigations designed to evaluate environmental media quality at Site 8 are summarized in Table 2-1. Results of these investigations indicated elevated concentrations of PAHs and metals in soil, VOCs and metals in groundwater, and PCBs and lead in sediment at the site. The nature and extent of contamination identified in soil, groundwater, and sediment is discussed in Section 2.5.

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION		
INVESTIGATION	**DATE**	**ACTIVITIES**
Initial Assessment Study (IAS)	1983	Available information indicated that the NUSC Disposal Area was used for disposal of inert materials, such as scrap lumber, tires, wire, cable, and empty paint cans. The IAS concluded that the site did not pose a threat to human health or the environment and was not included in the subsequent Confirmation Study (CS).
National Priority List (NPL) listing	1989	NAVSTA Newport was listed on the EPA NPL as the "Naval Education and Training Center (NETC)".
Building 179 Soil and Groundwater Investigation	1995	After a propulsion test failure and explosion occurred in Building 179 in 1995, the Navy conducted a soil and groundwater investigation to support the Building 179 Reconstruction Program under the RIDEM Remediation Regulations. VOCs, total petroleum hydrocarbons (TPH), propylene glycol dinitrate (PGDN), and cyanide were detected in groundwater. VOCs, and PGDN were detected in soil.
Building 179 Concrete UST Remedial Investigation (RI)	1999	The Navy conducted a RI of the Building 179 concrete UST and a nearby UST to the south (upgradient) under the RIDEM Remediation Regulations. A **VOC plume** was found to extend from the former concrete UST to the NUSC Disposal Area.
Final Project Close-Out Report for Building 179 Remediation	1999	During **Building 179 reconstruction**, contaminated groundwater from excavations was pumped out, treated on-site, and discharged to the local, publically owned treatment works (POTW). Railroad tracks, ties and ballast materials were removed and disposed off-site. Approximately 220 tons of concrete flooring were removed and disposed off-site. Most of the floor slab contained 1,1,1-trichloroethane (1,1,1-TCA) and was classified as hazardous waste. Soil was removed to meet the RIDEM's Industrial/Commercial Direct Exposure Criteria (DEC). Within the former building footprint, soil was excavated to the top of competent bedrock. In addition, two extraction wells were installed to provide a means to remove and treat groundwater during reconstruction. A liner system was installed to limit migration of any contaminant vapors into the newly reconstructed Building 179. The environmental cleanup work was conducted in accordance with RIDEM's UST program and Remediation Regulations.
Environmental Baseline Survey (EBS) Checklist for NUWC Pond	2002	According to the report, the Navy allowed Wanumetonomy Golf Course, Inc., to pump pond water from NUWC Pond to the golf course greens for irrigation from 1974 until 1996. The EBS Checklist referenced water quality assessment sampling events, the most recent of which (Winter 2002) stated that levels of lead and aluminum in surface water and inorganics and pesticides in sediment exceeded benchmarks. (However, during the 2009 RI, it was determined that the levels of lead and aluminum detected in surface water do not pose an unacceptable risk to human health or the environment.)
Study Area Screening Evaluation (SASE)	2003	A SASE was conducted at Site 8 which concluded that a RI and human health and ecological risk assessments should be performed. Limited removal actions were recommended at the Buried Container Area and the Buried Drum Area in the South Meadow.
Building 185 Removal Action	2004	During construction work at Building 185, the Navy removed 2,630 pounds of soil and 1,450 pounds of concrete suspected of **Otto Fuel contamination**.
Removal Action	2005	In response to the findings of the SASE, limited removal actions were conducted from June 2005 to February 2006 at the Buried Container Area and Buried Drum Area. At the Buried Container Area, an area approximately 34 feet by 30 feet by 9 feet deep was excavated adjacent to Deerfield Creek to remove what appeared to be empty aerosol spray paint cans, metal debris, and contaminated soil. A total of approximately **157 cubic yards (236 tons) of soil and metal debris** were removed from the excavation. During the removal action at the Buried Drum Area in the South Meadow, a total of **36 drums and 113 tons of contaminated soil** were removed during multiple phases. The drums were in various states of decay and contained a tar-like substance.

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION		
INVESTIGATION	**DATE**	**ACTIVITIES**
Site 8 Background Soil Investigation	2006	A **background soil investigation** was conducted for the NUSC Disposal Area to provide a background data set for comparisons to soil and sediment data collected from the site during the RI. The objective of the investigation was to identify chemicals/compounds expected to be present, had the fill/disposal activities not occurred. These compounds included naturally-occurring and anthropogenic metals, as well as anthropogenic organic chemicals such as pesticides, PCBs, and semi-volatile organic compounds (SVOCs). As part of this effort, 60 surface soil samples were collected at off-site, upgradient locations.
Site 8 Remedial Investigation	2009	The Navy completed the RI for Site 8 which included geophysical surveys, test pit excavations, hydrogeological studies, a wetland survey, fish and earthworm tissue sampling, and the **sampling of soil, sediment, surface water, and groundwater**. The RI included a **Human Health Risk Assessment (HHRA)** and an **Ecological Risk Assessment (ERA)**.
Site 8 Supplemental Remedial Investigation	2010	The Navy conducted a Supplemental Remedial Investigation (SRI) for Site 8 to **resolve data gaps** in the RI, including additional data needed to evaluate contaminants present in the Building 179 area, to evaluate 1,4-dioxane in groundwater, and to follow up on other recommendations made during the evaluation of the RI.
Groundwater Sampling for Natural Attenuation	2011-2012	Supplemental groundwater sampling events were performed to further evaluate the **natural attenuation** of chlorinated volatile organic compounds (CVOCs) and metals in groundwater.
Feasibility Study (FS)	2012	The FS identified cleanup goals, screened potential remedial technologies, and developed and evaluated **remedial alternatives**, based on the available information from previous investigations. The final FS presented four remedial alternatives to address contamination in Site 8 soil, four remedial alternatives to address contamination in Site 8 groundwater, and four remedial alternatives to address contamination in Site 8 sediment.

*Additional information about term in **blue text** is provided in the Administrative Record Reference Table included at the end of this ROD.*

There have been no cited violations under federal or state environmental law or any past or pending enforcement actions pertaining to the cleanup of Site 8.

2.3 COMMUNITY PARTICIPATION

The Navy performs public participation activities in accordance with CERCLA and the NCP throughout the site cleanup process at NAVSTA Newport. The Navy has a comprehensive community relations program for NAVSTA Newport, and community relations activities are conducted in accordance with the NAVSTA Newport Community Involvement Plan. These activities include regular technical and Restoration Advisory Board (RAB) meetings with local officials and the establishment of an online Information Repository for dissemination of information to the community (available at http://go.usa.gov/Tsy).

The Navy organized a RAB in 1990 to review and discuss NAVSTA Newport environmental issues with local community officials and concerned citizens. The RAB consists of representatives of the Navy, EPA, RIDEM, and members of the local community. The RAB has met frequently since its inception and now meets bi-monthly. Site 8 investigation activities, results, and associated remedial decisions have been discussed at RAB meetings. Documents and other relevant information relied on in the remedy selection process are available for public review as part of the Administrative Record. For additional information about the Installation Restoration (IR) Program at NAVSTA Newport, contact: Ms. Lisa Rama, Public Affairs Office, 690 Peary Street, Naval Station Newport, Newport, RI 02841 (lisa.rama@navy.mil).

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from July 16 to August 15, 2012, for the proposed remedial action described in the Proposed Plan for Site 8. A public meeting to present the Proposed Plan was held on July 18, 2012, near the NAVSTA Newport. A **public notice** of the meeting and availability of documents was published in the *Newport Daily News* on July 14 and July 16, 2012. Immediately following the public informational meeting, the Navy held a public hearing to solicit public comments for the record. A transcript of the oral comments received during the public hearing was prepared and is available for review as part of the Site 8 Administrative Record. Several oral comments were received during the public hearing and one written comment was received during the 30-day comment period. The Navy's Responsiveness Summary is presented in Section 3 of this ROD.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

Site 8 (OU7) is part of a comprehensive environmental investigation and cleanup program currently being performed at NAVSTA Newport under CERCLA authority pursuant to the FFA dated March 23, 1992. Fifteen Installation Restoration (IR) sites have been identified at NAVSTA Newport. An Initial Assessment Study (IAS), completed in 1983, identified 18 sites where contamination was suspected to pose a threat to human health and the environment. Six of the 18 sites were investigated further in a Confirmation Study (CS), completed in 1986. A Phase I RI/FS was completed in 1992 and included McAllister Point Landfill (Site 1), Melville North Landfill (Site 2), Old Fire Fighting Training Area (Site 9), Tank Farm 4 (Site 12), and Tank Farm 5 (Site 13). The McAllister Point Landfill, Melville North Landfill, and Tank Farm 4 had been previously investigated in both the IAS and CS; and Tank Farm 5 in the IAS.

Investigations at four of the five sites have continued under the Department of Defense IR Program following the listing of NAVSTA Newport (then NETC) on the NPL in 1989.

These investigations have led to decision documents in the forms of RODs for the McAllister Point Landfill, OFFTA (combined with the Surface Warfare Officers School), and Tank Farm 5 - Tanks 53 and 56. One site, the Melville Water Tower, was addressed through a Non-Time Critical Removal Action. Ten additional sites (Tank Farm One, Tank Farm Two, Tank Farm Three, Coddington Cove Rubble Fill Area, NUSC Disposal Area, Tank Farms Four and Five, Derecktor Shipyard, Building 32 at Gould Island, and Carr Point) are also being investigated under the IR Program. The Melville North Landfill has been investigated under RIDEM regulations, rather than under the IR program, since it was not owned by the Navy at the time of the NPL listing.

Investigations at Site 8 indicated the presence of soil, groundwater, and sediment contamination from past operating practices that poses unacceptable risk to current and potential future human and ecological receptors. Previous actions taken in response to the contamination at Site 8 are summarized in Table 2-1. The remedy documented in this ROD will achieve the Remedial Action Objectives (RAOs) for Site 8, as listed in Section 2.8. Implementation of this remedy will allow for continued industrial use of the site, which is consistent with current and reasonably anticipated future use and the overall cleanup strategy for NAVSTA Newport of restoring sites to support base operations.

2.5 SITE CHARACTERISTICS

Figure 2-2 presents the Site 8 conceptual site model (CSM), which identifies contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. Historical activities at Site 8 have resulted in the presence of PAHs, PCBs, and metals in soil and sediment and VOCs and metals in groundwater. The nature and extent of contamination at Site 8 is described in Section 2.5.2. The evaluated contaminant exposure pathways and potential human and ecological receptors under current and potential future land use scenarios are presented in Section 2.7.

FIGURE 2-2. CONCEPTUAL SITE MODEL

2.5.1 Physical Characteristics

Geological and hydrogeologic conditions at Site 8 are based on data from published maps as well as data collected during the RI and SRI field investigations.

The site overburden geology consists of approximately 0.5 to 19.5 feet of unconsolidated materials overlying bedrock. The overburden thickness is greatest at the western corner of the Paved Storage Area and thinnest in the North Meadow. Three overburden units consisting of debris fill, non-debris fill, and non-fill materials were identified.

Debris fill materials dominate the South Meadow where past disposal operations filled low-lying areas or grading operations reworked the upper few feet of soil. Fill materials primarily consist of construction debris and/or natural soil or rock (silt, sand, gravel, and weathered bedrock fragments). Debris fill ranging in thickness from 4 to 18 feet was encountered throughout South Meadow and the area between the Paved Storage Area and Deerfield Creek. Surface geophysical surveys and test pitting revealed significant metallic content in the debris fill of these areas. Debris was observed only sporadically in the

North Meadow, the Paved Storage Area, and Building 179 Area. The non-debris fill consists of road base materials and reworked native deposits. The non-fill (native) overburden materials are generally grey to brown sand and silt with various quantities of gravel. The gravel is generally platy, angular or sub-angular, and appears to be derived from in-place weathering of bedrock.

The site bedrock consists of metamorphosed sedimentary rock (predominantly phyllite). Metaconglomerate, schist, and quartzite were encountered at a few discrete depths in several locations. The hardness and degree of foliation of the bedrock varies with location, and the color of the rock varies from light to dark grey. The upper portion of the bedrock is significantly weathered and degraded and contains evidence of groundwater flow through the fractures.

The depth to bedrock ranges from approximately 0.5 to 19.5 feet below ground surface (bgs) across the site. Beneath the Paved Storage Area and the Building 185 Complex, the depth to bedrock ranges from 3 feet bgs in the east to 17 feet bgs in the west. In the South Meadow, bedrock depths are between 5 and 16.5 feet bgs, increasing from east to west through the South Meadow. Bedrock is very shallow (about 0.5 feet bgs) in the valley that forms Deerfield Creek. Bedrock is also very shallow (within 5 feet of ground surface) in the North Meadow. At the north end of the site, the depth to bedrock increases to between 8.5 and 17 feet bgs. Overall, the site topography tends to mimic the bedrock surface. Deerfield Creek and NUWC Pond have formed a deep bedrock valley. This valley and the valley associated with the unnamed stream were likely formed by weathering and erosion of softer bedrock at the site. At the southern portion of the Site (the Building 179 Area), Deerfield Creek has not weathered the bedrock to form a deep valley, but rather appears to be situated on more competent bedrock (based upon its rocky bottom and the shallow depth to bedrock).

Borehole geophysics revealed that the strike and dip direction of the bedrock planar features vary (these planar features consist of fractures, bedding planes, cleavage, or contacts). Overall, the most common strike direction is north-south, with a dip direction to the east or west. Possible or likely transmissive fractures were also identified in the bedrock cores. During bedrock drilling operations, evidence of water-bearing fractures (iron staining) was observed in core holes. The number and frequency of fractures generally decreased with depth. Drilling observations, subsurface geophysics, and hydraulic conductivity testing indicate that there is a long, linear zone of water-bearing fractures and highly degraded bedrock that extends from the South Meadow through the North Meadow and to the north.

Beneath the Building 185 Complex, the Building 179 Area, the Paved Storage Area, and the South Meadow, the water table is generally near the bedrock/overburden interface. Beneath the North Meadow and further north, the water table is located within the bedrock zone. Surface water is present at the site in Deerfield Creek flowing from the south, the unnamed stream flowing from the golf course to the east, and NUWC Pond. The depth to groundwater was observed to range from approximately 0.5 to 24 feet bgs in May 2008, and from 2 to 24 feet bgs in September 2008.

Groundwater at the site generally flows west toward the NUWC Pond and Deerfield Creek. In the Building 179 Area, groundwater in bedrock flows northward and appears to be influenced by Deerfield Creek, which flows into NUWC Pond. Deerfield Creek appears to be a discharge zone for shallow bedrock groundwater in this area. In the area of the Paved Storage Area and the South Meadow, groundwater generally flows in a west-northwesterly direction. In the northern portion of the site, groundwater flows in a west-northwesterly and a west-southwesterly direction (towards NUWC Pond and associated wetlands). The intermittent, unnamed stream flowing from the east appears to have little influence on the direction of groundwater flow. The potentiometric surface in the northern part of the site could not be developed without significant inference, but groundwater flow in this area is expected to follow the ground surface topography, which drops steeply towards NUWC Pond.

In general, there is a downward vertical hydraulic gradient in the surficial aquifer or between the overburden and the bedrock. The nature of the fill and the natural overburden material is such that it would not impede infiltration of water and/or transmission of contaminants. One exception is at the eastern corner of the Paved Storage Area, where a silt layer overlies the bedrock, and an upward vertical hydraulic gradient exists—both of which are expected to minimize migration of COCs to the bedrock.

In the North Meadow, where there are groundwater monitoring wells screened at varying depths in the bedrock aquifer, an upward hydraulic gradient was observed, which is consistent with the model of groundwater discharging to NUWC Pond.

2.5.2 Nature and Extent and Fate and Transport of Contamination

The upland portion of Site 8 was used for materials/equipment disposal and storage since the Navy began operating there in the early 1950s. Reportedly, the South Meadow area was used for the disposal of scrap lumber, tires, wire, cable, and empty paint cans. Other historical operations at Site 8 also had the potential to generate hazardous materials, including former industrial plating, anodizing, and chemical cleaning within Building 1170 (formerly located approximately 200 feet southwest of the site) and PCB storage at an unknown location. However, the available information does not indicate that materials associated with these operations were disposed at Site 8.

The Building 185 Complex is another possible source of contaminants at the Site. The Building 185 Complex consists of four, one-story sheds that were used for storage of flammable materials. Otto Fuel, a highly flammable material composed largely of PGDN and used for fueling torpedoes, is also stored in this area. During the RI, it was determined that a release of Otto Fuel had occurred in the Building 185 Complex. In the late 1980s, Building 185 was also reportedly used as a less-than-90-day accumulation area for drummed hazardous wastes that consisted primarily of Otto Fuel contaminated solids (rags, Tyvek® protective suits, and cleaning absorbents).

In the North Meadow, the cause of the groundwater contamination is unknown, but was likely to have been associated with the disposal of spent liquid solvents from past operations.

The Building 179 Area is a research facility and formerly had a 2,000-gallon concrete UST that collected byproducts generated from the torpedo propulsion system tests. This UST likely received wastewater mixed with engine oil, solvent-based cleaners, Otto Fuel, and combustion byproducts. In 1995, it was discovered that the UST had leaked, contaminating soil and groundwater in this area and necessitating cleanup.

A summary of sample results for the Site 8 COCs is presented in Table 2-2. The extent of COCs exceeding cleanup goals in surface soil, subsurface soil, groundwater, and sediment is presented on Figures 2-3 through 2-6, respectively.

A continuing source of VOCs in soil has not been identified for the chlorinated ethene plume in North Meadow groundwater (primarily trichloroethene [TCE]) or in the chlorinated ethane plume in groundwater of the Building 179 Area (1,1,1-TCA and 1,1-dichloroethane [1,1-DCA]). In the North Meadow, it appears that a historical release(s) of TCE to the ground surface occurred in the vicinity of monitoring well MW-03B (central/western edge of the North Meadow). Following the original release(s), it is likely that some of the TCE volatilized into the air and the rest migrated through the unsaturated zone into the groundwater within the fractured bedrock. After reaching groundwater, the solvents would have migrated by advective transport and molecular dispersion toward NUWC Pond.

As evidenced by the high groundwater seepage velocity towards NUWC Pond, the upward vertical gradients in deeper bedrock, and the measured discharge of the plume into NUWC Pond (measured via the diffusion bag sampling at the edge of the pond), it is likely that much of the TCE plume quickly discharged into the pond. However, the plume in the North Meadow also has expanded somewhat to the north via a combination of advective transport and dispersion through bedrock fractures. Bedrock in many areas of the North Meadow is highly degraded and weathered, even at depth. In addition, a **high yielding fracture zone** was encountered during drilling at MW-127B and MW-128B (central/northern portion of the North Meadow), which yielded high volumes of water during drilling (indicating the hydraulic conductivity of the fracture zone is high). These observations indicate that groundwater flow and advective transport does not occur in discrete fractures, as it can in many bedrock aquifers. Rather, groundwater flow and transport occurs throughout the bedrock matrix and in the fracture zones.

During migration, reductive dechlorination processes likely degraded some of the TCE into its breakdown products, cis-1,2-dichloroethene (cis-1,2-DCE) and some vinyl chloride. Further degradation of vinyl chloride would have resulted in non-toxic ethane and/or carbon dioxide. As described in the RI, the SRI, and in the March 2011 technical memorandum, analytical data and field measurements of groundwater quality parameters provide some evidence that reducing conditions exist in the site groundwater and that anaerobic biodegradation and **reductive dechlorination has occurred** to some degree at Site 8, particularly in the southern portion of the site (Tetra Tech, 2011a).

During the RI, a small pocket of light, non-aqueous phase liquid **(LNAPL) was identified in well MW-100B** (southwest corner of the Paved Storage Area). This LNAPL was primarily comprised of extractable total petroleum hydrocarbons (ETPH), gasoline-range organics (GRO), aromatic VOCs, and CVOCs. The results of groundwater monitoring around MW-100B indicated that this LNAPL was limited in extent and was trapped within a bedrock fracture or a set of bedrock fractures. Even though the LNAPL appeared to be contained within the bedrock fracture(s), downgradient migration of dissolved-phase constituents emanating from the LNAPL would have the potential to occur over time. The 4.5-inch layer of LNAPL identified in MW-100B was removed in 2008. No measureable LNAPL was present when the well was rechecked in March 2011 (static conditions) and May 2012 (during sampling).

The Building 179 Area chlorinated ethane plume originated in the vicinity of the former concrete UST and, due to the shallow groundwater table, and/or a possible subsurface release, would have migrated quickly to the groundwater. Like the release in the North Meadow, some of the solvent(s) may have volatilized to the air and the rest migrated to the groundwater. Once in bedrock groundwater, the 1,1,1-TCA migrated northerly via advective transport and dispersion. A plume of 1,1-DCA extends to the north beyond Deerfield Creek and the western part of the South Meadow (bordering Deerfield Creek). Reductive dechlorination processes have degraded much of the 1,1,1-TCA to the breakdown products 1,1-DCA and chloroethane.

SVOCs, primarily PAHs, have been detected in soil and sediment, with only low concentrations in groundwater. The presence of PAHs in the subsurface soils, where the maximum PAH concentrations were detected, is likely due to the fact that much of the area consists of fill material, with and without artificial materials incorporated. The greater concentrations of PAHs in the surface soil are located in the vicinity of the Buried Drum Area, the Buried Canister Area (also called the Paint Can Area), the northern portion of the Paved Storage Area and within the wetland soils. PAHs also were detected in the sediment of Deerfield Creek and NUWC Pond. The absence of PAHs in surface water and in nearly all groundwater samples is attributable to the relative insolubility of these compounds and their strong sorption potential to soil/sediment. The only SVOCs detected in groundwater included trace amounts of benzo(k)fluoranthene and the Otto Fuel components PGDN and dibutyl sebacate. The transport of these SVOCs is predominantly related to soil erosion, and it is expected that the PAHs would migrate to the deeper sediments over time, if left unchecked.

The most prevalent pesticides were detected in sediment and surface water. Surface and subsurface soil contained the most individual detections of pesticides, but no detection in soil was greater than the screening levels. The types of pesticides detected at Site 8 are manufactured chemicals that were widely used in the United States in the past and are persistent in the environment. Based on the low concentrations of pesticides detected in site soil and groundwater, it appears that the presence of pesticides is not due to a specific release or disposal associated with past Site 8 operations. Instead, the detected pesticides are likely either associated with the borrow material used at the site, from general historic use of pesticides, and from background and upgradient sources migrating to the site via sorption to particles that are entrained in the water column of the local streams and depositing in low flow velocity areas along the streams and within NUWC Pond.

Metals were detected in surface soil, subsurface soil, groundwater, surface water, and sediment. The most predominant metals detected in these environmental media at concentrations greater than screening levels included arsenic, chromium, cobalt, iron, manganese, and lead. The locations with most of the maximum detected metals concentrations varied, although in surface soils, the maximum concentrations were located in the wetland area, south of NUWC Pond. The maximum concentrations of metals in subsurface soil were detected in the vicinity of the Buried Canister Area. Detections of metals in groundwater were wide-spread, although largely consisted of arsenic and manganese which may be the result of mobilization from site soil due to the presence of the solvent plumes at the site. Maximum concentrations of other metals in groundwater were located by the Paved Storage Area.

Metals associated with suspended particulates (surface water) were found in surface water throughout NUWC Pond. Metals were detected in pond sediment by the NUWC Pond dam, with concentrations generally decreasing with distance (southward) from the dam. Metals, particularly lead, were also detected in the sediment of Deerfield Creek adjacent to the Buried Canister Area.

Many metals, including arsenic, chromium, cobalt, manganese, iron, and lead, occur naturally in soils at varying concentrations. These naturally occurring metals are related to the bedrock composition which is generally the original source material. The oxidation-reduction (redox) state of the subsurface environment will affect the form and valence state of metals such as arsenic and manganese and will influence how much of each metal remains bound to soil and rock surfaces and how much is dissolved in groundwater. Under oxidizing conditions, naturally-occurring arsenic and manganese will remain bound in soil and rock or sorbed to suspended particles. Under reducing conditions, the concentrations of dissolved metals such as arsenic and manganese tend to increase as the metals on soil and rock surfaces reduce to a more soluble form.

With the exception of chromium and lead, the distribution of metals at Site 8 suggests that their presence is not associated with a CERCLA release. The presence of lead is likely related to the Buried Canister Area. In addition, the higher concentrations of some metals in NUWC Pond sediments are related to the fact that this area is continuously submerged and is a low-velocity flow area with conditions conducive to suspended solids settling out and accumulating as sediment.

Of the analytes detected in surface water and fish tissue, none were retained as COCs for remediation. For the fish tissue samples collected from NUWC Pond, there were significant uncertainties in the source of pesticides found in those tissue samples and regarding the uptake of PCBs from sediment to fish. Fish tissue samples from NUWC Pond also were not identified for remediation based on comparisons to similar fish-tissue samples collected from local background/reference ponds. For surface water, no COCs were identified for remediation because the risk assessments identified no unacceptable risks to human health or the environment from exposure to surface water at Site 8.

TABLE 2-2. SUMMARY OF RI SAMPLE RESULTS FOR SITE 8 COCS

COC	FREQUENCY OF DETECTION	CONCENTRATION RANGE
Surface Soil – Exposed Area		
SVOCs (ug/kg)		
1,1-Biphenyl	1/55	660
Acenaphthene	57/74	2.4 - 9,500
Anthracene	62/74	3.6 - 13,000
Benzo(a)anthracene	67/74	15 - 20,000
Benzo(a)pyrene	64/74	18 - 17,000
Benzo(b)fluoranthene	64/74	24.5 - 15,000
Benzo(g,h,i)perylene	62/74	12 - 7,400
Benzo(k)fluoranthene	65/74	13 - 12,000
Chrysene	67/74	13 - 17,000
Dibenzo(a,h)anthracene	48/74	5.4 - 3,500
Fluoranthene	67/74	22 - 45,000
Fluorene	51/74	2.3 - 5,900
Indeno(1,2,3-cd)pyrene	61/74	14 - 9,200
Naphthalene	45/74	2.3 - 11,000

TABLE 2-2. SUMMARY OF RI SAMPLE RESULTS FOR SITE 8 COCS		
COC	**FREQUENCY OF DETECTION**	**CONCENTRATION RANGE**
Phenanthrene	67/74	12 - 48,000
Pyrene	67/74	16 - 50,000
Metals (mg/kg)		
Arsenic	72/72	0.29 - 90
Beryllium	72/72	0.21 - 0.74
Lead	72/72	4.2 - 2,870
Manganese	72/72	79.8 - 2,020
Zinc	72/72	13.8 - 663
Subsurface Soil – Exposed Area		
SVOCs (ug/kg)		
1,1-Biphenyl	4/40	170 - 8,300
Acenaphthene	39/65	2.1 - 480,000
Anthracene	44/65	2.9 - 970,000
Benzo(a)anthracene	45/65	3.2 - 1,900,000
Benzo(a)pyrene	43/65	6.2 - 1,500,000
Benzo(b)fluoranthene	44/65	7.2 - 1,300,000
Benzo(g,h,i)perylene	42/65	8.5 - 830,000
Benzo(k)fluoranthene	44/65	7.3 - 1,200,000
Chrysene	45/65	3.3 - 1,700,000
Dibenzo(a,h)anthracene	35/65	4.5 - 330,000
Fluoranthene	46/65	4.8 - 4,600,000
Fluorene	37/65	2.8 - 480,000
Indeno(1,2,3-cd)pyrene	40/65	10 - 850,000
Naphthalene	33/65	8.8 - 220,000
Phenanthrene	43/65	15 - 3,500,000
Pyrene	44/65	18 - 3,600,000
Metals (mg/kg)		
Arsenic	65/65	2.7 - 40
Beryllium	65/65	0.21 - 2.5
Lead	65/65	6.2 - 4,650
Manganese	65/65	180 - 3,300
Zinc	65/65	30 - 9,840
Surface Soil – Paved Area		
SVOCs (ug/kg)		
1,1-Biphenyl	0/17	Not detected
Acenaphthene	15/27	1.8 - 890
Anthracene	18/27	3.1 - 2,000
Benzo(a)anthracene	24/27	2.6 - 5,600
Benzo(a)pyrene	25/27	7.3 - 4,800
Benzo(b)fluoranthene	23/27	14 - 5,700
Benzo(g,h,i)perylene	21/27	3 - 2,000
Benzo(k)fluoranthene	23/27	6.8 - 3,900
Chrysene	25/27	2.8 - 5,700
Dibenzo(a,h)anthracene	14/27	10 - 760
Fluoranthene	26/27	4.4 - 10,000

TABLE 2-2. SUMMARY OF RI SAMPLE RESULTS FOR SITE 8 COCS		
COC	**FREQUENCY OF DETECTION**	**CONCENTRATION RANGE**
Fluorene	13/27	3.8 - 870
Indeno(1,2,3-cd)pyrene	19/27	8.25 - 2,200
Naphthalene	11/27	2.9 - 340
Phenanthrene	25/27	4.6 - 8,500
Pyrene	26/27	3.3 - 13,000
Metals (mg/kg)		
Arsenic	25/25	1.7 - 41
Beryllium	24/25	0.21 - 0.57
Lead	25/25	7.3 - 54.8
Manganese	25/25	150 - 827
Zinc	25/25	27.5 - 94.7
Subsurface Soil – Paved Area		
SVOCs (ug/kg)		
1,1-Biphenyl	1/21	310
Acenaphthene	12/31	2.6 - 65.5
Anthracene	10/31	7.8 - 730
Benzo(a)anthracene	17/31	5.4 - 7,700
Benzo(a)pyrene	15/31	5.6 - 5,700
Benzo(b)fluoranthene	15/31	12.2 - 6,500
Benzo(g,h,i)perylene	16/31	3.4 - 1,350
Benzo(k)fluoranthene	15/31	5.3 - 5,350
Chrysene	18/31	3.3 - 7,550
Dibenzo(a,h)anthracene	7/31	6.9 - 700
Fluoranthene	19/31	5 - 11,500
Fluorene	10/31	2.9 - 170
Indeno(1,2,3-cd)pyrene	14/31	9 - 2,750
Naphthalene	8/30	2.4 - 125
Phenanthrene	18/31	4.8 - 3,100
Pyrene	17/31	11.2 - 11,500
Metals (mg/kg)		
Arsenic	29/29	2.25 - 122
Beryllium	28/29	0.2 - 0.76
Lead	29/29	6.9 - 159
Manganese	29/29	171 - 2,820
Zinc	29/29	23 - 81.2
Groundwater – Overburden		
VOCs (ug/L)		
1,1,1-Trichloroethane	1/4	1.0
1,1-Dichloroethane	1/4	0.4
1,1-Dichloroethene	0/4	Not detected
Carbon Tetrachloride	0/4	Not detected
Ethylbenzene	0/4	Not detected
Tetrachloroethene	2/4	0.5 – 2.0
Trichloroethene	1/4	0.9
Vinyl Chloride	0/4	Not detected

TABLE 2-2. SUMMARY OF RI SAMPLE RESULTS FOR SITE 8 COCS		
COC	**FREQUENCY OF DETECTION**	**CONCENTRATION RANGE**
SVOCs (ug/L)		
1,4-Dioxane	0/7	Not detected
Total Metals (ug/L)		
Arsenic	2/4	2.7 - 503
Chromium	2/4	5.2 - 868
Cobalt	2/4	3.7 - 637
Lead	2/4	3.6 - 1,890
Manganese	4/4	0.972 - 13,800
Nickel	2/4	6.5 - 1,160
Vanadium	2/4	3.8 - 832
Dissolved Metals (ug/L)		
Arsenic	1/4	20.2
Chromium	0/4	Not detected
Cobalt	1/4	6.8
Lead	1/4	19.9
Manganese	3/4	240 - 1,910
Nickel	1/4	10.6
Vanadium	1/4	7.5
Groundwater – Bedrock		
VOCs (ug/L)		
1,1,1-Trichloroethane	5/24	0.4 - 4
1,1-Dichloroethane	14/24	0.4 - 310
1,1-Dichloroethene	7/24	0.5 - 7
Carbon Tetrachloride	1/24	2.0
Ethylbenzene	1/24	58
Tetrachloroethene	8/24	0.5 - 12
Trichloroethene	12/24	2 - 730
Vinyl Chloride	8/24	0.3 - 19
SVOCs (ug/L)		
1,4-Dioxane	9/14	0.054 - 8.3
Total Metals (ug/L)		
Arsenic	12/20	2.2 - 17.8
Chromium	4/20	2.4 - 5.6
Cobalt	5/20	0.98 - 15.6
Lead	7/20	1.1 – 3.5
Manganese	20/20	56 - 8,370
Nickel	14/20	0.335 - 10
Vanadium	1/20	1.5
Dissolved Metals (ug/L)		
Arsenic	11/20	1.37 - 18.4
Chromium	0/20	Not detected
Cobalt	4/20	1 - 15.6
Lead	2/20	0.732 - 1.8
Manganese	20/20	53.5 - 8,220
Nickel	7/20	0.76 - 4.9

TABLE 2-2. SUMMARY OF RI SAMPLE RESULTS FOR SITE 8 COCS		
COC	**FREQUENCY OF DETECTION**	**CONCENTRATION RANGE**
Vanadium	0/20	Not detected
Surface Water		
No COCs identified for surface water		
Sediment (mg/kg)		
Lead	31/31	14 - 27,200
Total Aroclors	12/20	0.035 - 2.93
Fish Tissue		
No COCs identified for fish tissue		

Concentrations as noted.

FIGURE 2-3. SURFACE SOIL RESULTS

FIGURE 2-4. SUBSURFACE SOIL RESULTS

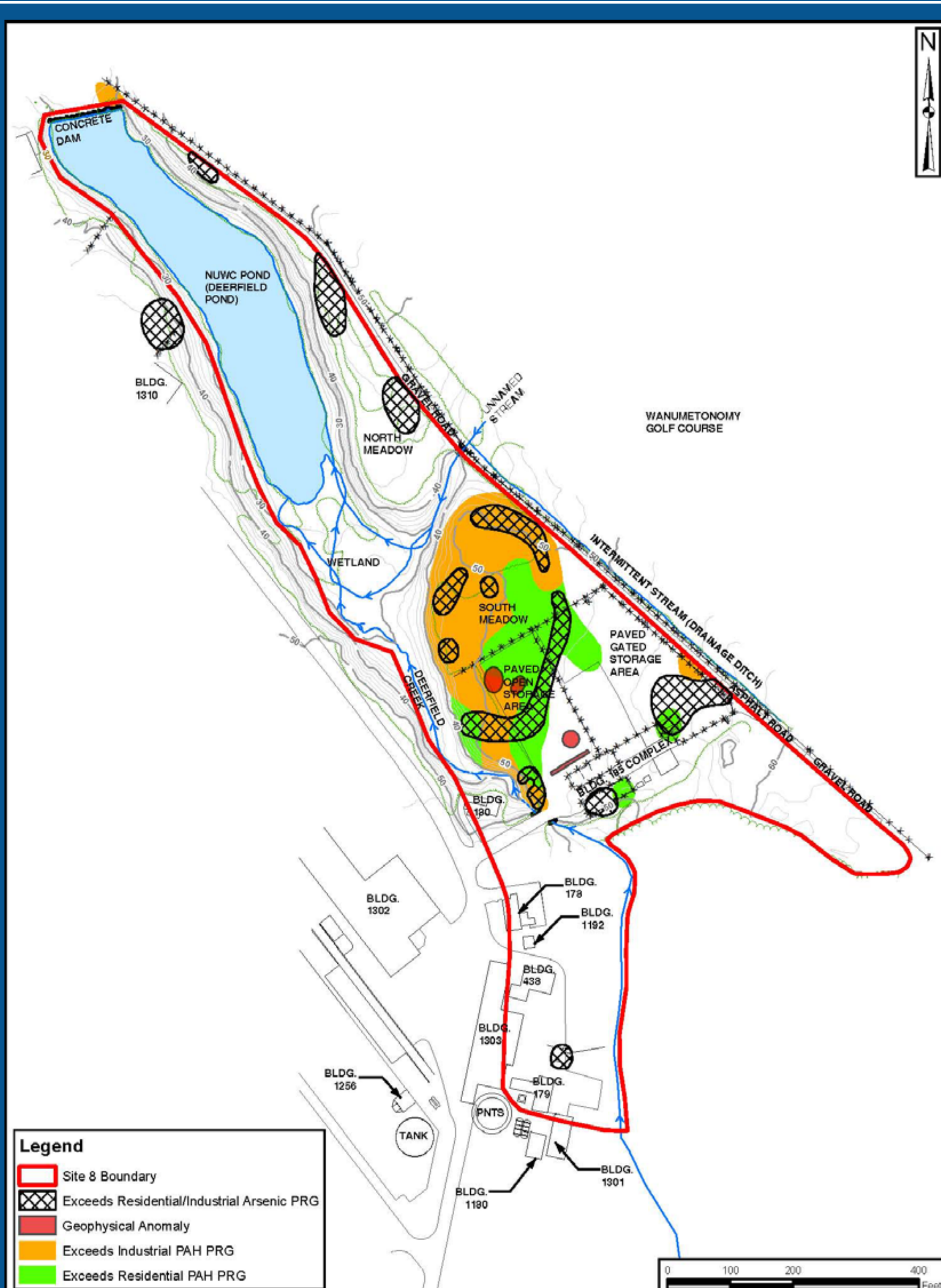
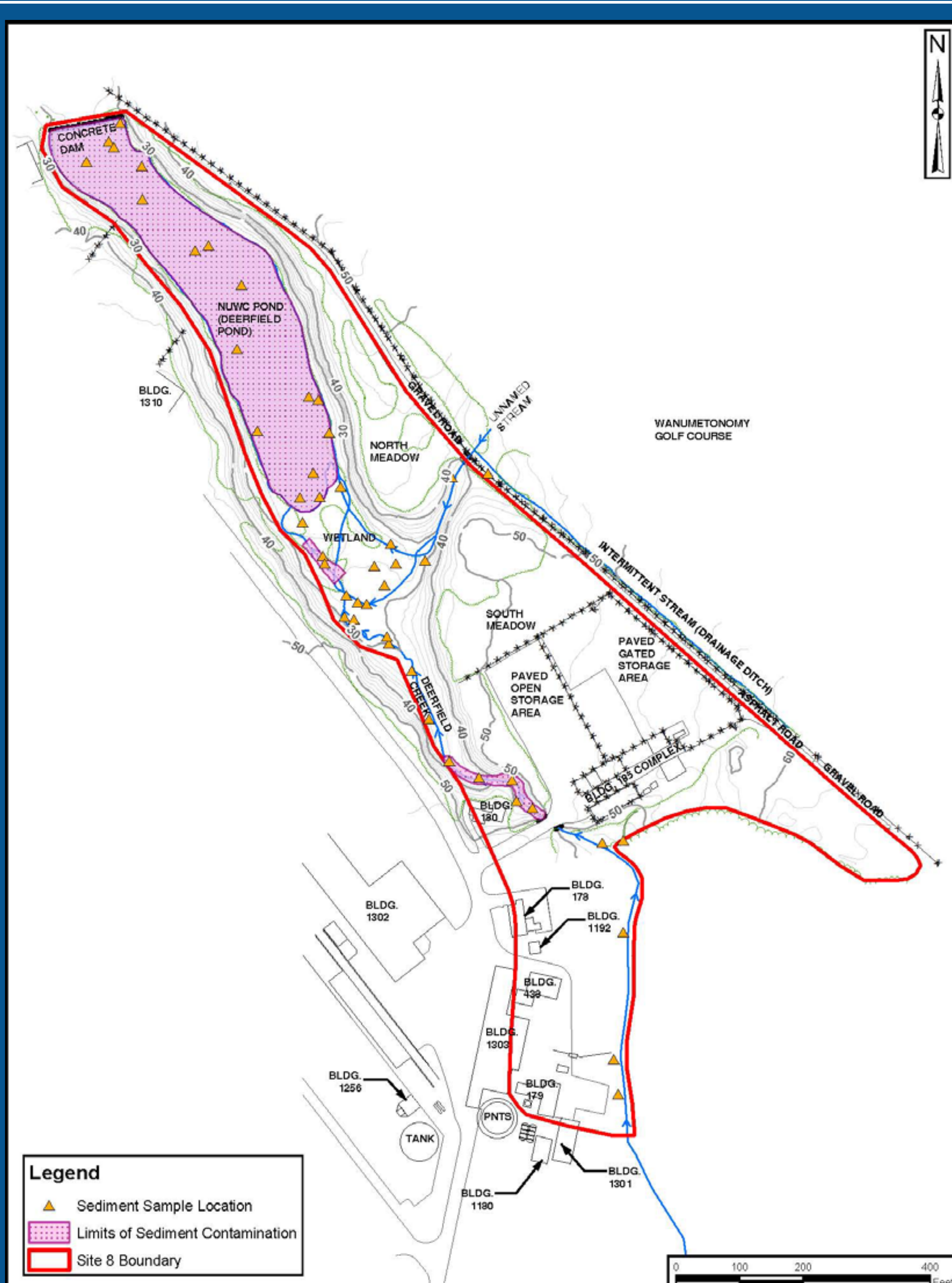


FIGURE 2-5. GROUNDWATER RESULTS (THROUGH 2011)

FIGURE 2-6. SEDIMENT RESULTS



2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

NAVSTA Newport is an active military training facility and is expected to remain active for the foreseeable future. Forty-two Naval and defense commands currently operate at NAVSTA Newport, which is one of the Navy's primary sites for training and educating officers, officer candidates, senior enlisted personnel, and midshipman candidates, and which is also used for conducting advanced undersea warfare and development systems activities. Tenant commands include the NUWC, Naval Warfare College, Surface Warfare Officers School (SWOS), Navy Warfare Development Command, Officer Training Command, Center for Service Support, Naval Academy Preparatory School, and Senior Enlisted Academy.

The NAVSTA Newport area has been used by the U.S. Navy since the Civil War era. Activities have increased during war times and later decreased as naval forces were reorganized. Between 1900 and the mid-1970s, the facility has also been used as a refueling depot. The Shore Establishment Realignment Program reorganization in April 1973 resulted in reductions in personnel and the Navy excessed a large portion of the acreage of the original facility. NETC was subsequently established. In the mid-1990s several new laboratories at the NUWC were constructed to provide research, development, testing, evaluation, engineering and fleet support for submarines and underwater systems. In October 1998, NAVSTA Newport was established as the primary host command, taking over base operating support responsibilities from NETC.

The NUSC Disposal Area (Site 8) is located within the NUWC facility situated in Middletown, Rhode Island. Site 8 is located adjacent to the northern boundary of the NUWC grounds and is surrounded on the northwest, west, and southwest by developed areas of the NUWC facility. A wetland area lies southeast of the site and the Wanumetonomy Golf and Country Club adjoins the Site to the northeast.

Site 8 was reportedly used for disposal of rubble and inert materials, including scrap lumber, tires, wire, cable, and empty paint cans. The NUSC disposal area consists of approximately 12.4 acres of land adjacent to two streams, associated wetlands, and a small (2 acre) pond. The upland portions have been used as fill and storage areas since the Navy developed the site in the early 1950s. Currently there is a secured storage area and open storage area (both paved – approximately 2.3 acres), a research facility (Building 179 Area), as well as open fields (1.6 acres) and brush covered areas (4.2 acres). Accordingly, the current site use is industrial and will remain as such for the foreseeable future.

Groundwater underlying NAVSTA Newport is **not used for drinking water**. Drinking water for NAVSTA Newport and most of the residents of Newport and Middletown is supplied and managed by the Newport Water Department, which receives its water supply from a series of seven surface water reservoirs located on Aquidneck Island and two surface water reservoirs on the mainland. Site 8 is not within the watershed of any of the area supply reservoirs. Private wells located within 3 miles of NAVSTA Newport provide drinking water to approximately 4,800 of the estimated 10,000 people that live within 3 miles of NAVSTA Newport (Tetra Tech, 2004). Due to the near-coastal location, groundwater at Site 8 is downgradient of any potential or existing water sources.

Groundwater flows to Site 8 from the undeveloped wetland to the south and from the golf course area to the east. RIDEM has established a state groundwater classification system to protect its groundwater resources. Site 8 straddles the line delineating the boundary between **RIDEM's GA and GB groundwater classification areas**. Groundwater under the northeastern half of the Site, abutting the Wanumetonomy Golf and Country Club, is classified by RIDEM as GA (presumed suitable for public or private drinking water use without treatment). Groundwater underlying the southwestern half of the Site has a GB classification as does the NAVSTA property southwest of the Site. Groundwater classified as GB is considered to be not suitable for drinking water without treatment because of known or presumed degradation. However, per EPA groundwater remediation guidance, in states without an EPA-approved Comprehensive State Groundwater Protection Program (CSGWPP) such as Rhode Island, CERCLA groundwater remediation must meet federal drinking water standards (i.e., Maximum Contaminant Levels [MCLs] and non-zero Maximum Contaminant Level Goals [MCLGs]) and risk-based standards, or more stringent State groundwater standards, unless the water is non-potable.

2.7 SUMMARY OF SITE RISKS

The baseline risk assessment estimates the risks that the site poses if no action were to be taken. The risk assessment results provide the basis for taking action and identify the contaminants and exposure pathways that need to be addressed by the remedial action. A baseline HHRA was conducted as part of the RI and a risk evaluation was conducted as part of the Supplemental RI (SRI) in 2011 (Tetra Tech, 2010, Tetra Tech, 2011b). An ERA was conducted as part of the RI (Tetra Tech, 2010). This section of the ROD summarizes the results of the risk assessment for this site.

The risks summarized in this section were those for **potential receptors** indicated on Figure 2-2 which assumes an unrestricted use of the site. Some media and receptors were later eliminated after review of subsequent data collected (Section 2.7.3).

2.7.1 Summary of Human Health Risk

The quantitative HHRA was conducted using chemical concentrations detected in soil, groundwater, surface water, sediment, and fish tissue samples. Key steps in the risk assessment process included identification of chemicals of potential concern (COPCs), exposure assessment, toxicity assessment, and risk characterization. Tables summarizing data used in the HHRA and the associated results are presented in Appendix C.

Identification of COPCs

The available validated data collected during the field investigations were used to identify soil and groundwater COPCs for the Site 8. Both federal and RIDEM criteria were used for COPC selection. Federal criteria include EPA Regional Screening Levels (RSLs), EPA MCLs, EPA Groundwater Screening Levels for Evaluating the Vapor Intrusion into Indoor Air from Groundwater and Soils, and EPA Region 3 Fish Tissue Screening Levels. RIDEM criteria included DECs for residential soil and GA groundwater objectives. The Site 8 **COPCs were first identified** for soil, groundwater, surface water, sediment, and fish tissue during the HHRA. Subsequently, the **COPC screening was updated** by including data collected during the SRI.

Table C-1 in Appendix C presents exposure point concentrations (EPCs) for the COPCs identified during the HHRA for surface soil, subsurface soil, groundwater, surface water, sediment, and fish tissue at Site 8. EPCs are the concentrations used in the risk assessment to estimate exposure and risk from each COPC. The following guidelines were used to calculate EPCs for Site 8 COPCs during the HHRA:

- For soil and sediment, the 95-percent upper confidence limit (UCL) on the arithmetic mean, which was based on the distribution of the data set, was selected as the EPC. EPCs were calculated following EPA's Calculating UCL for EPC's at Hazardous Waste Sites and using EPA's ProUCL software (USEPA, 2002, USEPA, 2007).

- For groundwater, in accordance with the EPA New England Risk Updates (1995) maximum groundwater concentrations were used as EPCs for the reasonable maximum exposure (RME) scenarios.

- Non-detected values were evaluated in accordance with the ProUCL guidance. The results of duplicate samples were averaged for purposes of calculating EPCs for COPCs in environmental media at Site 8.

During the SRI, the chemical concentrations from the SRI samples were compared to the results of the HHRA to give an approximate estimation of risks associated with the SRI samples. Tables C-2 through C-6 of Appendix C present a comparison of the concentrations of COPCs and EPCs from the RI report to the concentrations of COPCs and EPCs in this SRI.

Two exposure units (EU) were evaluated for soil: exposed and unexposed soil. The "exposed soil" (currently unpaved) area was considered one EU; however, it was also assumed that in the future, the pavement in the southeastern portion of the site might be removed, exposing the soil beneath it. Consequently, the "unexposed" (paved) area was also considered to be an EU. Surface soil and subsurface soil were evaluated separately for each EU. Groundwater, surface water, and sediment samples were evaluated as one EU.

Exposure Assessment

During the **exposure assessment** step of the HHRA, current and potential future exposure pathways through which humans might come into contact with the COPCs identified in the previous step were evaluated. The results of the exposure assessment for Site 8 were used to refine the CSM, which identifies potential contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. The CSM is shown on Figure 2-2. Surface soil, subsurface soil, groundwater, and sediment were identified as the media of concern. The evaluated potential exposure routes include inhalation of air or volatiles from soil and groundwater (including vapor intrusion into buildings); dermal contact with soil, sediment, surface water, and groundwater; and ingestion of soil, sediment, groundwater, and fish. The HHRA considered receptor exposure under non-residential land use (construction and industrial workers and trespassers) and future hypothetical residential land use. Current and hypothetical future exposure pathways at Site 8 are summarized in Table 2-3. Exposure assumptions and other supporting information used in the HHRA are presented in Tables C-7 through C-10 in Appendix C.

TABLE 2-3. RECEPTORS AND EXPOSURE ROUTES EVALUATED IN HHRA

RECEPTOR	EXPOSURE ROUTE
Construction Workers (current and future land use) (Storage Area and Building Complexes)	Inhalation of air or volatiles from soil and groundwater Dermal contact with soil and groundwater Ingestion of soil and groundwater
Industrial Workers (current and future land use) (Storage Area and Building Complexes)	Inhalation of air Dermal contact with soil Incidental ingestion of soil Vapor intrusion
Adolescent Trespassers (current and future land use) (Whole Site)	Inhalation of air Dermal contact with surface soil, surface water, and sediment Ingestion of sediment and surface soil
Residents (Adults/Children) (future land use) (Whole Site)	Inhalation of air, soil, and groundwater Ingestion of soil, groundwater, and fish Dermal contact with soil and groundwater Vapor intrusion
Recreational Users (Adults/Children) (future land use) (Whole Site)	Inhalation of air Dermal contact with surface water and sediment Ingestion of fish

Toxicity Assessment

The objective of the toxicity assessment is to identify the potential adverse health effects in exposed populations. Quantitative estimates of the relationship between the magnitude and type of exposures and the severity or probability of human health effects are defined for the identified COPCs. Quantitative toxicity values determined during this component of the risk assessment are integrated with outputs of the exposure assessment to characterize the potential for the occurrence of adverse health effects for each receptor group.

The toxicity value used to evaluate non-carcinogenic health effects for ingestion and dermal exposures is the reference dose (RfD). The reference concentration (RfC) is used to evaluate non-carcinogenic health effects for inhalation exposures. RfDs and RfCs are estimates of the daily exposure level for the human population that are likely to be without appreciable risk during a portion or all of a lifetime. RfDs and RfCs are based on a review of available animal and/or human toxicity data, with adjustments for various uncertainties associated with the data. Carcinogenic effects are quantified using the cancer slope factor (CSF) for ingestion and dermal exposures and inhalation unit risk (IUR) for inhalation exposures, which is a plausible upper-bound estimate of the probability of development of cancer per unit intake of chemical over a lifetime. The potential carcinogenic effects are calculated using available dose-response data from human and/or animal studies.

Although toxicity criteria can be found in several toxicological sources, EPA's Integrated Risk Information System (IRIS) online database is the preferred source of toxicity values. This database is continuously updated, and the presented values have been verified by EPA. The toxicity criteria for the constituents selected as COPCs during the HHRA are presented in Tables C-11 through C-14 in Appendix C.

Risk Characterization

During the risk characterization, the outputs of the exposure and toxicity assessments are combined to characterize the baseline risk (cancer risks and non-cancer hazards) at the site if no action was taken to address the contamination. Potential **cancer risks and non-cancer hazards** were calculated based on RME assumptions. The RME scenario assumes the maximum level of human exposure that could reasonably be expected to occur.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Cancer Risk} = \text{CDI} \times \text{SF}$$

where: Cancer Risk = a unitless probability (e.g., 2×10^{-5}) of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor ($[\text{mg/kg-day}]^{-1}$)

These calculated risks are probabilities that are usually expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} under an RME scenario indicates that an individual experiencing the reasonable maximum exposure estimate has an “excess lifetime cancer risk” because it would be in addition to the risks of contracting cancer that individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA’s generally acceptable risk range for site-related exposures to COCs is 1×10^{-4} (one in ten thousand) to 1×10^{-6} (one in one million).

Table C-15 in Appendix C provides RME cancer risk estimates from the Site 8 HHRA for the significant receptors and routes of exposure developed by taking into account various conservative assumptions about the frequency and duration of exposure for each receptor and also about the toxicity of the COCs. Site 8 COCs associated with carcinogenic risk include arsenic and PAHs. Total risk estimates for all applicable exposure routes range from 8×10^{-10} for inhalation of subsurface soil in the paved area by adult recreational users to 2×10^{-2} for ingestion of subsurface soil in the exposed area by hypothetical child residents. These risk levels indicate that if no cleanup action was taken, the increased probabilities of developing cancer as a result of site-related exposure would range from approximately 8 in 10,000,000,000 to 2 in 100.

The potential for non-carcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., a lifetime) to an RfD derived for a similar exposure period. An RfD represents a level to which an individual may be exposed that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a Hazard Quotient (HQ). An HQ less than 1 indicates that a receptor’s dose of a single contaminant is less than the RfD and that toxic non-carcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all chemicals that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may be reasonably exposed. An HI of 1 or less indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic non-carcinogenic effects from all contaminants are unlikely. An HI greater than 1 indicates that site-related exposures may present a risk to human health. The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI} / \text{RfD}$$

where: CDI = chronic daily intake (mg/kg-day)
RfD = reference dose (mg/kg-day)

CDIs and RFDs are expressed in the same units and represent the same exposure period (i.e., chronic, sub-chronic, or short-term).

Table C-15 in Appendix C also provides RME non-cancer HQs for each receptor and route of exposure and total HIs for all routes of exposure. Total HIs for all applicable exposure routes range from 0.00005 for inhalation of surface soil in the paved area by adolescent trespassers and hypothetical future child and adult recreational users to 655 for ingestion of groundwater by hypothetical future child residents.

Soil Risks

The HIs for all receptors exposed to site-related COPCs in surface and subsurface soil at the site under the RME scenario were less than or equal to 1, with the exception of hypothetical child residents exposed to subsurface soil in the paved area. Arsenic was the major contributor to the HI for hypothetical child residents.

ILCRs for hypothetical child residents and lifelong residents exceeded EPA's target risk range of 10^{-4} to 10^{-6} for surface and subsurface soils in both the exposed and paved areas. In addition, the incremental lifetime cancer risk (ILCRs) for industrial workers, adolescent trespassers, child recreational users, adult recreational users, lifelong recreational users and hypothetical adult residents exceeded EPA's target risk range for subsurface soil in the exposed area.

ILCRs for industrial workers, child and lifelong recreational users, and hypothetical child, adult and hypothetical lifelong residents exceeded RIDEM cumulative risk benchmark of 1×10^{-5} for surface and subsurface soils in both the exposed and paved areas. ILCRs for construction workers, adolescent trespassers, and adult recreational users exceeded RIDEM cumulative risk benchmark of 1×10^{-5} only for subsurface soil in the exposed area.

Carcinogenic PAHs were the major contributors to the ILCRs for exposures to surface soil and subsurface soil in the exposed area. Carcinogenic PAHs were the major contributors to the ILCRs for exposures to surface soil and arsenic and carcinogenic PAHs were the major contributors to the ILCRs for exposures to subsurface soil in the paved area.

Groundwater Risks

HIs for construction workers, hypothetical child residents, and hypothetical adult residents exposed to groundwater at the site exceeded 1. VOCs and metals were the major contributors to the HI.

The ILCR for construction workers exposed to groundwater was less than EPA and RIDEM target risk levels. The ILCRs for domestic use of groundwater by hypothetical child residents, hypothetical adult residents, and hypothetical lifelong residents exceed the EPA target risk range and RIDEM cumulative cancer risk benchmark. Tetrachloroethene (PCE), TCE, vinyl chloride, and arsenic were the major contributors to the ILCRs estimated for exposures to groundwater.

The maximum detected concentration was used in the estimation of the HIs and ILCRs. The maximum detected concentration of inorganics occurred in the groundwater sample collected at location MW-103S, which was highly turbid. The elevated concentrations of inorganics in this sample were likely associated with particulates present in the groundwater sample.

Surface Water Risks

HIs and ILCRs for adolescent trespassers and recreational users exposed to surface water did not exceed EPA or RIDEM risk management benchmarks.

Sediment Risks

HIs for adolescent trespassers and recreational users exposed to sediments in Deerfield Creek and NUWC Pond were less than 1. ILCRs for adolescent trespassers and recreational users exposed to sediment were within EPA's target risk range. ILCRs for adolescent trespassers, child recreational users, and adult recreational users were less than or equal to the RIDEM cumulative cancer risk benchmark. ILCRs for child and lifelong recreational users exceeded the RIDEM cumulative cancer risk benchmark. Carcinogenic PAHs and arsenic were the major contributors to the ILCRs during the HHRA.

Risks from Ingestion of Fish

The ILCR for ingestion of fish caught from NUWC Pond by child recreational users was within EPA's target risk range. The ILCR for ingestion of fish by adult recreational users was equal to the upper bound of EPA's target risk range. The ILCR for lifelong recreational users exceeds EPA's target risk range. ILCRs for child, adult and lifelong recreational users exceeded the RIDEM's cumulative cancer benchmark. PCBs and the pesticides 4,4'-DDE, dieldrin, and aldrin were the major contributors to the ILCR. However, these chemicals in fish tissue were not carried forward as COCs for remediation, due to significant uncertainties in the source of pesticides found in the fish tissue and in the uptake of PCBs from sediment to fish, as well as due to comparisons to similar fish tissue samples from local background/reference ponds.

Risks from Vapor Intrusion

HIs for residential and industrial exposures via vapor intrusion into current/future site buildings were less than 1, indicating that adverse non-carcinogenic effects are not anticipated for these receptors under the defined exposure conditions. The ILCRs estimated assuming a residential land use scenario and an industrial land use scenario were less than EPA's target risk range and less than the RIDEM's cumulative risk benchmark.

Risks from Lead

Exposure to lead in site soil, measured through blood lead models, was found to be below EPA's level of concern. The maximum detected concentration of lead in groundwater indicates that there would be unacceptable risks from exposure to lead in groundwater; however, the elevated concentration was associated with only one monitoring well (MW-103S). Lead concentrations in sediment exceed the available screening criteria.

Risks Associated with Building 179 Groundwater

Groundwater analytical results from the Building 179 Concrete UST RI, shown in Table C-16 in Appendix C, and the SRI were not included as part of the groundwater database for the HHRA in the Site 8 RI. The maximum detected concentrations in groundwater from the Building 179 Area were compared to the maximum detected groundwater concentrations evaluated as part of the HHRA. Overall, COPC concentrations in the Building 179 Area were higher than the remainder of the site. Therefore, because unacceptable risks were associated with groundwater in the northern half of the site, it was assumed that risks associated with groundwater in the Building 179 Area would also be unacceptable, assuming the same existing and potential future risks.

Risk Uncertainties

The distribution of sampling locations in some media of interest at Site 8, affects whether the data set is considered representative of potential site conditions for exposed receptors, and thus impacts the uncertainty for risk estimation.

One of the significant uncertainty within Site 8 HHRA, lies with the measurement of inorganic contaminant concentrations in groundwater and the methods used to calculate EPCs, when the maximum concentration was used as the EPC. Maximum detected groundwater concentrations were used in the estimation of HIs and ILCRs. The maximum detected concentrations of inorganics were detected in the groundwater sample collected at location MW-103S, which had the highest turbidity (greater than 1,100 Nephelometric Turbidity Units [NTUs]). These include aluminum, chromium, nickel, and vanadium. The elevated metals concentrations detected at MW-103S are likely due to soil particulates that were entrained in the highly turbid water sample. In some cases, some elevated sample turbidities at other locations may contribute to other elevated metals concentrations as well. Use of the maximum concentration tends to overestimate potential risks because receptors are assumed to be exposed continuously to the maximum concentration for the entire exposure period.

Another uncertainty in the HHRA pertains to the presence of chromium in groundwater. Groundwater samples were analyzed for total chromium whereas the HHRA conservatively assumed that it is present in the form of hexavalent chromium (Cr^{6+}) rather than the less toxic trivalent form (Cr^{3+}). If chromium is present predominantly in the trivalent form, then the calculated risks associated with exposure to groundwater would be lower.

Identification of COCs and Remediation Goals

Human health risk-based COCs were identified in soil, groundwater, and sediment based on the results of the HHRA included in the RI Report, as well as the supplemental data and risk evaluations from the SRI (Tetra Tech, 2010, Tetra Tech 2011b).

Human health risk-based COCs are identified in site environmental media for scenarios where the total cancer risk or non-cancer HI exceeds the target risk benchmarks. EPA's target cancer risk range is 1×10^{-4} to 1×10^{-6}, and RIDEM's cumulative cancer risk benchmark is 1×10^{-5}. Therefore, to comply with both of these criteria for each receptor/exposure scenario, a cumulative site cancer risk of 1×10^{-5} was used as the threshold to indicate whether further evaluation was required in the FS. An HI of 1 on a target-organ basis was used for non-cancer effects, which is consistent with both EPA and RIDEM requirements. Chemicals retained as COCs during the RI are summarized in Table C-17 of Appendix C.

Remedial (cleanup) goals were developed for soil, groundwater, and sediment for the COCs that contributed significantly to the cancer risk above 10^{-4} and/or HI greater than 1 for each exposure pathway in a land use scenario for a receptor group. Chemicals were not considered as significant contributors to risk if their individual carcinogenic risk contribution was less than 1×10^{-6} and their non-carcinogenic HQ was less than 0.1. Also chemicals identified as being within naturally occurring levels were not retained as COCs. The calculated RGs for soil, groundwater, and sediment are presented in Section 2.8.

Following the COCs identified directly from the standardized risk calculation in the RI, there was additional consideration given during the SRI for those COCs regarding the presence in background or reference data, the frequency of detection, the presence of the constituents above target risk levels, and the representativeness of the CERCLA-release contaminants that are related to the site. The purpose of this **COC refinement step** was to determine which chemicals were appropriate for the development of preliminary remediation goals (PRGs) in the FS. During this refinement process, the COCs identified in the RI were compared to (1) the target risk values calculated from the risk assessment, and (2) to an appropriate background concentration (although no background data have been identified for groundwater). The representative site concentration was selected as the 95 percent UCL of the available data set which includes both the RI and the SRI data.

Tables C-18 through C-22 summarizes the SRI Report's refinement of COPCs and selection of CERCLA COCs that were carried forward for development of PRGs in the FS. The refinement step used maximum and representative site values (e.g., 95% UCL), and compared those values to target risk levels (determined by calculation in the RI) and background concentrations documented previously. Based on the refinement step during the SRI, Table C-23 summarizes the COCs that were carried forward to the FS for PRG development.

These risk-based COCs, along with the COCs identified based on comparisons of site data to applicable or relevant and appropriate requirements (ARARs), were used to identify the complete list of COCs for which PRGs were developed in the FS. The COCs for the environmental media at Site 8 are summarized below.

Soil

The following chemicals exceeding threshold values for the residential scenario in either surface or subsurface soils were selected as risk-based COCs for residential and recreational soil:

- benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and arsenic.

In addition to these risk-based COCs which were identified in the HHRA as the primary risk drivers in residential soil, the following chemicals were also identified as COCs based on exceedences of chemical-specific ARARs (i.e., RIDEM's residential DEC and/or leachability criteria):

- 1,1-biphenyl, acenaphthene, anthracene, benzo(g,h,i)perylene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, beryllium, lead, manganese, and zinc.

The following chemicals in soil exceeding threshold values for the industrial/commercial worker scenario were selected as risk-based COCs for industrial soil:

- benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

In addition to these risk-based COCs, which were identified in the HHRA as the primary risk drivers in industrial soil, the following chemicals were also identified as COCs based on exceedences of chemical-specific ARARs (i.e., RIDEM's industrial DEC and/or leachability criteria):

- benzo(k)fluoranthene, naphthalene, chrysene, arsenic, beryllium, and lead.

Groundwater

The following chemicals in groundwater exceeding the threshold values for the residential drinking water scenario were selected as COCs:

- VOCs – 1,1,1-TCA, 1,1-DCA, 1,1-DCE, carbon tetrachloride, ethylbenzene, PCE, TCE, vinyl chloride
- SVOC – 1,4-dioxane
- metals – arsenic, chromium, cobalt, lead, manganese, nickel, vanadium

Most of the chemicals in groundwater exceeding threshold values for the construction worker scenario (aluminum, beryllium, iron, and manganese) were not selected as COCs for industrial scenario during the

COC refinement step in the SRI because the representative site concentration (95 percent UCL) did not exceed the calculated risk values. Chromium was retained as a COC to be addressed in the FS for the construction worker receptor because the representative site concentration exceeded the target risk levels, based on the conservative assumption that it is present in the form of hexavalent chromium (Cr^{6+}) rather than the less toxic trivalent form (Cr^{3+}). If future sampling determines that chromium is present predominantly in the trivalent form, then chromium may be eliminated from the list of groundwater COCs.

Arsenic and manganese are likely present at elevated concentrations in groundwater due to the geochemical environment that resulted from the primary release of contaminants to groundwater (i.e., arsenic and manganese were mobilized from soil to groundwater as a secondary release from the reducing conditions produced in the aquifer).

1,4-Dioxane was detected during the SRI, subsequent to the HHRA calculations conducted as part of the RI. Due to its toxicity and its presence in more than one location at levels above the literature toxicity values, 1,4-dioxane is included as a COC for groundwater.

1,1,1-TCA and 1,1-DCA were not identified in the HHRA as posing risk, however, during the SRI and other investigation efforts, these VOCs were detected in groundwater at concentrations greater than those that would be expected to pose unacceptable risk to future residential receptors. Rather than calculate risk for 1,1,1-TCA and 1,1-DCA specifically, these VOCs were adopted as COCs for the site.

Sediment, Fish Tissue, Surface Water

Of the COCs identified in sediment during the HHRA, lead in the stream sediment is the only analyte selected as a COC targeted for cleanup for the protection of human health. The other human health-based COCs in sediment were excluded during the COC refinement step in the SRI due to the comparison of sediment to the background sediment data set for this site. For example, the concentrations of arsenic and benzo(a)pyrene in sediment are within the range of background concentrations, as shown in Table C-20 of Appendix C. Also, the risks estimated in the HHRA for lifelong recreational users exposed to benzo(a)pyrene and arsenic in sediment are comparable to risks associated with background levels of these chemicals. The ILCRs estimated in the HHRA for lifetime recreational users were $1x10^{-5}$ for benzo(a)pyrene and $5x10^{-6}$ for arsenic. The ILCRs for lifetime recreational users exposed to background concentrations of benzo(a)pyrene would be $2x10^{-5}$ based on the maximum concentration and $9x10^{-6}$ based on the average concentration. The ILCRs for lifetime recreational users exposed to background concentrations of arsenic would be $1x10^{-5}$ based on the maximum concentration and $6x10^{-6}$ based on the average concentration. The ILCRs from arsenic and benzo(a)pyrene in sediment at this site are similar to background ILCRs for these constituents; therefore, arsenic and benzo(a)pyrene were eliminated as sediment COCs for human health.

The contaminants identified in fish tissue during the HHRA were not retained as COCs in the FS based on the COC refinement step during the SRI. Fish tissue contaminants were excluded from PRG development due to significant uncertainties in the source of pesticides found in the fish tissue and in the uptake of PCBs from sediment to fish, as well as due to comparisons to similar fish tissue samples from local background/reference ponds.

As described above, the HIs and ILCRs for adolescent trespassers and recreational users exposed to surface water did not exceed EPA or RIDEM risk management benchmarks. Therefore, no surface water COCs were identified.

2.7.2 Summary of Ecological Risk

The ERA was performed during the RI to assess ecological risks to the terrestrial and aquatic receptors exposed to COPCs at the site. Ecological COPCs identified during the ERA are summarized in Appendix D. Surface soil, sediment, surface water, fish tissue, and earthworm tissue, along with soil and sediment toxicity test data and benthic community data were evaluated. Later, the additional data collected during the SRI also were evaluated and it was determined at that time that the ERA from the RI did not require a revision (Tetra Tech, 2011b).

During the ERA, several chemicals were identified in surface soil at concentrations that exceed plant screening levels; however, terrestrial plants were eliminated as receptors of concern because it does not appear that significant impacts are occurring to plants, as evidenced by the heavy vegetative growth at the site.

For terrestrial invertebrates, the ERA determined that significant risks are not expected, based on the only slight impacts to earthworms as measured in toxicity tests, and based on the lack of a relationship between chemistry and toxicity.

Risks to sediment invertebrates in NUWC Pond were evaluated through sediment toxicity testing and a benthic community investigation. The benthic community in NUWC Pond appears to have been adversely impacted by a combination of organic and inorganic chemicals in sediment. Therefore, the toxicity data were used to develop no-observed-effects-concentrations (NOECs) and lowest-observed-effects-concentrations (LOECs) for the associated COPCs. Based on the toxicity test data, this evaluation for NUWC Pond included total DDx (the sum of DDT, DDE, and DDD concentrations), total chlordane (LOECs only), total PCBs (LOECs only), high molecular weight (HMW) PAHs, total PAHs, and the probable effects concentration quotient (PEC-Q).

There were various uncertainties associated with the risk evaluation of the sediment invertebrates in the stream samples. However, NOECs and LOECs were also developed for total PCBs, HMW PAHs, total PAHs, and lead in stream sediment because the toxicity test data indicated that the benthic community in the stream sediment also may have been impacted by a combination of these chemicals.

The ERA determined that no adverse impacts to aquatic organisms are expected, based on a comparison of the measured concentrations of chemicals in surface water to screening levels.

After a re-evaluation of the food-chain model using less conservative exposure assumptions during the RI, unacceptable risks to insectivorous mammals and birds were identified for surface soil. The surface soil HQs are greater than 1, due to the detected concentrations of cadmium, chromium, and selenium. For sediment, no unacceptable risks were identified for piscivorous mammals or birds.

Surface water and sediment sample data from the Building 179 Concrete UST RI were also evaluated for potential ecological risks. No unacceptable risks were identified for surface water (aquatic organisms) or sediment (invertebrates).

Similar to the HHRA, the COCs identified as posing an unacceptable risk to ecological receptors were used in the FS to assist in identifying potential remedial alternatives for the site. The ecological COPCs identified in the ERA were further evaluated during the SRI to account for some of the variables and limitations of the risk assessment as well as the actual conditions at the site (Tetra Tech, 2011b). These considerations include the reference (background) conditions applicable to soil and sediment, and consideration of both maximum and average measured COPC concentrations. During the SRI, it was determined that concentrations of selenium in surface soil were similar to background levels and, therefore, selenium did not need to be carried forward as a surface soil COC. Similarly, total DDx, chlordanes, and PAHs were not carried forward as sediment COCs in the FS because they were found to be similar to background levels and their presence in sediment was not directly associated with a CERCLA release.

Based on the COPCs identified in the risk assessment and in the SRI refinement step, the following chemicals were selected as ecological COCs:

- Total PCBs and the PEC-Q in pond sediment, based on measured concentrations greater than background and greater than LOECs for invertebrates.

- Total PCBs and lead in stream sediment, based on measured concentrations greater than background and greater than LOECs for invertebrates.

- Cadmium and chromium in soil, because hazard quotients were greater than 1.0 for insectivorous mammals and birds based on LOAELs.

2.7.3 Basis for Action

Unacceptable risks to human health and the environment were identified for current and future site exposure scenarios. Therefore, the response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

The results of the HHRA indicated that potential unacceptable risks were associated with (1) exposure to soil in the upland area of the site (for each of the evaluated receptor groups); (2) potable use of site groundwater by future residents (child, adult, and lifetime resident); (3) exposure to groundwater for future construction workers; and (4) exposure to lead in stream sediment. Although the HHRA during the RI also identified the ingestion of fish by recreational users as potential risk (with PCBs, 4,4'-DDE, dieldrin, and aldrin as the major contributors to the incremental cancer risk), it was subsequently determined that these chemicals in fish tissue did not warrant being carried forward as COCs for remediation, due to significant uncertainties in the source of pesticides found in the fish tissue, the uncertainties in the likelihood of the uptake of PCBs from sediment to fish, and due to comparisons to similar fish tissue samples from local background/reference ponds.

The results of the ERA indicated that potential unacceptable risks were associated with benthic invertebrate exposure to sediment in Deerfield Creek and NUWC Pond as well as for insectivorous mammals and bird exposure to surface soil. Although remedial action is being selected to mitigate ecological risks in sediment, the FS determined that the ecological COCs in surface soil (cadmium and chromium) are collocated with the COCs associated with excess human health risks. Therefore, actions performed to address the human health risks will also mitigate the ecological risks in surface soil.

2.8 Remedial Action Objectives

RAOs are medium-specific goals that define the objective of conducting remedial actions to protect human health and the environment. RAOs specify the COCs, potential exposure routes and receptors, and acceptable concentrations (i.e., cleanup levels or RGs) for a site and provide a general description of what the cleanup will accomplish. RAOs typically serve as the design basis for the remedial alternatives described in Section 2.9.

The **RAOs for Site 8** are as follow:

- Prevent the incidental ingestion of and dermal contact with surface and subsurface soil containing COCs that exceed human health RGs.

- Prevent the use of site groundwater for human consumption until groundwater RGs have been achieved.

- Restore groundwater quality to its beneficial use.

- Prevent insectivorous mammals and birds from exposure to surface soil containing COCs that exceed ecological RGs.

- Prevent the migration of sediment COCs that could cause unacceptable ecological risk to pond and stream sediment via groundwater transport and overland runoff.

- Prevent pond and stream invertebrates from exposure to sediments containing COCs that exceed ecological RGs.

- Prevent human exposure to stream sediment containing COCs above RGs.

These RAOs are based on current and reasonably anticipated future site use, which is industrial/commercial. Although the site is not currently used for residential or recreational purposes and there are no plans for residential/recreational use of the property in the future, RGs for residential exposures also have been calculated in order to evaluate cleanup options which provide for unrestricted use and unlimited exposure of the property and to determine whether institutional controls are needed to control hypothetical future site uses.

PRGs were developed during the FS as target cleanup goals for remedial actions that would reduce COC concentrations in Site 8 media of concern, and thereby mitigate risks to human health and the environment. PRGs were established for the COCs (site-specific constituents that pose unacceptable risks to human health and to ecological receptors). PRGs also are established for CERCLA hazardous substances, pollutants or contaminants, while not posing unacceptable risk, if detected at concentrations exceeding RIDEM's soil DEC and/or Leachability Criteria.

The PRGs were developed to determine the degree of remediation necessary to protect human health and the environment. The PRGs must be protective of each of the principal receptors identified at the site and they should be reasonable and practical to implement. PRGs can be developed based on chemical-specific ARARs, when available, and risk-based factors. In addition, the protection of groundwater and the presence of COCs in background locations are also considered in developing the PRGs. For Site 8, PRGs were developed for COCs identified for unrestricted (residential) site use and for restricted (industrial/commercial) site use. PRGs also take into consideration RIDEM soil DEC and Leachability Criteria, as well as federal MCLs, non-zero MCLGs, federal risk-based standards, and more stringent State standards which are ARARs.

The PRGs developed in the FS have been retained as RGs in this ROD. As shown in Table 2-4, the human health RGs for soil at Site 8 were selected to support continued industrial use of the site. Residential goals were used to help determine the extent of LUCs. For each COC, the calculated 10^{-6} cancer risk value, the RIDEM Method 1 DEC, the RIDEM Leachability Criterion, and the background value were compared. The lower of the calculated risk-based value, DEC, and Leachability Criterion was selected and compared to the background value. If greater than the background value, then the selected value is used as the cleanup level. If less than the background value, then the background value is used as the cleanup level. Toxicity Characteristic Leaching Procedure/Synthetic Precipitation Leaching Procedure (TCLP/SPLP) data are not available for comparison to the Leachability Criteria for metals in soil, although the available groundwater data indicate that exceedences of metals Leachability Criteria are not anticipated. Additional verification sampling for SPLP analysis will be conducted during the Remedial Design/Remedial Action (RD/RA) phase to verify that metals levels in site soil are not exceeding Leachability Criteria. As noted in Table 2-4, the RGs for some metals may be modified if it is found that Leachability Criteria are being exceeded.

TABLE 2-4. REMEDIATION GOALS FOR SOIL

CHEMICAL OF CONCERN	INDUSTRIAL CLEANUP LEVEL (mg/kg)	BASIS FOR SELECTION
1,1-Biphenyl	---	(d)
Acenaphthene	---	(d)
Anthracene	---	(d)
Benzo(a)anthracene	2.1	Cancer Risk[(a)] = 10^{-6}
Benzo(a)pyrene	0.21	Cancer Risk[(a)] = 10^{-6}
Benzo(b)fluoranthene	2.1	Cancer Risk[(a)] = 10^{-6}
Benzo(g,h,i)perylene	---	(d)
Benzo(k)fluoranthene	21	Cancer Risk[(a)] = 10^{-6}
Chrysene	780	RIDEM DEC
Dibenzo(a,h)anthracene	0.21	Cancer Risk[(a)] = 10^{-6}
Fluoranthene	---	(d)
Fluorene	---	(d)
Indeno(1,2,3-cd)pyrene	2.1	Cancer Risk[(a)] = 10^{-6}
Naphthalene	0.8	RIDEM Leachability Criterion
Phenanthrene	---	(d)
Pyrene	---	(d)
Arsenic	18	Background[(b)]
Antimony	---	(e)
Barium	---	(e)
Beryllium	1.5	RIDEM DEC
Cadmium[(c)]	---	(e)
Chromium[(c)]	---	(e)
Cyanide	---	(e)
Lead	500	RIDEM DEC
Manganese	---	(d)
Mercury	---	(e)
Nickel	---	(e)
Selenium	---	(e)
Thallium	---	(e)
Zinc	---	(d)

(a) Risk-based RGs are calculated for the risk-based COCs identified from the HHRA.
(b) Background values are based on the Upper Predictive Limit (UPL) of the background sample data set.
(c) Ecological-based PRGs were calculated for cadmium and chromium in the FS; however, these were not retained as RGs because these ecological COCs are collocated with the human health COCs and the actions performed to address the human health risks will also mitigate the ecological risks.
(d) The COC was selected based on an exceedence of RIDEM's residential DEC. An industrial RG was not selected because the maximum COC concentration in site soil does not exceed the industrial standards. Exceedences of the residential DEC in soil at the site will be addressed through LUCs.
(e) Potential COC based on RIDEM's leachability criteria. RGs may be modified based on the leachability criteria if sampling during the RD/RA shows that SPLP criteria are being exceeded by the identified metals in soil.

The RGs for Site 8 groundwater were selected as the more stringent standards of the federal drinking water MCLs and RIDEM GA Criteria, as shown in Table 2-5. For COCs with no published MCLs, federal risk-based standards, or RIDEM GA Criteria, the more stringent of the cancer risk level or non-cancer risk level was selected.

TABLE 2-5. REMEDIATION GOALS FOR GROUNDWATER

CHEMICAL OF CONCERN	CLEANUP LEVEL (µg/L)	BASIS FOR SELECTION
1,1-Dichloroethane[(d)]	2.4	Cancer Risk = 10^{-6}
1,1-Dichloroethene	7	MCL
1,4-Dioxane[(d)]	0.67	Cancer Risk = 10^{-6}
1,1,1-Trichloroethane	200	MCL
Carbon Tetrachloride	5	MCL
Ethylbenzene	700	MCL
Tetrachloroethene	5	MCL
Trichloroethene	5	MCL
Vinyl Chloride	2	MCL
Arsenic	10	MCL
Chromium[(c)]	100	MCL
Cobalt[(d)]	4.7	Non-Cancer HI=1
Lead	15	MCL
Manganese	300	Health Advisory[(b)]
Nickel	100	RIDEM GA Criterion[(a)]
Vanadium[(d)]	78	Non-Cancer HI=1

(a) RIDEM's Method 1 GA Groundwater Objectives from Section 8.03 of the Rhode Island Remediation Regulations, DEM-DSR-01-93, as amended Nov. 2011.
(b) The calculated risk-based value (non-cancer) for manganese is 775 µg/L; however, EPA has requested that their Health Advisory guidance value be use at Site 8.
(c) Chromium was retained as a COC based on the conservative assumption that it is present in the form of hexavalent chromium (Cr^{6+}) rather than the less toxic trivalent form (Cr^{3+}). If future sampling determines that chromium is present predominantly in the trivalent form, then chromium may be eliminated from the list of groundwater COCs.
(d) The RGs for 1,1-DCA, 1,4-dioxane, cobalt, and vanadium differ from the PRGs calculated in the FS because an updated exposure assumption was used for the ingestion rate under a child resident scenario (assumed ingestion rate of 1.0 liter per day instead of 1.4 liters per day).

The human health RG for lead in stream sediment is based on EPA's adult lead model for calculating an acceptable blood lead level for construction workers/industrial workers and residential exposure scenarios. The ecological RGs are based on geometric means of NOECs and LOECs as well as calculations of acceptable overall toxicity levels to aquatic organisms, as represented by PEC-Qs. The sediment RGs are summarized in Table 2-6.

TABLE 2-6. REMEDIATION GOALS FOR SEDIMENT

CHEMICAL OF CONCERN	POND SEDIMENT		STREAM SEDIMENT	
	SELECTED CLEANUP LEVEL	BASIS FOR SELECTION	SELECTED CLEANUP LEVEL	BASIS FOR SELECTION
Organics (µg/kg)				
Total PCBs	150	Ecological risk(a)	451	Ecological risk(a,b)
Metals (mg/kg)				
Lead	---	---	1,233	Ecological risk(d)
PEC-Q (unitless)(c)				
PEC-Q (with DDE)	0.68	Ecological risk(a)	---	---

(a) Geometric mean of NOEC and LOEC; if a NOEC was not available, RG was set at the LOEC.
(b) Because there is more uncertainty in whether there are risks to sediment invertebrates in the stream, the RGs are based on the endpoint specific NOECs and LOECs.
(c) To calculate the overall mean PEC-Q, first calculate the individual PEC-Qs for total PAHs, total PCBs, DDE, and individual metals (arsenic, cadmium, chromium, copper, lead, nickel, and zinc). PEC-Qs are calculated by dividing the chemical concentrations by the respective PECs (unitless). The average of those ten individual PEC-Qs is used as the overall mean PEC-Q.
(d) The RG for lead in stream sediment is based on the lower of the industrial value for human health (2,200 mg/kg) and the ecological RG (1,233 mg/kg). Lead concentrations in sediment above the human health value of 400 mg/kg will be addressed though LUCs.

µg/kg – Microgram(s) per kilogram
LOEC – Lowest Observed Effects Concentration
NA – Not available
ND – Not Detected
NOEC – No Observed Effects Concentration
mg/kg – Milligram(s) per kilogram
PCB – Polychlorinated biphenyls
PEC-Q – Probable Effects Concentration Quotient
RG – Remediation Goal

2.9 DESCRIPTION OF ALTERNATIVES

To address potential unacceptable human health and ecological risks associated with soil, groundwater, and sediment at Site 8, a **preliminary technology screening** evaluation was conducted in the FS. A number of treatment technologies and process options for soil, groundwater, and sediment were initially screened based on their potential effectiveness, implementability, and cost, but most were eliminated based on the type and volume of contamination at Site 8 (e.g., large volumes of soil and sediment containing a mixture of organic and inorganic COCs, and relatively diffuse plumes of VOCs and metals in a fractured bedrock aquifer).

The technologies and process options retained after the initial screening were assembled into various alternatives for soil, groundwater, and sediment. Consistent with the NCP, the no action alternatives were evaluated as a baseline for comparison with other alternatives during the comparative analysis. The remedial alternatives developed in the FS for soil, sediment, and groundwater, are presented in Sections 2.9.1, 2.9.2, and 2.9.3, respectively.

2.9.1 Soil Alternatives

To address COCs and the associated human health and ecological risks in soil, a screening of General Response Actions, remedial technologies, and process options was conducted as part of the FS. The technologies and process options retained from the detailed screening were assembled into four remedial alternatives for soil at Site 8. Consistent with the NCP, the No Action alternative was evaluated as a baseline for comparison with other alternatives during the comparative analysis. Table 2-7 summarizes the major components and provides estimated costs for each of the remedial alternatives developed for Site 8 soil.

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SOIL

ALTERNATIVE	COMPONENTS	DETAILS	COST	TIME TO CLEANUP
No Further Action (Alternative SO1)	None	No further actions would be taken. Five-year reviews of the no action decision would be required.	**Capital**: $0 **O&M**: $0 **5-Year Reviews**: $27,500 **Total 30-Year NPW**: $118,000	Not Applicable
Excavation, Ex-Situ Treatment, Selective Excavation and Removal of Anomalies, Off-Site Disposal, LUCs, and Monitoring (Alternative SO2)	Pre-Design Investigations	Additional investigations will include (1) soil sampling to verify that metals levels do not exceed Rhode Island leachability standards and (2) soil borings to verify that a VOC source is not present in North Meadow soil.	**Capital**: $4,863,000 **O&M**: $3,500 **5-Year Reviews**: $27,500 **Total 30-Year NPW**: $5,059,000	2 Years
	Soil/Debris Excavation	An area of approximately 147,500 square feet with COCs exceeding industrial RGs would be excavated to a depth of 2 feet bgs. This corresponds to a volume of approximately 11,600 cubic yards of excavated material. Soil/debris would be removed and staged on-site for treatment and/or subsequent disposal at an off-site, permitted facility. Wetland areas impacted by the remedy would be restored.		
	Ex-Situ Treatment – Low-Temperature Thermal Desorption (LTTD)	The excavated PAH-contaminated soil without elevated arsenic levels (estimated at 3,700 cubic yards) would be treated on-site using LTTD. The off-gas may require treatment to capture contaminants prior to discharge. Treated soils would be sampled and used onsite as backfill to help restore the site grade, once sampling results confirm that the soils are clean. The excavated soil not amenable to treatment due to elevated levels of metals such as arsenic (estimated at 7,910 cubic yards) would be disposed off-site at a permitted facility. Clean fill would be brought on-site to complete the restoration of the site grade and to serve as a cover for the remaining COCs in subsurface soil.		
	Selective Excavation of Soil and Removal of Anomalies	An estimated 558 cubic yards of soil/debris would be excavated and disposed offsite at a permitted facility (with the exception of one area of PAHs to be excavated west of NUWC Pond, to undergo LTTD), including the following: <u>Paved Storage Area:</u> Identified geophysical anomalies, believed to be buried waste materials, would be excavated, backfilled, and repaved. The Paved Storage Area will then be managed as a Waste Management Area which uses the existing asphalt pavement as a means to contain and		

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SOIL				
ALTERNATIVE	**COMPONENTS**	**DETAILS**	**COST**	**TIME TO CLEANUP**
		prevent exposure to remaining COCs in soil and potential buried debris. South Meadow: Known remaining buried drum fragments and areas where benzo(a)pyrene and/or naphthalene exceed RIDEM Soil Leachability Criteria would be excavated. Buried Container Area: Remaining buried canisters would be excavated. West of Deerfield Creek and NUWC Pond: sample locations DA-SB142, DA-SB145, DA-SB146, DA-SB153, B179-SB1/2/3, DA-SS149 would be excavated.		
	LUCs and maintenance	LUCs would be implemented to preclude both residential and recreational future use of the site, limiting future site use to industrial only. The extent of the LUCs would cover the area where COCs remain in soil at levels exceeding residential RGs. Periodic inspections of the site would be conducted to verify continued effectiveness of the LUCs. Inspection and repairs of the soil and asphalt covers would be conducted as needed.		
	Groundwater Monitoring and Five-Year Reviews	Groundwater monitoring would be performed for the cover area, including around the perimeter of the Waste Management Area to verify that COCs are not migrating from that area. Five-year reviews would be conducted by the Navy, EPA, and RIDEM until site conditions were restored to allow for unrestricted use and unlimited exposure.		
Soil Cover, Selective Excavation and Removal of Anomalies, Off-Site Disposal, LUCs, and Monitoring (Alternative SO3)	Pre-Design Investigations	Same as Alternative SO2.	**Capital**: $1,926,000 **O&M**: $3,500 **5-Year Reviews**: $27,500 **Total 30-Year NPW**: $2,123,000	2 Years
	Selective Excavation of Soil and Removal of Anomalies	Same as Alternative SO2 (except that no LTTD treatment would be conducted).		
	Soil Cover	A soil cover system would be constructed in the North and South Meadow areas, over the identified limits of unpaved soils where industrial RGs are exceeded. The **soil cover thickness** would be 2 feet, including 18 inches of common fill and 6 inches of topsoil. The soil cover would be vegetated upon completion. Portions of the cover close to the creeks and pond will be armored with 2 feet of armor stone cover to resist erosive forces. The soil cover will consist of 8,300 cubic yards of common fill, 2,800 cubic yards of topsoil, and 2,500 cubic yards of armor stone (average stone size, 6 inches). The existing asphalt pavement would be maintained and handled as a Waste Management Area.		
	LUCs and Inspection	Same as Alternative SO2.		

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SOIL				
ALTERNATIVE	COMPONENTS	DETAILS	COST	TIME TO CLEANUP
	Groundwater Monitoring and Five-Year Reviews	Same as Alternative SO2.		
Excavation, Consolidation, Soil Cover, Selective Excavation and Removal of Anomalies, LUCs, and Monitoring (Alternative SO4)	Pre-Design Investigations	Same as Alternative SO2.	**<u>Capital</u>**: $2,267,000 **<u>O&M</u>**: $3,500 **<u>5-Year Reviews</u>**: $27,500 **<u>Total 30-Year NPW</u>**: $2,464,000	2 Years
	Selective Excavation of Soil and Removal of Anomalies	Same as for Alternative SO2, except soil containing COC concentrations below RIDEM Leachability Criteria may be consolidated in the South Meadow under the new soil cover (and no LTTD treatment would be conducted).		
	Soil Excavation and Consolidation	Approximately 5,600 cubic yards of surface and subsurface soil in the North Meadow would be excavated (up to 9 feet bgs in some areas) and relocated to the South Meadow for consolidation under a constructed soil cover. The North Meadow would be backfilled with clean soil to restore the site topography.		
	Soil Cover for Consolidation Area	A soil cover system would be constructed in the South Meadow over the identified limits of unpaved soils where industrial RGs are exceeded. The soil cover thickness would be 2 feet, including 18 inches of common fill and 6 inches of topsoil. The soil cover would be vegetated following completion. Portions of the cover close to the creeks and pond would be armored with 2 feet of armor stone cover to resist erosive forces. The soil cover will consist of 4,950 cubic yards of common fill, 1,650 cubic yards of topsoil, and 2,300 cubic yards of armor stone (average stone size, 6 inches). The existing asphalt pavement would be maintained and handled as a Waste Management Area		
	Verification Sampling	Same as Alternative SO2.		
	LUCs and Inspection	Same as for Alternative SO2, except that the LUCs would not include the North Meadow soil.		
	Groundwater Monitoring and Five-Year Reviews	Same as Alternative SO2.		

Notes: For purposes of cost estimation, all O&M costs represent 30-year timeframes, only. Actual total costs may be higher.

Alternative SO2 through SO4 could be implemented within 2 years of signing the ROD, and would attain the RAOs pertaining to soil upon implementation. The RD and preparation of the construction work plan, the LUCs, and the long-term monitoring/management plan would be completed within the first year, and construction activities would be expected to require several months after that, which could be impacted by access limitations at this active facility.

2.9.2 Groundwater Alternatives

To address COCs and the associated human health risks in groundwater, a screening of General Response Actions, remedial technologies, and process options was conducted as part of the FS. The technologies and process options retained from the detailed screening were assembled into four remedial alternatives for groundwater at Site 8. Consistent with the NCP, the No Action alternative was evaluated as a baseline for comparison with other alternatives during the comparative analysis. Table 2-8 summarizes the major components and provides estimated costs for each of the remedial alternatives developed for Site 8 groundwater.

Table 2-8. Summary of Remedial Alternatives Evaluated For Groundwater

Alternative	Components	Details	Cost	Time to Cleanup
No Further Action (Alternative GW1)	None	No further actions would be taken. Five-year reviews of the no action decision would be required.	**Capital**: $0 **O&M**: $0 **Total 30-Year NPW**: $0	Not Applicable
Monitored Natural Attenuation (MNA) and LUCs (Alternative GW2)	MNA	Long-term monitoring (LTM) of COCs in groundwater and MNA assessments would be performed to verify that the Site 8 plumes are attenuating at an acceptable rate. Indigenous microbial populations would degrade (metabolize) the CVOC portion of the plume over time. Following CVOC cleanup, dissolved metals concentrations would be restored to background levels via abiotic attenuation processes.	**Capital**: $16,500 **O&M**: $274,000 (Yr 1) $137,000 (Yrs 2 & 3) $69,000 (Yrs 4-30) **Total 30-Year NPW**: $1,880,000	35-50 Years for CVOCs plus 10-15 Years for metals
	LUCs and 5-Year Reviews	LUCs would be implemented to control exposure to COCs in groundwater and to protect human health during the interim time period until cleanup goals have been achieved in groundwater. The groundwater LUCs would prohibit the installation of groundwater supply wells, including public and private drinking water wells and irrigation wells, in addition to prohibiting any use of groundwater for drinking water purposes. Five-year reviews would be conducted by the Navy, EPA, and RIDEM until site conditions were restored to allow for unrestricted use and unlimited exposure.		
In-Situ Enhanced Bioremediation, MNA, and LUCs (Alternative GW3)	Pre-Design Investigations	Additional investigations will include pilot/bench-scale studies to (1) determine the type of amendment to be used for in-situ groundwater treatment (bioremediation or chemical oxidation) and (2) provide information needed to engineer the full-scale system (e.g., microcosm study, aquifer hydraulic testing).	**Capital**: $3,764,000 **O&M**: $274,000 (Yr 1) $137,000 (Yrs 2 & 3) $69,000 (Yrs 4-30) **Reinjection**: $1,536,000 (Yr 2) **Total 30-Year NPW**: $7,104,000	**25-35 Years for CVOCs plus 10-15 Years for metals**
	In-Situ Enhanced Bioremediation	Introduction of specific nutrients into the most contaminated portions of the plumes (i.e., the target treatment zone) to stimulate the activity and growth of naturally-occurring microbes that can break down (metabolize) the organic COCs. The introduction of a microbial food source will promote the		

TABLE 2-8. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR GROUNDWATER				
ALTERNATIVE	**COMPONENTS**	**DETAILS**	**COST**	**TIME TO CLEANUP**
		anaerobic conditions needed for microbes to degrade organic COCs in groundwater. Plume conditions will be monitored over time and additional nutrients could be added as needed to complete the process. Other subsurface conditions such as pH may also be adjusted, if necessary.		
	MNA	In the untreated portions of the plumes (and as a polishing step following active treatment of the most contaminate portions of the plume), MNA would be used the same as for Alternative GW2. The favorable aquifer geochemistry established by the bioremediation portion of this alternative is expected to augment the subsequent MNA of residual CVOCs.		
	LUCs and 5-Year Reviews	Same as Alternative GW2.		
In-Situ Chemical Oxidation, MNA, and LUCs (Alternative GW4)	Pre-Design Investigations	Same as Alternative GW3.	**Capital**: $3,398,000 **O&M**: $274,000 (Yr 1) $137,000 (Yrs 2 & 3) $69,000 (Yrs 4-30) **Reinjection**: $1,609,000 (Yr 1) **Total 30-Year NPW**: $6,839,000	5-30 Years for CVOCs plus 10-15 Years for metals
	In-Situ Chemical Oxidation	Introduction of a chemical oxidant into the most contaminated portions of the plumes (i.e., the target treatment zone) to destroy organic COCs. The chemical oxidant may consist of sodium or potassium permanganate, sodium persulfate, or "Fenton's Reagent" (a mix of hydrogen peroxide and an iron catalyst). Plume conditions will be monitored over time and additional chemical oxidants could be added as needed to complete the process.		
	MNA	In the untreated portions of the plumes (and as a polishing step following active treatment of the most contaminate portions of the plume), MNA would be the same as for Alternative GW2. In the target treatment zones, the previous application of chemical oxidants would impact (hinder) the indigenous microbial population responsible for reductive dechlorination; however, the microbial populations would be expected to recover over time.		
	LUCs and 5-Year Reviews	Same as Alternative GW2		

Notes: Five-year review costs are included under the soil alternatives.
For purposes of cost estimation, all O&M costs represent 30-year timeframes, only. Actual total costs may be higher.

Under Alternative GW2, the RAO to prevent the use of site groundwater for human consumption would be achieved immediately upon implementation of LUCs and the monitoring program. Alternative GW2 would attain the RAO to restore groundwater quality to its beneficial use once COCs reach the cleanup goals through natural attenuation. MNA modeling performed during the FS estimated that RGs would be achieved for CVOCs in 35 to 45 years in the North Meadow plume and 40 to 50 years in the South Meadow plumes. An additional timeframe (estimated as 10 to 15 years) may be required for the attenuation of residual metals concentrations in groundwater following the reduction of CVOC concentrations; however, due to the current uncertainties in metals attenuation rates, the Navy would reevaluate the predicted MNA timeframe for metals after the CVOC plume is nearing cleanup and more LTM data are available.

Similarly, under Alternatives GW3 and GW4, the RAOs for preventing exposure to COCs would be achieved immediately upon implementation of LUCs and the monitoring program. Active treatment of the groundwater plume via in-situ enhance bioremediation (Alternative GW3) reduces the predicted cleanup timeframe to 25 to 35 years for CVOCs in the North Meadow plume and in 15 to 20 years in the South Meadow, plus the additional 10 to 15 years for the attenuation of residual metals concentrations. Active treatment of the groundwater plume via in-situ chemical oxidation (ISCO) (Alternative GW4) reduces the predicted cleanup timeframe to 5 to 30 years in the North Meadow plume and 5 to 25 years in the South Meadow plumes, plus the additional 10 to 15 years for the attenuation of residual metals concentrations.

Groundwater cleanup standards applicable to the rest of the site will not have to be achieved within the Waste Management Area, provided the LUCs prevent groundwater use within the area and monitoring indicates that the conditions within the Waste Management Area are not adversely impacting the surrounding aquifer. Groundwater currently is not used as a drinking water source and there are no plans for such a use in the foreseeable future.

2.9.3 Sediment Alternatives

To address COCs and the associated human health and ecological risks in sediment, a screening of General Response Actions, remedial technologies, and process options was conducted as part of the FS. The technologies and process options retained from the detailed screening were assembled into four remedial alternatives for sediment at Site 8. Consistent with the NCP, the No Action alternative was evaluated as a baseline for comparison with other alternatives during the comparative analysis. Table 2-9 summarizes the major components and provides estimated costs for each of the remedial alternatives developed for Site 8 sediment.

TABLE 2-9. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SEDIMENT

ALTERNATIVE	COMPONENTS	DETAILS	COST	TIME TO CLEANUP
No Further Action (Alternative SD1)	None	No further actions would be taken. Five-year reviews of the no action decision would be required.	**Capital**: $0 **O&M/Monitoring**: $0 **Total 30-Year NPW**: $0	Not Applicable
Selective Sediment Removal and Off-Site Disposal, Enhanced Natural Recovery (ENR) Sediment Cover, LUCs, and Monitoring (Alternative SD2)	Pre-Design Investigation	Additional sampling to verify the depth of sediment to be dredged.	**Capital**: $1,376,000 **O&M/Monitoring**: $18,700 **Total 30-Year NPW**: $1,908,000	1 Year
	Selective Sediment Removal and Off-Site Disposal	Sediment from affected sections of Deerfield Creek would be removed to a depth of 6 inches (approximately 51 cubic yards). The dredged sediment would be dewatered and disposed offsite at a permitted facility. Dredging may be performed using mechanical equipment.		
	ENR Sediment Cover	Six inches of clean, fine-grained material would be placed over the existing pond sediment. The material would create a new sediment barrier (cover) to reduce human and ecological exposure to the underlying contaminated sediments. Approximately 1,548 cubic yards of material would be required to establish the 6-inch sediment cover across the pond.		

TABLE 2-9. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SEDIMENT

ALTERNATIVE	COMPONENTS	DETAILS	COST	TIME TO CLEANUP
		In order to maintain the pond's water volume, an equivalent volume of sediment would be removed from the northern and southern ends of the Pond, where COC concentrations are highest. The dredged sediment would be dewatered and disposed offsite at a permitted facility.		
	LUCs	LUCs would be implemented to ensure that the land use (pond) and site features (fine-grained sediment cover) within designated areas are not changed, and that the sediment cover remains in place.		
	Monitoring and 5-Year Reviews	A management plan would be prepared to provide for the monitoring of the sediment cap integrity and any required maintenance of the pond and dam over time. Five-year reviews would be conducted by the Navy, EPA, and RIDEM until site conditions were restored to allow for unrestricted use and unlimited exposure.		
Selective Sediment Removal and Off-Site Disposal, Pond Sediment Cover, LUCs, and Monitoring (Alternative SD3)	Pre-Design Investigation	Same as Alternative SD2	**<u>Capital</u>**: $2,098,000 **<u>O&M/Monitoring</u>**: $22,000 **<u>Total 30-Year NPW</u>**: $2,703,000	1 Year
	Selective Sediment Removal and Off-Site Disposal	Same as Alternative SD2		
	Pond Sediment Cover	A geotextile liner and 12 inches of clean, fine-grained material would be placed over the existing pond sediment to create a new sediment barrier (cover) to prevent human and ecological exposure to the underlying contaminated sediments. Approximately 10,200 square yards of geotextile would first be placed over the contaminated sediment. The geotextile would then be covered with 6 inches of fine-grained sands or silty sand (approximately 1,550 cubic yards), followed by an additional 6 inches of a fine-grained sand which has a higher organic carbon content to serve as a habitat layer for aquatic organisms. The new cover would include approximately 3,100 cubic yards of material. In order to maintain the pond's water volume, an equivalent volume of sediment would be removed from the northern and southern ends of the Pond, where COC concentrations are highest. The dredged sediment would be dewatered and disposed offsite at a permitted facility.		
	LUCs	Same as Alternative SD2.		

TABLE 2-9. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED FOR SEDIMENT				
ALTERNATIVE	COMPONENTS	DETAILS	COST	TIME TO CLEANUP
	Monitoring and 5-Year Reviews	Same as Alternative SD2.		
Sediment Removal and Off-Site Disposal (Alternative SD4)	Pre-Design Investigation	Same as Alternative SD2.	**Capital**: $2,197,000 **O&M/Monitoring**: $15,500 **Total 30-Year NPW**: $2,293,000	1 Year
	Sediment Removal and Off-Site Disposal	Sediment from affected sections of Deerfield Creek would be removed to a depth of 6 inches (approximately 51 cubic yards). Sediment from NUWC Pond would also be removed to a depth of 2 feet (the currently estimated depth of contamination). An **estimated 6,735 cubic yards of contaminated sediment** from the pond would be removed. The dredged sediment would be dewatered and disposed offsite at a permitted facility. Dredging may be performed using mechanical and/or hydraulic dredging equipment. No backfill or cover would be necessary.		
	LUCs	LUCs will prohibit residential and unrestricted recreational use in areas where residual (post-dredging) lead concentrations in stream sediment exceed the residential RG.		

Notes: Five-year review costs are included under the soil alternatives.
For purposes of cost estimation, all O&M costs represent 30-year timeframes, only. Actual total costs may be higher.

Alternatives SD2 through SD4 could be implemented within 1 year of startup and would attain the RAOs pertaining to sediment upon implementation. The RD and preparation of the construction work plan, LUCs, and long-term management plan would be completed within that year. Construction activities would need to be coordinated with the selected soil remedy and the schedule could be affected by access limitations at this active facility.

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

Tables 2-10 through 2-12 and subsequent text in this section summarize the comparison of the remedial alternatives with respect to the **nine CERCLA evaluation criteria** outlined in the NCP at 40 Code of Federal Regulations (CFR) 300.430(e)(9)(iii) and categorized as threshold, primary balancing, and modifying criteria. Further information on the detailed comparison of remedial alternatives is presented in the Site 8 FS.

2.10.1 Comparative Analysis of Soil Alternatives

Table 2-10 and subsequent text in this section summarize the comparison of the soil remedial alternatives with respect to the nine CERCLA evaluation criteria and categorized as threshold, primary balancing, and modifying criteria. Further information on the detailed comparison of remedial alternatives is presented in the Site 8 FS.

TABLE 2-10. SUMMARY OF COMPARATIVE ANALYSIS OF SOIL ALTERNATIVES

	Alternative SO1	Alternative SO2	Alternative SO3	Alternative SO4
ALTERNATIVE DESCRIPTION/COMPONENTS				
Evaluation Criteria	No Further Action	Excavation, Ex-Situ Treatment, Removal of Anomalies, Offsite Disposal, LUCs, Monitoring	Soil Cover, Selective Excavation and Removal of Anomalies, Offsite Disposal, LUCs, Monitoring	Excavation, Consolidation, Soil Cover, Removal of Anomalies, LUCs, Monitoring
ESTIMATED TIMEFRAMES FOR CLEANUP (YEARS)				
Time to achieve cleanup goals	Not Applicable	2	2	2
***CRITERIA ANALYSIS:* Threshold Criteria – Selected alternative must meet these criteria**				
Overall Protection of Human Health	⃠	●	●	●
Compliance with ARARs	⃠	●	●	●
Primary Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria				
Long-Term Effectiveness and Permanence	⃠	●	●	●
Reduction of Mobility, Toxicity, and Volume of Contaminants through Treatment	⃠	○	⃠	⃠
Short-Term Effectiveness	⃠	○	●	○
Implementability	●	○	●	○
Cost (30-Year Net Present Worth, see Table 2-7)	$118,000	$5,059,000	$2,123,000	$2,464,000
Modifying Criteria – May be used to modify recommended cleanup				
State Agency Acceptance	For State Agency Acceptance, see the text below.			
Community Acceptance	For Community Acceptance, see the text below.			

Notes:

ARARs: Applicable or relevant and appropriate requirements
LUCs: Land Use Controls
O&M: Operation and Maintenance

● Meets
○ Partially Meets
⃠ Does not Meet

Threshold Criteria

Overall Protection of Human Health and the Environment. Alternative SO2 would be the most effective at protecting human health and the environment because most of the contaminated surface soil and debris would be either treated (destroying the organic contaminants) or removed and transported off site for disposal (to reduce metals contamination on site). However, Alternatives SO2, SO3, and SO4 eventually lead to equal measures of onsite protectiveness of human health and the environment, because all three alternatives prevent exposure to the COCs remaining in soil. The cost-benefit for Alternative SO2 needs to be considered, given that the metals-contaminated soil would only be moved for management elsewhere, and the same management practices will still be needed onsite to fully address contamination in subsurface soil. Alternative SO4 would reduce the size of the soil cover area, and thus, the area for which soil LUCs would be required; however, it would not allow the full, unrestricted use of the North Meadow in the short-term, as LUCs would still be required due to the underlying groundwater contamination at the North Meadow. The costs associated with the additional subsurface soil removal to depths of 9 feet bgs in this area need to be weighed against the benefits of the additional excavations, since overall industrial site use is not planned to change.

Alternatives SO2, SO3, and SO4 would include LUCs, which add equal human health protection and prevent exposure to the contaminated soil remaining onsite. In addition, all three Alternatives, SO2, SO3, and SO4, would include groundwater monitoring to ensure long-term performance of the alternatives. Alternative SO1 would not be protective of human health and the environment because contact with the contaminated soil would not be prevented for either human or ecological receptors.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate to the site or remedial action. Alternatives SO2, SO3, and SO4 meet chemical-specific, location-specific, and action-specific ARARs as the implementation of any of these three alternatives would be in accordance with regulations. Alternative SO1 would not comply with ARARs because it does not prevent exposure to contaminated soil/debris containing COC at concentrations greater than RGs.

Alternative SO3 is deemed to be the Least Environmentally Damaging Practicable Alternative to protect wetland resources in accordance with Section 404 of the Clean Water Act, because it involves the least disturbance (least excavation) to the upland areas abutting the wetlands and the adjacent wetland soils.

In accordance with TSCA, the status of residual (low level) PCBs to remain in soil at the site was evaluated. The human health and ecological risk evaluations concluded that leaving PCBs in-place (disposal) at the present concentrations does not pose an unreasonable risk to public health or the environment based on current and proposed future use. The preferred remedy will include the construction of a soil cover, which would provide additional protection to Site receptors. Accordingly and based on the provisions of 40 CFR § 761.61(c), EPA has determined that in-place management of PCBs in soil will not pose an unreasonable risk to public health or the environment.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Alternative SO2 would have the greatest long-term effectiveness, due to removal of the largest volume of contaminated soil/debris from the site. However, Alternatives SO2, SO3, and SO4 utilize the same processes over the long-term to provide the desired long-term effectiveness for subsurface soil (i.e., cover with 2 feet of clean soil, in order to support continued industrial use of the site). Alternative SO1 would not be effective or provide permanent protection from COCs in soil, because no remedial actions would be implemented.

Reduction in Toxicity, Mobility, or Volume Through Treatment. Alternative SO2 provides some reduction of PAHs contaminants, through treatment by LTTD. Treated soil would be reused onsite as clean backfill material. Elevated levels of metals COCs are not addressed in this manner and would instead be disposed offsite. Alternatives SO1, SO3, and SO4 do not include treatment.

Short-Term Effectiveness. Alternative SO1 would have no short-term effects in the sense that the alternative does not involve any major construction activities that would expose construction workers, the surrounding community, or the environment to COCs; however, Alternative SO1 would not meet RAOs. Alternative SO3 has the next fewest short-term effects, because a smaller volume of soil would be handled/removed and then transported through the surrounding community. Alternative SO4 would have more short-term effects, due to the greater potential for worker exposure to COCs in soil during the excavation and consolidation of North Meadow soil; however, compared to Alternative SO2, a lower volume of soil would need to be transported offsite and through the surrounding community. Alternative SO2 has the greatest amount of short-term effects, due to the amount of contaminated soil/debris to which construction workers, the surrounding community, and the environment could be exposed. The timeframes to achieve RAOs under Alternatives SO2, SO3, and SO4 are similar. Finally, in accordance with DoD policy, a “sustainable remediation evaluation” was performed as part of the FS which calculated and compared additional metrics such as greenhouse gas emissions, criteria pollutant emissions, energy usage, water consumption, and worker safety. The evaluation determined that Alternative SO3 was slightly more favorable than Alternative SO4 (particularly with respect to accident risks and air emissions of nitrogen oxides [NOx]). Both Alternatives SO3 and SO4 were more favorable than Alternative SO2 for most of the metrics evaluated.

Implementability. Alternative SO1 would be the easiest to implement in a technical sense because no action is specified; however, it is not implementable in an administrative sense, because it does not achieve the threshold criteria for the protection of human health and the environment and for achieving ARARs. Alternative SO3 would be easier to implement than Alternatives SO2 and SO4, because a smaller volume of contaminated soil/debris would be excavated. Alternative SO4 would be more difficult to implement than Alternative SO2, due to the deeper excavation in the North Meadow, and the greater change in the South Meadow topography following consolidation and final cover completion (side slopes would be more difficult to tie into the topography of the surrounding stream slopes and the Paved Storage Area). Under each of the alternatives, except Alternative SO1, work affecting the Paved Storage Area (i.e., removal of waste anomalies) would have to be coordinated with NUWC operations.

Cost. The estimated, 30-year present worth cost is greatest for Alternative SO2 ($5,059,000). The estimated net present-worth costs for Alternatives SO3 and SO4 are comparable ($2,123,000 and $2,464,000, respectively), but are slightly higher for Alternative SO4.

Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process. RIDEM, as the designated state support agency in Rhode Island, concurs with the Selected Remedy. RIDEM’s concurrence letter is presented in Appendix A.

Community Acceptance. The public was notified of a formal public comment period, as described in Section 2.3, and was encouraged to participate in the process. One written comment letter was received during the formal public comment period (July 16 to August 15, 2012) for the Proposed Plan. The questions posed at the public meeting (informal session) on July 18, 2012 were general inquiries for informational purposes and were addressed at the public meeting. The formal public hearing, at which attendees were asked to state their comments for the record, took place immediately after the public meeting on July 18, 2012. These formal comments/questions and the Navy responses are summarized in Section 3.0. Oral/written comments were made by six people during the public comment period and were generally in support of the selected remedy. No objections to the proposed remedial alternative were voiced. The transcript of the public hearing is provided in the Administrative Record for Site 8.

2.10.2 Comparative Analysis of Groundwater Alternatives

Table 2-11 and subsequent text in this section summarize the comparison of the groundwater remedial alternatives with respect to the nine CERCLA evaluation criteria and categorized as threshold, primary balancing, and modifying criteria. Further information on the detailed comparison of remedial alternatives is presented in the Site 8 FS.

TABLE 2-11. SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES				
	Alternative GW1	Alternative GW2	Alternative GW3	Alternative GW4
ALTERNATIVE DESCRIPTION/COMPONENTS				
Evaluation Criteria	No Action	MNA and LUCs	In-Situ Enhanced Bioremediation, MNA, and LUCs	In-Situ Chemical Oxidation, MNA, and LUCs
ESTIMATED TIMEFRAMES FOR CLEANUP (YEARS)				
Time to achieve cleanup goals	Not Applicable	50 – 70	25 – 50	15 – 45
***CRITERIA ANALYSIS:* Threshold Criteria – Selected alternative must meet these criteria**				
Overall Protection of Human Health	⦸	●	●	●
Compliance with ARARs	⦸	●	●	●
Primary Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria				
Long-Term Effectiveness and Permanence	⦸	●	●	●
Reduction of Mobility, Toxicity, and Volume of Contaminants through Treatment	⦸	⦸ (passive remediation only)	○	○
Short-Term Effectiveness	⦸	○	●	○
Implementability	●	●	○	○
Cost (30-Year Net Present Worth, see Table 2-8)	$0	$1,880,000	$7,104,000	$6,839,000
Modifying Criteria – May be used to modify recommended cleanup				
State Agency Acceptance	For State Agency Acceptance, see the text below.			
Community Acceptance	For Community Acceptance, see the text below.			

Notes:

ARARs: Applicable or relevant and appropriate requirements
LUCs: Land Use Controls
O&M: Operation and Maintenance
MNA: Monitored Natural Attenuation

● Meets
○ Partially Meets
⦸ Does not Meet

Threshold Criteria

Overall Protection of Human Health and the Environment. The no action alternative would not achieve the RAOs and, therefore, would not be protective of human health or the environment. Alternatives GW2, GW3, and GW4 would be protective of human health and the environment, with Alternative GW4 providing the best potential protection, because ISCO would treat the areas with high concentrations of COCs in what may be the shortest amount of time; however, the timeframe for remediation under Alternative GW3 is comparable. Under Alternative GW2, COCs would persist for the longest period of time due to the slower rate of natural attenuation, with no enhancement to address the highest concentrations of COCs present.

The natural attenuation components of Alternatives GW2, GW3, and GW4 would further reduce the residual COC concentrations. This would significantly reduce the potential future risk from exposure to COCs in groundwater. Monitoring under each of these alternatives would be effective in detecting the potential migration of the plume and in monitoring the progress of the remediation. By restricting the use of groundwater, the LUCs would provide equivalent levels of protection of human health until RGs are met.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate to the site or remedial action. Alternatives GW2, GW3, and GW4 would comply with location- and action-specific ARARs and TBCs. Alternative GW4 has the potential to achieve chemical-specific ARARs and TBCs in target treatment zones in a shorter timeframe than GW3. Alternatives GW3 and GW4 would achieve chemical-specific ARARs in a shorter timeframe than Alternative GW2. For areas outside of target treatment zones, compliance would eventually be achieved through natural attenuation under Alternatives GW3 and GW4.

Although Alternative GW1 may eventually meet chemical-specific ARARs through natural attenuation, there would be no monitoring to confirm this. Action-specific ARARs or TBCs do not apply to Alternative GW1.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Alternatives GW3 and GW4 would provide long-term effectiveness and permanence through a combination of in-situ treatment, MNA, and LUCs, whereas Alternative GW2 would provide effectiveness and permanence through MNA and LUCs alone. The treatment technologies involved in Alternative GW3 and GW4 are reliable for the target COCs. Alternative GW2 may be less effective than Alternative GW3 and GW4 because relying only on natural attenuation processes would leave COCs at the site longer in comparison to alternatives involving active treatment. Uncertainties in the current MNA model for determining the remediation timeframes, as identified in the FS, are of less concern under Alternatives GW3 and GW4 than they are under Alternative GW2, given that Alternatives GW3 and GW4 provide active treatment for the highest COC concentrations and only specify MNA for addressing the residual, low-level plume. For all three alternatives, LUCs would be equally effective in preventing exposure to groundwater COCs in the long-term until RGs are met.

Alternative GW1 would not be effective though it might provide protection from contaminants in the long run. Although COC concentrations might eventually decrease to RGs through natural attenuation, no monitoring would be conducted to verify this.

Reduction in Toxicity, Mobility, or Volume Through Treatment. Alternative GW3 and GW4 would achieve the greatest reductions in COC toxicity and volume through active treatment of CVOCs in the most contaminated portions of the plumes. Under Alternative GW3, the short-term partitioning of CVOCs into the applied substrate oil may help to reduce COC mobility within the target treatment zones. Incomplete biodegradation of DCE into vinyl chloride would result in an increase in toxicity; however, system performance will be monitored and adjusted as needed to achieve the degradation of vinyl chloride. Under Alternative GW2, the degradation of vinyl chloride would be achieved through natural attenuation alone. Alternative GW4 is not expected to generate treatment residues of concern. Alternative GW2 provides no reduction through treatment (passive remediation only). Alternative GW1 also provides no reduction through treatment (and any natural attenuation which occurs would not be monitored/verified).

Alternative GW3 would permanently and irreversibly remove an estimated 0.33 pound of COCs (0.001 pound of PCE, 0.08 pound of TCE, 0.003 pound of vinyl chloride, 0.03 pound of 1,1,1-TCA, 0.22 pound of 1,1-DCA, and 0.00001 pound of carbon tetrachloride) and 0.0007 pound of 1,4-dioxane through enhanced bioremediation. Alternative GW4 would permanently and irreversibly remove the same amount of CVOCs through chemical oxidation.

Short-Term Effectiveness. Implementation of Alternative GW1 would have no short-term effects to site workers or the surrounding community and environment because no remedial activities would be performed; however, RAOs would not be achieved under Alternative GW1.

Implementation of Alternatives GW2, GW3, and GW4 would have minor short-term effects related to a slight possibility of exposing site workers to COCs in groundwater during the installation, maintenance, and sampling of new and existing monitoring wells and during active remediation. Of these, Alternative GW2 would have the fewest lowest short-term effects, with the potential for exposure only during monitoring well installation and groundwater sampling. Alternatives GW3 and GW4 would result in approximately the same level of short-term effects, with increased potential exposure during installation of injection points. During Alternative GW4, workers would also be required to handle strongly oxidizing (hazardous) chemicals. Under Alternative GW4, the risk of exposure to oxidizers would need to be controlled by wearing appropriate PPE and working in compliance with proper site-specific health and safety procedures. Extra care would also be needed when using oxidizers around the occupied buildings and active storage areas at Site 8. The nutrient substrate to be used under Alternative GW3 is non-hazardous. Implementation of Alternatives GW2, GW3, and GW4 would not adversely impact the surrounding community; however, because of the introductions of nutrient substrates or chemical oxidants into groundwater under Alternatives GW3 and GW4, respectively, precautions not to impact nearby wetlands and NUWC Pond would be required (i.e., through exposure to potentially damaging oxidants under Alternative GW4 or to high nutrient concentrations under Alternative GW3).

Alternatives GW2, GW3, and GW4 would achieve the groundwater RAO immediately upon implementation of LUCs and monitoring. Construction activities associated with Alternatives GW3 and GW4 would be completed in approximately three months. However, after active treatment, additional time would be required to meet the RGs via natural attenuation. For Alternative GW3, it is estimated that RGs for CVOCs would be achieved in 25 to 35 years in the North Meadow plume and in 15 to 20 years in the South Meadow plumes. For Alternative GW4, it is estimated that RGs for CVOCs would be achieved in 5 to 30 years in the North Meadow plume and in 5 to 25 years in the South Meadow plumes. For Alternative GW2, it is estimated that RGs for CVOCs would be achieved in 35 to 45 years in the North Meadow plume and in 40 to 50 years in the South Meadow plumes. Additional, equivalent timeframes (estimated as requiring up to 15 years) would be required for the attenuation of metals concentrations in groundwater following remediation of the CVOC plumes under each of the alternatives.

Finally, in accordance with DoD policy, a "**sustainable remediation evaluation**" was performed as part of the FS which calculated and compared additional metrics such as greenhouse gas emissions, criteria pollutant emissions, energy usage, water consumption, and worker safety. The evaluation determined that Alternative GW2 would have the smallest environmental "footprint", given that only monitoring is specified. Of the treatment alternatives, Alternative GW3 was found to be more favorable than Alternative GW4, particularly with respect to most of the evaluated metrics (e.g., fewer greenhouse gas emissions, less energy used, lower particulate emissions, and lower accident risks).

Implementability. Alternative GW1 would be easiest to implement in a technical sense because no action would be required; however, this alternative would not be implementable in an administrative sense because it does not achieve the threshold criteria for the protection of human health and the environment and for achieving ARARs

Of the remaining three alternatives, Alternative GW2 would be the easiest to implement because of the minimal construction effort (e.g., potential new monitoring wells) and the ease of conducting a long-term monitoring program. Technical implementation of the various components of Alternatives GW3 and GW4 would be feasible, although handling of the oxidizing agent in Alternative GW4 would add to the difficulty of implementation. For all three alternatives, contractors and equipment are readily available. However, under Alternatives GW3 and GW4, there is uncertainty associated with the distribution of chemicals injected into the bedrock because of the heterogeneity in bedrock fractures. Administrative, management, and operational issues and coordination with other agencies are achievable for Alternatives GW2, GW3, and GW4, although these issues and coordination would be easiest under Alternative GW2, because this alternative does not include injections of chemicals/substrates into groundwater. Due to the active operations at the Paved Storage Area, the Building 185 Complex, and the Building 179 Area, the notification of and coordination with NUWC operations would be required for all steps of any remedial action (e.g., installation and operation of injection wells). Potential future remedial actions at the site, if necessary, would not be hindered by the identified alternatives.

Cost. The estimated, 30-year net present-worth cost is greatest for Alternative GW3, $7,104,000, which is comparable to the estimated cost of Alternative GW4 ($6,839,000). The estimated cost to implement Alternative GW2 is the lowest ($1,880,000), except for Alternative GW1 which would only require 5-year reviews.

Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process. RIDEM, as the designated state support agency in Rhode Island, concurs with the Selected Remedy. RIDEM's concurrence letter is presented in Appendix A.

Community Acceptance. The public was notified of a formal public comment period, as described in Section 2.3, and was encouraged to participate in the process. One written comment letter was received during the formal public comment period (July 16 to August 15, 2012) for the Proposed Plan. The questions posed at the public meeting (informal session) on July 18, 2012 were general inquiries for informational purposes and were addressed at the public meeting. The formal public hearing, at which attendees were asked to state their comments for the record, took place immediately after the public meeting on July 18, 2012. These formal comments/questions and the Navy responses are summarized in Section 3.0. Oral/written comments were made by six people during the public comment period and were generally in support of the selected remedy. No objections to the proposed remedial alternative were voiced. The transcript of the public hearing is provided in the Administrative Record for Site 8.

2.10.3 Comparative Analysis of Sediment Alternatives

Table 2-12 and subsequent text in this section summarize the comparison of the sediment remedial alternatives with respect to the nine CERCLA evaluation criteria and categorized as threshold, primary balancing, and modifying criteria. Further information on the detailed comparison of remedial alternatives is presented in the Site 8 FS.

TABLE 2-12. SUMMARY OF COMPARATIVE ANALYSIS OF SEDIMENT ALTERNATIVES				
	Alternative SD1	Alternative SD2	Alternative SD3	Alternative SD4
ALTERNATIVE DESCRIPTION/COMPONENTS				
Evaluation Criteria	No Action	Selective Sediment Removal and Offsite Disposal, Enhanced Natural Recovery of Pond Sediment, LUCs, Monitoring	Selective Sediment Removal and Offsite Disposal, Pond Sediment Cover, LUCs, Monitoring	Sediment Removal and Offsite Disposal
ESTIMATED TIMEFRAMES FOR CLEANUP (YEARS)				
Time to achieve cleanup goals	Not Applicable	1	1	1
***CRITERIA ANALYSIS:* Threshold Criteria – Selected alternative must meet these criteria**				
Overall Protection of Human Health	⊘	●	●	●
Compliance with ARARs	⊘	●	●	●
Primary Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria				
Long-Term Effectiveness and Permanence	⊘	○	○	●
Reduction of Mobility, Toxicity, and Volume of Contaminants through Treatment	⊘	○	○	○
Short-Term Effectiveness	⊘	○	○	○
Implementability	●	●	●	●
Cost (30-Year Net Present Worth, see Table 2-9)	$0	$1,908,000	$2,703,000	$2,293,000
Modifying Criteria – May be used to modify recommended cleanup				
State Agency Acceptance	For State Agency Acceptance, see the text below.			
Community Acceptance	For Community Acceptance, see the text below.			

Notes

ARARs: Applicable or relevant and appropriate requirements
LUCs: Land Use Controls
O&M: Operation and Maintenance

● Meets
○ Partially Meets
⊘ Does not Meet

Threshold Criteria

Overall Protection of Human Health and the Environment. The no action alternative would not achieve the RAOs and therefore does not protect human health or the environment. No excess human health risks were identified for pond sediment. Potential human health risks and ecological risks associated with exposure to COCs in stream sediment would be equally addressed under Alternatives SD2, SD3, and SD4, through removal and offsite disposal (and LUCs to prevent residential/unrestricted recreational exposure to remaining lead in stream sediment at concentrations above the residential RG). Alternative SD4 would be the most effective at protecting potential ecological receptors from the COCs present in pond sediment because the contaminated sediment would be removed from the site and transported offsite for disposal. Alternatives SD2, SD3, and SD4 would damage the existing sediment ecosystem for the purpose of addressing COCs; however, repopulation of the flora and fauna in the area is expected from upstream influences (wetlands, streams). At completion, Alternative SD3 would be slightly more protective than Alternative SD2, due to the greater thickness of the new sediment barrier; however, both Alternatives SD2 and SD3 provide adequate protection for ecological receptors. Alternatives SD2 and SD3 would include sediment monitoring to ensure long-term performance of the remedies.

Compliance with ARARs. ARARs include any federal or state standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate to the site or remedial action. Alternatives SD2, SD3, and SD4 meet chemical-specific, location-specific, and action-specific ARARs. Implementation of any of these three alternatives would be in accordance with regulations. Alternative SD1 would not comply with ARARs because it does not prevent exposure to sediment associated with excess risk to ecological receptors.

In accordance with Section 404 of the Clean Water Act, the Navy believes that Alternative SD4 would be the Least Environmentally Damaging Practicable Alternative to protect wetland resources in the long-term because it provides the best balance of addressing contaminated sediment within and adjacent to wetlands and waterways, and minimizes both temporary and permanent alteration of wetlands and aquatic habitats on site. Although each of the Alternatives SD2, SD3, and SD4 would impact the wetland and pond areas during cleanup activities, Alternative SD4 would permanently remove COCs in sediment, which would be of long-term benefit to the restored wetland area. Alternative SD4 would also increase the water volume capacity of NUWC Pond, which would benefit the recovery of aquatic life in the pond.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence. Alternative SD4 would have the highest long-term effectiveness and permanence due to the complete removal of contaminated sediment from the site. Alternative SD4 also does not rely on long-term maintenance of the NUWC Pond dam, as would be required under Alternatives SD2 and SD3 as part of the needed containment of sediment under these alternatives. Alternative SD3 would provide slightly more long-term effectiveness than Alternative SD2, because it provides a thicker sediment cover upon implementation. A thinner sediment cover would be more susceptible to erosion and biological disturbance and could require more maintenance over time. Alternative SD1 would not be effective in the long-term nor would it provide permanent protection from risks associated with sediment.

Reduction in Toxicity, Mobility, or Volume Through Treatment. Only partial treatment/volume reduction of dredged pond sediment would occur under Alternatives SD2, SD3, and SD4. Water generated from the dewatering process would be treated (filtered) prior to discharging back to NUWC Pond. The dewatering process is expected to be supplemented using filtration bags and an absorbent agent. For costing purposes, it is assumed that sediment will be allowed to dewater for two weeks within the sediment bags prior to offsite transportation and disposal. In addition, sodium polyacrylate (absorbent polymer) will be added to each truck at a rate of 100 pounds per truck to absorb any additional free water generated during transportation to the landfill. Alternative SD4 would treat the greatest volume of pond sediment. Alternative SD3 would treat a larger volume of sediment than Alternative SD2, and there would be no treatment of sediment under Alternative SD1.

Short-Term Effectiveness. Alternative SD1 would have no short-term effects because the alternative involves no major construction activities that would expose construction workers, the surrounding community, or the environment to COCs, nor would it damage the existing ecosystem; however, Alternative SD1 would not achieve RAOs. Alternative SD4 would have the most short-term effects because this alternative includes the greatest potential exposure to COCs in sediments during remediation, causes the most sediment re-suspension within NUWC Pond, and causes the greatest short-term impact to the existing ecosystem. Alternative SD2 has a slight advantage in short-term effectiveness over Alternative SD3. Although both of these alternatives include the same amount of contaminant handling, Alternative SD3 includes more truck traffic through the surrounding area, causing more risk to the public and site workers. Alternative SD3 also includes the installation of a geotextile liner over the pond sediment, which would have more of an adverse impact on the existing benthic organisms than would a gradually-applied sand cover; however, benthic organisms would repopulate naturally over time in either case.

Finally, in accordance with DoD policy, a "sustainable remediation evaluation" was performed as part of the FS which calculated and compared additional metrics such as greenhouse gas emissions, criteria pollutant emissions, energy usage, water consumption, and worker safety. The evaluation determined that Alternative SD2 would have the smallest environmental "footprint", given that it involves the smallest volumes of sediment to be handled. Alternative SD3 scored slightly better than Alternative SD4, also due to the smaller volumes of sediment to be handled (e.g., fewer air emissions of particulates and sulfur oxides [SOx]).

Implementability. Alternative SD1 would be the easiest to implement because no action is required. Alternatives SD2 and SD3 would include the same processes, but Alternative SD2 would be more easily implemented due to the simpler components of the sediment cover layer and the smaller volume of material to be handled. Alternative SD4 would be the most difficult to implement due to the processes required, the space needed to implement the alternative (e.g., for the staging and dewatering of dredged sediment), and the amount of site restoration that would be required. Alternatives SD2, SD3, and SD4 would each have difficulties associated with accessing all pond and stream areas, due to the site topography (steep side slopes) and the presence of exposed bedrock along some portions of the stream.

Cost. The estimated, 30-year net present-worth cost is greatest for Alternative SD3 ($2,703,000). The estimated cost is lowest to implement Alternative SD2 ($1,908,000) and in the mid-range to implement Alternative SD4 ($2,293,000).

Modifying Criteria

State Acceptance. State involvement has been solicited throughout the CERCLA process. RIDEM, as the designated state support agency in Rhode Island, concurs with the Selected Remedy. RIDEM's concurrence letter is presented in Appendix A.

Community Acceptance. The public was notified of a formal public comment period, as described in Section 2.3, and was encouraged to participate in the process. One written comment letter was received during the formal public comment period (July 16 to August 15, 2012) for the Proposed Plan. The questions posed at the public meeting (informal session) on July 18, 2012 were general inquiries for informational purposes and were addressed at the public meeting. The formal public hearing, at which attendees were asked to state their comments for the record, took place immediately after the public meeting on July 18, 2012. These formal comments/questions and the Navy responses are summarized in Section 3.0. Oral/written comments were made by six people during the public comment period and were generally in support of the selected remedy. No objections to the proposed remedial alternative were voiced. The transcript of the public hearing is provided in the Administrative Record for Site 8.

2.11 PRINCIPAL THREAT WASTE

The NCP at 40 CFR 300.430(a)(1)(iii)(A) establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or that would present a significant risk to human health or the environment should exposure occur. A source material is a material that includes or contains hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air, or acts as a source for direct exposure. At Site 8, the contaminant concentrations are not highly toxic or highly mobile; therefore, principal threat wastes are not present at the site.

2.12 SELECTED REMEDY

2.12.1 Rationale for Selected Remedy

The Selected Remedy for Site 8 is a combination of soil Alternative SO3, groundwater Alternatives GW3/GW4, and sediment Alternative SD4. This includes selective excavation with offsite disposal and a soil cover for site soil; in-situ treatment of the most contaminated portions of groundwater using either enhanced bioremediation or chemical oxidation (as to be determined through pre-design studies) with MNA of the residual groundwater plume; dredging and offsite disposal of contaminated sediment; long-term monitoring of groundwater; and LUCs. Additional investigations will be performed as part of the RD phase to further examine soil and sediment contamination and to help determine the design parameters for the groundwater remedy. This combination of alternatives was selected because it provides the best balance with respect to the nine evaluation criteria and will allow for continued industrial use of the property.

The principal factors in the selection of this remedy included the following:

- The remedy is protective of human health and the environment and will comply with all pertinent federal and state regulations.

- The remedy is consistent with current and reasonably anticipated future site uses (industrial) and groundwater classifications (potential drinking water source area).

- The proposed soil Alternative SO3 includes selective excavation, and construction of a 2-foot-thick soil cover in the North and South Meadows. Alternative SO3 is preferred because it is the most implementable and cost-effective option for addressing the identified risks and it is consistent with the continued industrial use of the site. Some of the debris buried in site soil may be contributing to groundwater contamination; therefore, the removal of such debris will help to expedite the groundwater remedy. Additional excavation of the Buried Container Area will remove the likely source of lead contamination to stream sediment. The asphalt cover of the Waste Management Area and the soil cover constructed in the other areas of the site will be maintained over time. LUCs and monitoring will ensure the continued protection of human health and the environment.

- The proposed sediment Alternative SD4 includes removal and offsite disposal of contaminated sediment exceeding ecological RGs from Deerfield Creek and from the NUWC Pond. Sediment removal in Deerfield Creek also will achieve the industrial RG for the protection of human health. This is the preferred alternative because dredging of the pond and stream will mitigate the unacceptable ecological risks and render those areas suitable for continued industrial site use. This restoration will allow the ecological community to reestablish itself, with no need for long-term maintenance of a sediment cover system, which would be subject to deterioration over time.

- Active groundwater remediation is needed in the most contaminated portions of the plume, to complete the overall site remediation within a reasonable timeframe. The proposed groundwater remedy includes in-situ treatment of the highest VOC concentrations in the groundwater plume located outside of the compliance boundary established for the Waste Management Area (i.e., Paved

Storage Area). In-situ treatment will consist of either enhanced bioremediation (Alternative GW3) or a combination of Alternative GW3 and Alternative GW4 (ISCO). In general, bioremediation is preferred, as it is a more implementable and environmentally-friendly approach for treating the moderate contaminant concentrations present in Site 8 groundwater. However, the conditions in different portions of the plume may warrant different remedial approaches; therefore, either bioremediation or chemical oxidation, or a combination of the two, will be used, as to be determined based on the results of additional bench-scale studies which will be conducted during the RD phase.

- Following active treatment of the groundwater target treatment zones located outside of the compliance boundary for the Waste Management Area, the residual, low-level COC concentrations would be mitigated via MNA. The available site data indicate that MNA is already occurring to some degree, especially in the southern portion of Site 8. If selected, implementing bioremediation will promote the desired groundwater conditions (geochemistry) to support subsequent MNA. Bioremediation will create reducing conditions that promote the breakdown of chlorinated solvents within the aquifer. Upon completion of active bioremediation, those conditions will persist for a time, and enhance the continued natural attenuation of the residual VOC plume. Once the VOC plume is sufficiently remediated and the aquifer geochemistry is restored to more aerobic conditions, it is expected that metals concentrations in groundwater will also attenuate to background levels.

- Implementing LUCs will ensure continued protection of human health by preventing the use of groundwater until cleanup goals are achieved in the area outside of the compliance boundary for the Waste Management Area. Within the compliance boundary of the Waste Management Area, the groundwater LUCs will be maintained for as long as conditions therein are not suitable for unrestricted use and unlimited exposure. Groundwater currently is not used as a drinking water source and there are no plans for such a use in the future. The LUCs will also ensure the continued protection of human health and the environment by prohibiting future use scenarios associated with unacceptable risks (residential, recreational) and by establishing requirements for the upkeep and maintenance of the soil cover and Waste Management Area.

- In accordance with Section 404 of the Clean Water Act, the Navy has determined that the combination of Alternatives SD4/SO3/GW3/GW4 is the Least Environmentally Damaging Practicable Alternative to protect wetland resources because it provides the best balance of addressing contaminated sediment and soil within and adjacent to wetlands and waterways with minimizing both temporary and permanent alteration of wetlands and aquatic habitats on site. Although each of the sediment cleanup options would impact the wetland and pond areas during cleanup activities, Alternative SD4 will permanently remove COCs in sediment, which will be of long-term benefit to the restored wetland area. Alternative SD4 will also increase the water volume capacity of NUWC Pond, which will benefit the recovery of aquatic life in the pond. Alternative SO3 involves the least disturbance (least excavation) to the upland areas abutting the wetlands and the adjacent wetland soils.

2.12.2 Description of Selected Remedies

The following sections provide a detailed description of the selected remedies for soil, groundwater, and sediment.

2.12.2.1 Description of Selected Soil Remedy

The Selected Soil Remedy, Alternative SO3, includes the following components, described below:

- Selective excavation and off-site disposal of soil and waste anomalies (with verification sampling)
- Construction of a 2-foot soil cover
- LUCs
- Monitoring

Alternative SO3 would render the site suitable for the planned continued industrial use.

Selective Excavation and Removal of Anomalies

The Navy will conduct selective soil excavation in the following areas:

- Within the Paved Storage Area, excavation will be limited to several areas where geophysical anomalies, believed to be buried waste materials, were measured, as shown on Figure 2-7. These limited excavation areas in the Paved Storage Area will then be backfilled and repaved. Excavation would continue to the depth necessary to remove the materials associated with the anomaly. The Paved Storage Area will then be managed as a Waste Management Area which uses the existing asphalt pavement as a means to contain and prevent exposure to COCs in the underlying soil. LUCs would be implemented to maintain the pavement in the future. A long-term groundwater monitoring program would be conducted at the pavement perimeter to verify that COC migration is not occurring. During the RI, a complete geophysical survey of the Paved Storage Area was not possible, due to the active use of the area. Therefore, if the use of the Paved Storage Area were to change in the future, including transfer of the property outside the Navy, or if the Paved Storage Area becomes inactive, the Navy would complete follow-on geophysical investigations in that area and would remove subsurface debris, as necessary.

- Known remaining **buried drum fragments** in the South Meadow (RI test pit locations TP-103 and TP-105).

- Remaining buried canisters in the Buried Container Area (including sample location SB106, where lead was detected at 4,650 mg/kg at a depth of 6 to 8 feet bgs).

- Isolated locations to the west of Deerfield Creek and NUWC Pond or south of the main site area (sample locations DA-SB142, DA-SB145, DA-SB146, DA-SB153, B179-SB1/2/3, DA-SS149).

- Selected areas in the South Meadow where benzo(a)pyrene and/or naphthalene concentrations **exceeded RIDEM's Soil Leachability Criteria** (sample locations DA-TP15A, DA-SB110, DA-SB127, and DA-TP08). RIDEM's Leachability Criteria for metals are based on TCLP/SPLP analyses, which are not currently available for Site 8. Therefore, during the RD/RA phase, the Navy will collect soil samples from remaining area(s) with the highest concentrations of metals COCs (e.g., sample location B110B, where lead was detected at 4,540 mg/kg at a depth of 10 to 12 feet bgs). These samples would be analyzed for metals and SPLP-metals. If the results do not exceed RIDEM's Leachability Criteria, then it will be concluded that no further action regarding leachability will be required. If the results exceed Leachability Criteria, the soils from those location(s) would be excavated (i.e., hot spot removal) as part of the overall RA.

It is estimated that a total of 558 cubic yards of soil/debris would be excavated, temporarily staged on site, and disposed offsite at a licensed facility. After completion of selective excavation, the areas would be backfilled to restore prior surface elevations, using clean fill and/or treated soil, followed by 6 inches of topsoil that would be seeded for revegetation (or repaved, if within the Paved Storage Area). The excavations would be performed in a sequence that would allow for continued access to the surrounding operational buildings.

There are four sampling locations where soil TPH concentrations exceed RIDEM's Industrial DEC of 2,500 mg/kg: TP-15A, from 2 to 3 feet bgs (50,000 mg/kg), TP-15A, from 5 to 6 feet bgs (63,000 mg/kg), SB-110, from 8 to 10 feet bgs (12,000 mg/kg), and SB-121, from 4 to 6 feet bgs (2,800 mg/kg). Although TPH is not a CERCLA-regulated contaminant, the remedial alternative would address RIDEM's regulations for these TPH locations, through excavation or capping (excavation of TP-15A[1] and SB-110 due to leachability criteria, and capping of SB-121 in the South Meadow). Compliance with RIDEM TPH criteria would be demonstrated through confirmatory (verification) sampling. Any remaining site locations

[1] Excavation of location TP-15A also addresses RIDEM's Upper Concentration Limit for TPH in soil (30,000 mg/kg).

containing TPH above RIDEM's Residential DEC of 500 mg/kg, would be addressed by the LUCs (see below) prohibiting residential/recreational site use.

Verification Sampling

Verification samples for laboratory analysis would be collected from the sidewalls of the excavation areas and results would be compared to industrial RGs to verify that the proper extent of contaminated soil has been removed. Samples would also be tested for TPH to satisfy state requirements. If the results exceed RGs, the excavation would continue in the direction of the exceedence until subsequent verification samples meet RGs, or until the site boundary or other limiting site feature is reached. Verification samples would also be collected from the bottom and sidewalls of selective excavation areas listed above. Sampling of soil in areas of removed debris (anomalies) within the Paved Storage Area would not be used to verify COC removal (i.e., excavation areas would not be expanded beyond the targeted area), rather this sampling would be conducted for informational purposes regarding the status of any potential contamination being left and covered in-place under pavement). The Navy would develop a SAP for the verification sampling that would identify the frequency of verification sample collection.

Soil Cover

As shown on Figure 2-7, a soil cover system will be constructed east of the NUWC Pond and Deerfield Creek, over the identified limits of unpaved soils where COC concentrations are greater than the identified industrial RGs. The cover would be constructed to prevent contact with contaminated soil/debris and to prevent exposure, erosion and transport (to the stream/pond) of soil containing COCs at levels exceeding industrial RGs. The soil cover thickness will be 2 feet and will include 18 inches of common fill and 6 inches of topsoil. The soil cover would be vegetated upon completion of its construction. Portions of the cover closest to the streams will likely need to be armored to resist the occasional erosive forces associated with Deerfield Creek and the unnamed stream. Armoring may be achieved by replacing the 2-foot-thick soil cover with 2 feet of armor stone cover, mainly along sloped areas. Based on the proposed location and construction, the soil cover will consist of 8,300 cubic yards of common fill, 2,800 cubic yards of topsoil, and 2,500 cubic yards of armor stone (average stone size, 6 inches). Following site restoration to the proper grade, the soil would be seeded and maintained to prevent future erosion. Any wetland areas impacted by the remedy would also be restored.

The soil cover will not be constructed over the Paved Storage Area. Instead, the existing asphalt pavement will be maintained, and the Paved Storage Area would be handled as a Waste Management Area, as described above.

FIGURE 2-7. SOIL REMEDY

<u>Monitoring</u>

Because a portion of the site would be operated as a Waste Management Area, groundwater monitoring will be performed at the compliance boundary (edge of the Waste Management Area) to verify that COCs are not migrating from that area. The monitoring program for the Waste Management Area and overall soil cover will be included as part of the overall site groundwater monitoring program.

<u>LUCs and 5-Year Reviews</u>

See Sections 2.12.2.4 and 2.12.2.5.

2.12.2.2 Description of Selected Groundwater Remedy

The Selected Groundwater Remedy, Alternative GW3 or GW4, includes the following components, described below:

- In-situ treatment of the most contaminated portions of groundwater using either enhanced bioremediation or chemical oxidation, as to be determined through pre-design studies.
- MNA.
- LUCs.

In-situ Treatment

Active groundwater remediation is needed in the most contaminated portions of the plume, to complete the overall site remediation within a reasonable timeframe. The extent of the plumes is shown in Figure 2-8. Groundwater treatment will be conducted in targeted areas located outside of the compliance boundary established for the Waste Management Area (groundwater within that compliance boundary will be addressed through LUCs and monitoring).

In-situ treatment will consist of either enhanced bioremediation (Alternative GW3) or a combination of Alternative GW3 and Alternative GW4 ISCO. The conditions in different portions of the plume may warrant different remedial approaches; therefore, either bioremediation or chemical oxidation will be used, as to be determined based on the results of additional bench-scale studies conducted during the RD phase. For example, bioremediation could be selected for the entire plume, or it could be used only for the southern portion of the site, while chemical oxidation would be applied in the northern portion of the site. The design studies will likely include hydraulic testing of the aquifer to determine the best method for injecting the biological or chemical amendments.

Alternative GW3 involves the introduction of specific biological amendments, such as a carbon substrate (e.g., emulsified vegetable oil) into the most contaminated portions of the plumes to stimulate the reductive dechlorination of CVOCs in groundwater by naturally occurring microorganisms. Anaerobic reductive dechlorination (ARD) is the primary biological degradation process by which CVOCs are transformed to innocuous compounds such as carbon dioxide, ethene, ethane, and chloride. In the presence of a suitable electron donor (e.g., hydrogen), the appropriate microbial consortia, and favorable geochemical conditions, a hydrogen atom can replace a chlorine atom on a chlorinated ethene molecule. This rigorously studied microbial process occurs under anaerobic conditions. Hydrogen is typically generated when organic carbon is fermented. This organic carbon supply can come from natural organic carbon, anthropogenic carbon such as hydrocarbon contaminants, or applied/injected carbon substrates. In the presence of hydrogen, CVOCs such as TCE can be reduced to DCE. DCE is then reduced to vinyl chloride, which, in turn, can be reduced to ethene and ethane, or via mineralization, to carbon dioxide, water, and chloride. ARD will be promoted as the primary biological degradation process to treat the Site 8 organic COCs. Previous investigations indicated that biological reductive dechlorination is working to some degree at the site but the degree and consistency of the degradation was variable and limited. Therefore, with sufficient electron donor addition, in-situ bioremediation is anticipated to be successful at this site. Various carbon substrates are available for use. Carbon substrates fall into two general categories: soluble and slow-release electron donors:

- Soluble electron donor substrates include lactate, ethanol, and other short-chain hydrocarbons. These materials dissolve in water and are typically used quickly by the microorganisms. An advantage of soluble electron donors is that delivery and distribution are more easily achieved in a heterogeneous environment and the application from a given point can cover a larger area than with slow release electron donors. These two advantages are expected to be helpful at this site due to its varied geologic environment. The disadvantage of soluble electron donors is that they are generally consumed within 3 to 6 months.

- Slow release electron donors include hydrogen releasing compounds, vegetable oil, and chitin. These compounds slowly release fatty acids into the groundwater which in turn are metabolized and utilized by microbes for ARD. Many of these substrates persist for months or years before being exhausted. Emulsified vegetable oils are available commercially that have been engineered to exhibit enhanced transport properties while slowly releasing carbon. An added benefit of these oils is that they can preferentially partition CVOCs from the dissolved phase into the oil.

Soluble substrates and nutrients (e.g., lactate, yeast extract, vitamins) can be added as needed to the mixture prior to injection to stimulate rapid growth of desired bacteria. Microbe additions (bioaugmentation) can also be added as needed to promote the reductive dechlorination of CVOCs.

Alternative GW4 involves the introduction of a chemical oxidant into the most contaminated portions of the plumes rather than the carbon substrate specified under Alternative GW3. Oxidants that are expected to be effective for the COCs present at Site 8 include sodium or potassium permanganate, sodium persulfate, or Fenton's Reagent (a mix of hydrogen peroxide and an iron catalyst). The chemical oxidant to be used would be selected during the RD phase.

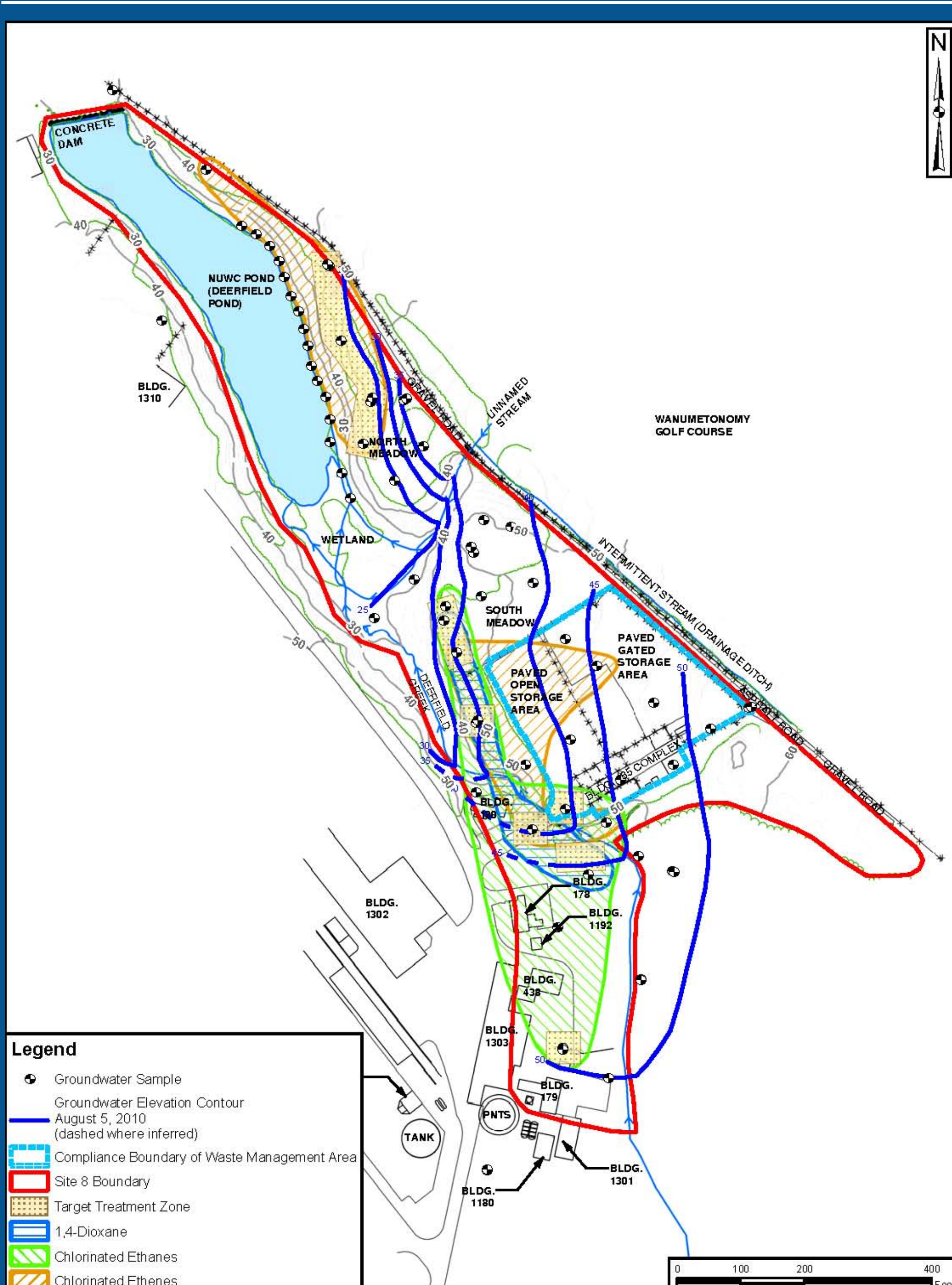
In general, bioremediation is preferred, as it is a more implementable and environmentally-friendly approach for treating the moderate contaminant concentrations present in Site 8 groundwater. However, for reducing COC concentrations, bioremediation would be somewhat slower than chemical oxidation and it would also be more sensitive to the site geochemistry, with respect to controlling microbial activity. Although effective, chemical oxidation technologies may present more risks to site workers and more concerns for facility operations due to the use of large volumes of the chemical oxidants. The chemical oxidants may also present more risks to the nearby pond and wetland ecosystem if some of the injected oxidants were to discharge to those areas along with the natural discharge of groundwater. Such risks would need to be managed through coordination with site workers at NUWC, system performance monitoring, and other engineering controls during remedy implementation.

In either case, the aquifer amendment (biological or chemical) will be introduced into the groundwater plume through a series of wells which can include recirculation systems or injection-only systems. For injection-only systems, two basic configurations, barriers or area treatment, are usually considered. Barriers would consist of rows of injection points placed across a plume perpendicular to the direction of groundwater flow so that the plume can be treated as it migrates through the emulsion treated zone. Area treatments would consist of grids or multiple rows of injection points in areas of interest to treat both mobile dissolved contaminants and relatively immobile sorbed/residual contaminants. Plume conditions will be monitored over time and additional amendments will be added, as needed, to complete the process.

A conceptual design was presented in the FS, which assumed that multiple injection points would be used to introduce the biological or chemical amendment to the bedrock aquifer; however, the specific injection methodology, as well as the specific type of amendment to be used, will be further evaluated during the RD phase. Additional investigations during the RD will aid in determination of application strategy(s), optimum amendment type(s) and dosage(s), the achievable amendment distribution in the various rock matrices, and whether bioaugmentation or other water quality adjustments are warranted. These pre-design investigations would include bench-scale studies (e.g., microcosm tests) and aquifer hydraulic (pumping) tests. The hydraulic test will be performed in a location that is representative of the heterogeneous conditions in the fractured bedrock aquifer, to confirm the appropriate well spacing and application rate, under the anticipated typical conditions that may be encountered. Supplemented with the understanding of the bedrock fracture characteristics across the site, and by adding necessary safety factors into design parameters, the RD would be able to account for uncertainties in the heterogeneity of the fractured bedrock aquifer.

Active remediation via bioremediation may temporarily increase the mobilization of the metal COCs from site soil to groundwater, as a result of the change in pH and redox conditions during the reductive dechlorination of CVOCs. Similarly, remediation via chemical oxidation could mobilize metal contaminants due to changes in oxidization states of the metals, degradation of metal-binding natural organic matter, or addition of acids, chelators, or stabilizers to enhance the activation of the chemical oxidant. However, it is expected that such increases in metals concentrations in groundwater would be temporary and subsequently be attenuated over time, via adsorption or (co)precipitation.

FIGURE 2-8. GROUNDWATER REMEDY



Monitored Natural Attenuation

In the untreated portions of the plumes in areas outside of the compliance boundary of the Waste Management Area, and as a polishing step to follow-up active remediation of the target treatment zones, MNA would be implemented in accordance with the OSWER Directive, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, 1999), and other MNA guidance documents.

Natural attenuation would rely on naturally-occurring processes within the aquifer to reduce the mass, toxicity, volume, or concentration of COCs in groundwater. The concentrations of CVOCs, which are the predominant COCs in groundwater at the site, would be reduced through a variety of biological (e.g., reductive dechlorination, aerobic oxidation, anaerobic oxidation, aerobic co-metabolism), physical (e.g., advection, dilution, dispersion, diffusion, etc.), and chemical (e.g., abiotic degradation) processes. The most important mechanism for the natural biodegradation of CVOCs is anaerobic reductive dechlorination. Optimal conditions for reductive dechlorination are created when sufficient carbon sources are present for microorganisms to use up the available oxygen. Once the oxygen is depleted, the microorganisms must use other electron acceptors (e.g., Mn^{4+}, SO_4^{2-}, NO_3^-, and Fe^{3+}) to metabolize the carbon. If enough carbon, suitable organisms, and the proper geochemical conditions are present, the aquifer would become depleted of these electron acceptors and conditions would become suitable for methanogenic bacteria to use CO_2 as the electron acceptor (producing methane in the process). These conditions are also optimal for the CVOCs to serve as electron acceptors, resulting in degradation of the CVOCs via reductive dechlorination.

Less-oxidized CVOCs, such as vinyl chloride, do not readily serve as electron acceptors and may degrade only slowly under anaerobic conditions via reductive dechlorination. If conditions are sufficient to promote reductive dechlorination of the more highly substituted CVOCs, and anaerobic conditions persist along the entire length of the plume, vinyl chloride may accumulate. However, vinyl chloride can also be removed from the plume via aerobic degradation where it can be used as a primary substrate and serve as an electron donor. Thus, optimal CVOC degradation can occur at sites where conditions change from strongly reducing to aerobic along the axis of the plume.

Modeling of the **predicted MNA timeframes** was performed using BIOCHLOR in the FS. With enhanced bioremediation followed by MNA as a polishing step, it is estimated that RGs for CVOCs would be achieved in 25 to 35 years in the North Meadow plume, and in 15 to 20 years in the South Meadow plumes. Some uncertainty is associated with the predicted timeframes for remediation, given the limited historical data set for groundwater contaminant levels and geochemical indicator parameters (e.g., electron acceptor concentrations, ORP, DO, etc.), as well as the need to use some literature-based values in the model's calculations, instead of site-specific values (e.g., fraction of organic carbon present in the aquifer matrix). The Navy will continue to update attenuation-rate models as more groundwater data are collected over time. As described for MNA under Alternative GW2, the attenuation of inorganic (metals) COCs would proceed following the cleanup of the organic (CVOC) plumes. The additional time required to achieve the attenuation of metals after the remediation of the CVOC plume was estimated to require up to 15 years in the FS, based on the expected replenishment rate from upgradient groundwater; however, further sampling and evaluation of metals attenuation would be required, following remediation of the CVOC plumes.

The scope of the MNA monitoring program (e.g., sampling frequency, number of locations, list of analytes) will be determined during the RD phase and can be adjusted over time based on the observed data trends. Conceptually, semi-annual sampling of the existing groundwater monitoring well network will be conducted for 2 years (four events), and based on those results, the Navy, with the concurrence of EPA and RIDEM, may decide that a less frequent sampling program (e.g., annual) will be used thereafter and the monitoring well network could be further optimized. Parameters to be analyzed in groundwater will include:

- The Site 8 COCs, to document reductions in contaminant concentrations.
- Dissolved oxygen, methane, ethane, and ethene.

- Nitrate, nitrite, total and ferrous iron, total and dissolved manganese, sulfate, sulfide, chloride, alkalinity, and total/dissolved organic carbon.
- Temperature, pH, oxidation/reduction potential, and conductivity.

<u>LUCs and 5-Year Reviews</u>

See Sections 2.12.2.4 and 2.12.2.5.

2.12.2.3 Description of Selected Sediment Remedy

The Selected Sediment Remedy, Alternative SD4, includes the removal and off-site disposal of contaminated sediment from Deerfield Creek and NUWC Pond. The removed sediment would be dewatered, characterized, transported, and disposed offsite within an approved permitted landfill.

At Deerfield Creek, sediment would be removed to the depth of bedrock, which comprises the bottom of the creek for the majority of its length, or to a depth of 0.5 feet in areas where sediment has accumulated, as indicated on Figure 2-9. Approximately 51 cubic yards of sediment would be removed from Deerfield Creek. At NUWC Pond, sediment would be removed to a depth of 2 feet, the currently estimated depth of contamination, as indicated on Figure 2-9. Approximately 6,735 cubic yards of contaminated sediment would be dredged from NUWC Pond, dewatered, characterized, and transported offsite for disposal. Additional sampling may be performed during the RD phase to better define the extent of contamination, possibly resulting in the removal of a smaller area of sediment. Removal of sediment can be conducted in these areas with standard construction equipment (mechanical and/or hydraulic dredging equipment), as to be determined during the RD phase.

Based on field observations, the sediment within Deerfield Creek is sandy in nature and is expected to drain easily; therefore, an absorbent agent may not be needed during offsite transportation and disposal. Based on field observations, the sediment within NUWC Pond contains a much higher percentage of silts and has a much higher content of organic material than the Deerfield Creek sediments.

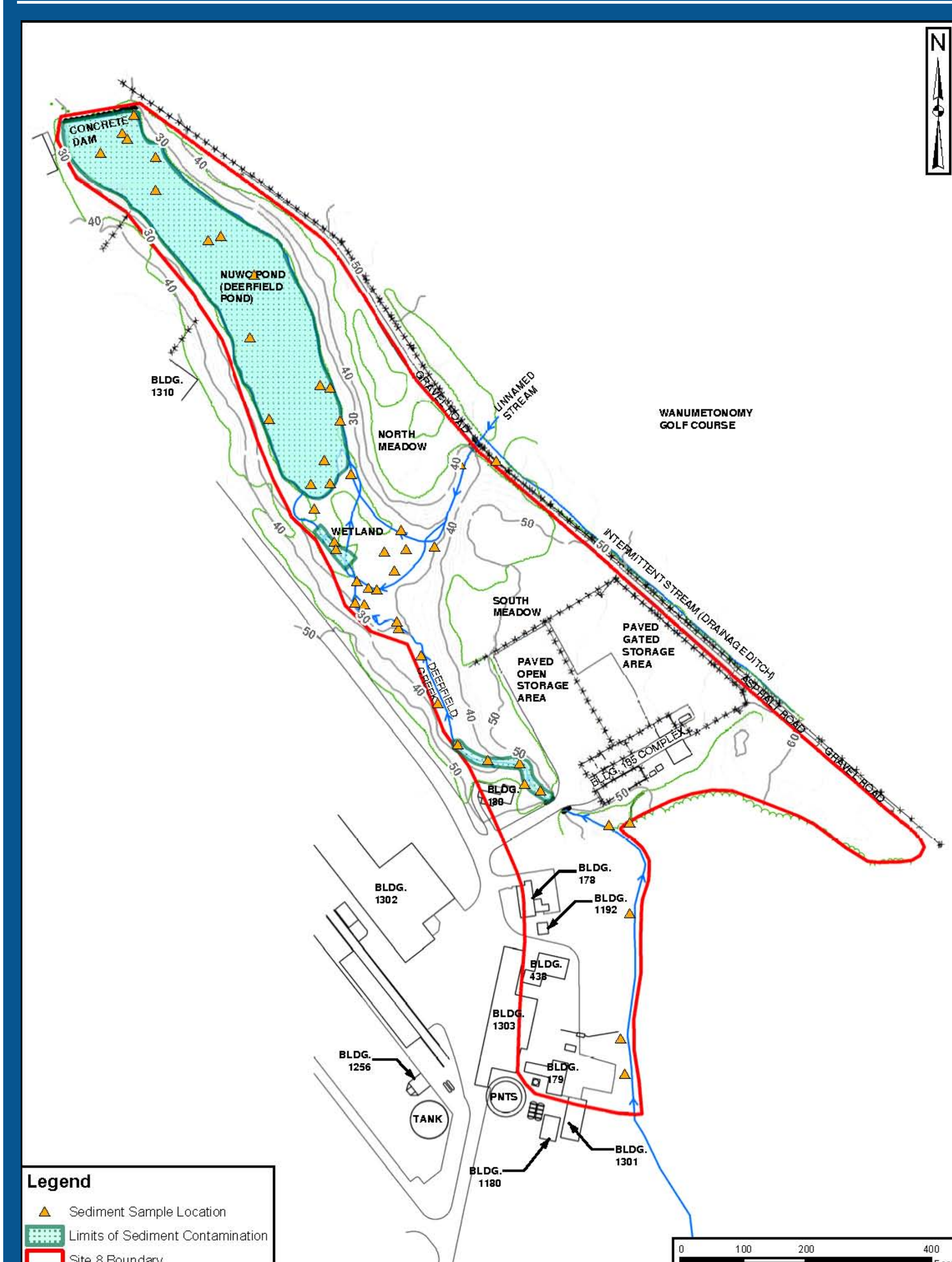
It is assumed that the water resulting from the dewatering process would be treated (filtered) prior to discharging to NUWC Pond. As a result, the dewatering process is expected to be supplemented using filtration bags and an absorbent agent. For costing purposes, it is assumed that sediment will be allowed to dewater for two weeks within the sediment bags prior to offsite transportation and disposal. In addition, sodium polyacrylate (absorbent polymer) will be added to each truck at a rate of 100 pounds per truck to absorb any additional free water generated during transportation to the landfill.

Because NUWC Pond receives transported contamination associated with Site 8 soil, implementation of this alternative would not occur until the soil remedy has been completed or otherwise controlled.

Verification samples will be collected from the banks of Deerfield Creek where sediment is removed, and from the bed of NUWC Pond where sediment is dredged (verification samples will not be collected from exposed bedrock in the creek). For cost estimating purposes during the FS, it was assumed that the frequency of verification sample collection would be one sample for every 100 linear feet of exposed bank along Deerfield Creek, and at a rate of one sample for every 1,000 square feet of exposed pond bed. The Navy will develop a sampling and analysis plan during the RD phase that will specify the frequency of verification sample collection.

Wetlands impacted by the sediment removal would be restored as part of the overall post-remediation site restoration effort. Contaminated sediment would be removed from the pond; no LUCs, monitoring, or inspections/maintenance (including the dam) would be required for the pond. Stream sediment containing COCs above ecological and industrial RGs would also be removed. LUCs would prevent residential/unrestricted recreational exposure to residual (post-removal) lead concentrations remaining above residential RGs in stream sediment.

FIGURE 2-9. SEDIMENT REMEDY



2.12.2.4 Description of Land Use Controls

As part of the selected remedy, the Navy will implement LUCs (institutional controls) to prevent exposure to COCs in soil, sediment, and groundwater and to protect human health during the interim time period until remedial actions have achieved RAOs across the site, outside of the designated Waste Management

Area. Inside the Waste Management Area, LUCs will be maintained for as long as conditions therein do not allow for unrestricted use and unlimited exposure. As depicted on Figure 2-10, the Site 8 LUCs boundary covers an area that is slightly larger than the Site 8 boundary that was designated during the RI/FS, such that the LUCs will be applied to the identified areas where the Site 8 COCs in soil, groundwater, and sediment exceed RGs. Consistent with the RAOs developed for the site, the specific performance objectives for the LUCs to be implemented at Site 8 are as follows:

- Establish a Waste Management Area for the Paved Storage Area where contaminants and debris remain in the subsurface. The Waste Management Area will be maintained and monitored by the Navy. The LUCs will include provisions for additional geophysical investigations to be conducted within the Waste Management Area to identify and remove potential subsurface anomalies, as necessary: (1) if the use of the site is changed such that the Paved Storage Area is no longer operated as a Waste Management Area, (2) if ownership of the property is transferred outside of the Navy, or (3) if groundwater restoration goals are not achieved in a reasonable timeframe and there is reason to believe that a continuing source of contamination from the Waste Management Area may be inhibiting groundwater cleanup.

- Restrict property uses to those consistent with industrial/commercial activities, such as parking, roadways, sidewalks, material stockpiles, heavy equipment storage, etc. Residential and recreational site use will be prohibited (includes areas where COC concentrations in soil and sediment exceed residential cleanup goals).

- Prevent use of the groundwater at the property for any consumptive purpose, including for household use, drinking water supply, irrigation, or industrial use.

- Prevent excavation or disturbance of the asphalt/soil cover, monitoring wells, and any other components of the remedy, and prevent access to the contaminated soil by persons who are not adequately trained and properly informed of the hazards associated with such activities.

- Establish LUC compliance monitoring requirements described elsewhere in this section.

The LUC implementation actions including monitoring and enforcement requirements will be provided in a Land Use Control Remedial Design (LUC RD) that will be prepared by the Navy as the LUC component of the overall RD. Regular site inspections will be performed to verify the continued maintenance of LUCs until the RGs have been achieved. The Navy will also coordinate with adjacent property owner(s) and state agencies (e.g., Department of Public Health and RIDEM) to prevent the installation of residential drinking water supply wells or other groundwater extraction wells directly adjacent to the site (i.e., in an area that would adversely impact the Site 8 remedial action or cause unacceptable risks to human health or the environment associated with affecting the Site 8 groundwater plume).

The LUCs will be established and implemented in accordance with the post-ROD LUC RD that will be prepared by the Navy as the LUC component of the remedy. Within 90 days of ROD signature, the Navy shall prepare and submit, for EPA and RIDEM review and approval, a LUC RD that shall contain LUC implementation actions, including maintenance, monitoring and enforcement requirements that are consistent with the requirements under this ROD. LUCs will be developed in accordance with the Principles and Procedures for Specifying, Monitoring, and Enforcement of Land Use Controls and Other Post-ROD Actions, per letter dated January 16, 2004, from Alex A. Beehler, Assistant Deputy Under Secretary of Defense (Environment, Safety and Occupational Health), and the requirements of the Naval Station Newport Federal Facilities Agreement. If the property is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the Site's Federal Facility Agreement, Navy would ensure as part of the transfer process that the gaining agency is made aware of the existing controls and would take appropriate action to ensure such controls remain in place. If the property is ever transferred to non-federal ownership, deed restrictions, meeting State property law standards, would be recorded that would incorporate the land use restrictions called for under this ROD. Although the Navy may transfer the procedural LUC responsibilities to another party by contract, property transfer agreement, or through other means, the Navy shall retain ultimate responsibility for remedy integrity.

LUCs will be maintained until the concentration of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and exposure.

FIGURE 2-10. LAND USE CONTROL BOUNDARY

2.12.2.5 Five-Year Reviews

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite in excess of levels that allow for unlimited use and unrestricted exposure, in accordance with Section 121(c) of CERCLA and NCP §300.430(f)(5)(iii)(c), a statutory review will be conducted within 5 years of the initiation of remedial action, and every five years thereafter, to ensure that the remedy continues to be protective of human health and the environment. During such reviews, the Navy, EPA, and state would review site conditions and monitoring data to determine whether the continued implementation of the selected remedy is appropriate. Five-year reviews will be conducted until Site 8 conditions are restored such that the site is suitable for unrestricted use and unlimited exposure in accordance with CERCLA.

2.12.3 Expected Outcomes of Selected Remedy

The current industrial land use, which will be supported by the Selected Remedy, is expected to continue at Site 8, and there are no other planned land uses in the foreseeable future. Groundwater at the site is not used and is not expected to be used in the future, and the Selected Remedy will have no impact on current or future groundwater uses available at the site. However, as per EPA groundwater remediation guidance, in states without an EPA-approved Comprehensive State Groundwater Protection Program (CSGWPP) such as Rhode Island, CERLCA groundwater remediation must meet federal MCLs and risk-based standards, unless the water is non-potable (except for the Waste Management Area, where groundwater cleanup goals will instead be used as monitoring performance standards). There are no socio-economic, community revitalization, or economic impacts or benefits associated with implementation of the Selected Remedy. RAOs for Site 8 are anticipated to be achieved within approximately 2 years for soil/sediment and between 25 and 50 years for groundwater. Table 2-13 describes how the Selected Remedy mitigates risk and achieves RAOs for Site 8.

Table 2-13. How Selected Remedy Mitigates Risk and Achieves RAOs

Risk	RAO	Comments
Direct exposure to and ingestion of contaminated soil	Prevent the incidental ingestion of and dermal contact with surface and subsurface soil containing COCs that exceed human health RGs.	Selective excavation (with off-site disposal) of soil, the 2-foot thick soil cover, and the asphalt cover of the Waste Management Area will prevent potential human exposure to COCs in surface and subsurface soil. Implementing and inspecting LUCs will maintain the integrity of the soil/asphalt cover system.
Ingestion of contaminated groundwater as a drinking water source	Prevent the use of site groundwater for human consumption until groundwater RGs have been achieved.	LUCs will prevent the use of site groundwater until RGs are achieved outside of the compliance boundary established for the Waste Management Area. LUCs will prevent the use of site groundwater inside that compliance boundary for as long as conditions therein do not allow for unrestricted use and unlimited exposure.
	Restore groundwater quality to its beneficial use.	In-situ treatment of groundwater using either enhanced bioremediation or chemical oxidation, followed by MNA of the residual groundwater plume, will reduce COC concentrations to achieve remediation goals outside of the Waste Management Area. COC concentrations will be monitored at the compliance boundary (outer edge) of the Waste Management Area to ensure that the subsurface conditions in that Area are not adversely impacting groundwater outside the compliance boundary.
Ecological exposure to contaminated surface soil	Prevent insectivorous mammals and birds from exposure to surface soil containing COCs that exceed ecological RGs.	Selective excavation (with off-site disposal) of soil, the 2-foot thick soil cover, and the asphalt cover of the Waste Management Area will prevent potential ecological exposure to COCs in surface soil. Implementing and inspecting LUCs will maintain the integrity of the soil/asphalt cover system.
Direct exposure to and ingestion	Prevent the migration of sediment COCs that could	Selective excavation (with off-site disposal) of soil (including removal of the remaining Buried Canister Area),

TABLE 2-13. HOW SELECTED REMEDY MITIGATES RISK AND ACHIEVES RAOs		
RISK	**RAO**	**COMMENTS**
of contaminated sediment	cause unacceptable ecological risk to pond and stream sediment via groundwater transport and overland runoff.	the 2-foot thick soil cover, and the asphalt cover of the Waste Management Area will prevent COC transport to sediment via soil erosion/overland runoff. In-situ treatment of groundwater using either enhanced bioremediation or chemical oxidation, followed by MNA of the residual groundwater plume, will prevent the transport of COCs to the creek and pond via groundwater discharge.
	Prevent pond and stream invertebrates from exposure to sediments containing COCs that exceed ecological RGs.	Dredging and off-site disposal of sediment from Deerfield Creek and NUWC Pond will prevent ecological exposure to contaminated sediments.
	Prevent human exposure to stream sediment containing lead above RGs.	Dredging and off-site disposal of sediment from Deerfield Creek will prevent human exposure to lead in stream sediments above industrial RGs. LUCs will prevent residential/unrestricted recreational exposure to residual (post-removal) lead in stream sediment remaining above residential RGs.

The current industrial use of the site is expected to continue for the foreseeable future, it is not expected that modification or removal of the LUCs will be required. However, if proposed land use changes in the future and uses other than industrial/commercial-type activities are expected, additional remedial approaches may be required. Any modifications to LUCs will be conducted in accordance with provisions in the Site 8 LUC RD, CERCLA, and the NCP.

2.13 STATUTORY DETERMINATIONS

In accordance with the NCP, the Selected Remedy meets the following statutory determinations:

- **Protection of Human Health and the Environment** – The Selected Remedy is needed to prevent the identified unacceptable risks to human health associated with potential exposure to COCs in site soil, groundwater, and sediment under current and future land use scenarios, as well as to mitigate the identified unacceptable ecological risks associated with soil and sediment. The Selected Remedy for soil will be protective of human health and the environment through prevention exposure to the COCs remaining in soil. The Selected Remedy for groundwater will be protective of human health and the environment through the reduction of COC concentration in site groundwater to achieve cleanup levels (or to ensure performance levels based on cleanup goals are met at the compliance boundary of the Waste Management Area). The Selected Remedy for sediment will be protective of human health and the environment through the removal and off-site disposal of contaminated sediment from the site. The Selected Remedy includes LUCs which will ensure the long-term effectiveness of the soil remedy and which would prevent exposure to contaminated groundwater until conditions are suitable for unlimited use and unrestricted exposure.

- **Compliance with ARARs** – The Selected Remedy will attain all identified federal and state ARARs, as presented in Appendix E.

- **Cost-Effectiveness** – The Selected Remedy is a cost-effective alternative that allows for continued industrial use of the property. The costs are proportional to overall effectiveness by achieving an adequate amount of long-term effectiveness and permanence within a reasonable time frame. Detailed costs for the Selected Remedy are presented in Appendix B[2].

- **Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable** – The Selected Remedy will be an

[2] Cost estimates presented in Appendix B are based on the conceptual designs evaluated during the FS. Line item quantities and costs may vary based on the engineering designs developed during the RD phase.

effective and permanent means of reducing COC concentrations in a practical manner which includes alternative treatment technologies for groundwater. The Selected Remedy includes active treatment of the most contaminated portions of the groundwater plume. Multiple injections of the selected aquifer amendment (whether biological or chemical) or other system optimizations will be conducted as needed to ensure successful remediation. Some treatment of dredged sediment may occur as part of the dewatering and disposal process. The Selected Remedy for soil does not include treatment.

- **Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility, or Volume of the Hazardous Substances as a Principle Element** – The Selected Remedy includes a focus on treatment of the most contaminated portions of the groundwater plume to break down COCs, thereby reducing the toxicity, mobility, and volume of the groundwater contamination. Some treatment of dredged sediment may occur as part of the dewatering and disposal process. The Selected Remedy for soil does not include treatment.

- **Five-Year Review Requirement** – Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site in excess of levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action and every 5 years thereafter to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

CERCLA Section 117(b) requires an explanation of significant changes from the Selected Remedy presented in the Proposed Plan that was published for public comment. No significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate. Formal comments received during the public comment period and the associated responses are provided in Section 3.0, Responsiveness Summary.

3.0 RESPONSIVENESS SUMMARY

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

Participants in the public meeting (informal session) held on July 18, 2012 included RAB members and representatives of the Navy, EPA, and RIDEM. The questions raised at the public meeting were general inquiries for informational purposes and were addressed at the public meeting. A formal public hearing was held immediately following the public meeting. Oral comments received during the public hearing and written comments received during the public comment period are summarized in Table 3-1. The complete transcript of the public hearing is included in the Administrative Record for Site 8.

TABLE 3-1. SUMMARY OF QUESTIONS FROM PUBLIC COMMENT PERIOD

QUESTION/COMMENT	RESPONSE
Mr. David Brown, a Newport resident and RAB member since 1996, provided written comments expressing support for the Selected Remedy. Mr. Brown noted that Site 8 is located at the lower end of a small watershed and may be susceptible to contamination originating from upgradient sources, and he offered his support to reach out to other local environmental groups in order to reduce contamination in the overall watershed.	The Navy appreciates the support for the Selected Remedy at Site 8 and the overall environmental restoration program at NAVSTA Newport.
Ms. Ginny Lombardo, the EPA Remedial Project Manager, commented during the public hearing to express EPA's support for the Selected Remedy.	The Navy appreciates the support for the Selected Remedy and looks forward to working with the restoration team to successfully implement the Site 8 remedial action.
Mr. John Vitkevich, RAB member, commented during the public hearing that it is preferable to retain on-site as much as possible of the environmental media being addressed under the remedy, and to minimize the amount of material that needs to be removed and disposed off-site.	The Selected Remedy includes in-situ (in-place) treatment of contaminated groundwater (Alternatives GW3/GW4) and construction of a soil cover on-site to address contaminated soil (Alternative SO3). As described in the FS, only a small amount of soil and debris will be excavated and disposed off-site under Alternative SO3 (less than 700 cubic yards) as compared to the larger volume specified under Alternative SO2 (over 7,900 cubic yards). The selected sediment remedy (Alternative SD4) does include more off-site disposal (approximately 4,100 cubic yards) than Alternatives SD2 (approximately 1,200 cubic yards) and SD3 (approximately 2,100 cubic yards); however, this was deemed to be preferable due to the complications in constructing and maintaining a sediment cover in the pond or relocating and containing the dredged sediment in another part of the site.
Mr. Ken Munney, from the U.S. Fish and Wildlife Service, commented during the public hearing to express his support for the Selected Remedy. Mr. Munney also commented that, during the Remedial Design/Remedial Action phase, it will be important to ensure the protection of the fish and wildlife resources at the site.	The Navy appreciates the support for the Selected Remedy and looks forward to working with the restoration team to successfully implement the Site 8 remedial action. The Navy will continue to keep the U.S. Fish and Wildlife Service involved during the Remedial Design/Remedial Action phase.
Mr. Jay Napoli, representing the Wanumetonomy Golf Course and Country Club that abuts Site 8,	No additional comments were received from representatives of the Golf Course during the public comment period. It should be noted that the Navy's RAB meetings are open to the public and representatives from

TABLE 3-1. SUMMARY OF QUESTIONS FROM PUBLIC INFORMATION SESSION	
QUESTION/COMMENT	RESPONSE
commented during the public hearing that the Country Club Board of Governors would be further reviewing the information presented in the Proposed Plan and would contact the Navy with any questions or comments. During the public informational meeting, Mr. Napoli also asked about the possibility of using NUWC Pond to support the irrigation of the Golf Course, as was done in the past.	the Golf Course are invited to attend to discuss the progress of environmental investigations at Site 8 and other areas at NAVSTA Newport. The contact information provided during the public meeting has been added to the Navy's community mailing list. At this time, with a Remedial Action pending for the sediment of NUWC Pond, the Navy does not plan to use the pond as an irrigation water supply. However, the possibility for such use in the future can be further discussed with representatives from NAVSTA Newport and the environmental restoration team.
Ms. Claudette Weissinger, RAB member, asked during the public hearing how extensively soil covers (like those under Alternative SO3) have been used at other environmental sites. Ms. Weissinger also asked whether the microbes in site soil and groundwater would be impacted by the Remedial Action or if there would be other side effects from chemical treatment of groundwater.	Soil covers are a common and well-proven option for containing and preventing exposure to contaminants in soil, particularly when those contaminants do not threaten groundwater or surface water. Soil covers are often a cost-effective option, compared to extensive excavation followed by expensive treatment and/or off-site disposal. At Site 8, the soil cover (and the asphalt cover in the Building 185 area) will address the site risks and allow for continued industrial use of the property with the least amount of disruption. The Navy will monitor and maintain the cap over time to ensure the continued protectiveness of human health and the environment in the future. As described in this ROD, groundwater treatment will involve in-situ enhanced bioremediation (Alternative GW3) and/or in-situ chemical oxidation (Alternative GW4), depending on the results of pre-design investigations. The advantages and disadvantages of these alternatives are described in the FS. With bioremediation, an organic substrate (food source) will be added to groundwater to promote the activity of indigenous microbes in the subsurface which are capable of degrading CVOCs. This will further promote an anaerobic environment in the aquifer which will favor some microbes over others. Upon completion of the remedial action, more aerobic conditions would return to the aquifer and the microbial ecosystem would return to background (normal) conditions. Injection of an organic substrate into the aquifer will need to be monitored to ensure that nutrient levels in groundwater discharging to the abutting pond do not adversely impact the pond/wetland area. Complete biodegradation of CVOCs will result in innocuous (non-toxic) compounds (carbon dioxide, water, salts). Incomplete biodegradation of some CVOCs can result in the formation of vinyl chloride; however, vinyl chloride concentrations will be monitored during the process and the remedy can be adjusted as needed. Vinyl chloride can also be further degraded under the more aerobic conditions outside of the treatment zone. With chemical oxidation, organic molecules would be directly broken apart. The oxidants would likely also reduce the microbial populations in the treatment zone, although the populations would be expected to recover over time after the remedial action has been completed. Complete oxidation would generate carbon dioxide, oxygen, water, and dilute hydrochloric acid as by-products (temporarily decreasing the pH of the aquifer). The oxidants can also generate large quantities of heat and pressure that can alter subsurface conditions. Therefore, chemical oxidation would need to be administered by experienced professionals, carefully monitored, and coordinated with site workers to ensure the safe and effective application of this technology.

3.2 TECHNICAL AND LEGAL ISSUES

No additional technical or legal issues associated with the Site 8 ROD were identified.

Administrative Record Reference Table

DETAILED ADMINISTRATIVE RECORD REFERENCE TABLE

ITEM	REFERENCE PHRASE IN ROD	LOCATION IN ROD	LOCATION OF INFORMATION IN ADMINISTRATIVE RECORD
1	**VOC plume**	Table 2-1	TRC, December 1999. Building 179 Concrete UST Remedial Investigation. Naval Undersea Warfare Center Division, Newport, Rhode Island. U.S. Department of the Navy.
2	**Building 179 reconstruction**	Table 2-1	FWEC, 2000. Final Project Close-Out Report for Building 179 Remediation at Naval Undersea Warfare Center. March.
3	**Otto Fuel contamination**	Table 2-1	Tetra Tech NUS, 2010. Remedial Investigation, Site 08, Naval Undersea Systems Center (NUSC) Disposal Area, Naval Station (NAVSTA) Newport, Rhode Island. January. Page 1-16.
4	**157 cubic yards (236 tons) of soil and metal debris**	Table 2-1	TN & Associates, Inc., December 2006. Final Interim Remedial Action Report, Limited Soil Removal Action, Drum Disposal Area, Paint Can Disposal Area, Site 8 NUWC (Formerly NUSC) Disposal Site, Middletown, Rhode Island.
5	**36 drums and 113 tons of contaminated soil**	Table 2-1	TN & Associates, Inc., December 2006.
6	**background soil investigation**	Table 2-1	Tetra Tech, 2006. Background Soil Investigation Report for NUSC Disposal Area, Naval Station Newport, Middletown, Rhode Island.
7	**sampling of soil, sediment, surface water, and groundwater**	Table 2-1	Tetra Tech, 2010. Section 2.
8	**Human Health Risk Assessment (HHRA)**	Table 2-1	Tetra Tech, 2010. Section 6.
9	**Ecological Risk Assessment (ERA)**	Table 2-1	Tetra Tech, 2010. Section 7.
10	**resolve data gaps**	Table 2-1	Tetra Tech, 2011b. Technical Memorandum Supplemental Remedial Investigation, Site 08, Naval Undersea Systems Center (NUSC) Disposal Area, Naval Station (NAVSTA) Newport, Rhode Island. October. Section 2.
11	**natural attenuation**	Table 2-1	Tetra Tech, 2011a. March 2011 Monitored Natural Attenuation Groundwater Sampling Results, Site 08 – Naval Undersea Systems Center (NUSC) Disposal Area, Naval Station Newport, Rhode Island. August 9.
12	**remedial alternatives**	Table 2-1	Tetra Tech, 2012. Feasibility Study for Site 8 – Naval Undersea Systems Center (NUSC) Disposal Area, Naval Station Newport, Rhode Island. July. Section 4 (soil), Section 5 (groundwater), and Section 6 (sediment).
13	**Public notice**	Section 2.3	U.S. Navy, 2012. Legal Notice. Public Information Meeting and Public Hearing for the Site 8 (Naval Undersea Systems Center (NUSC) Disposal Area) Proposed Plan, Naval Station Newport, Rhode Island. Published in the *Newport Daily News*. July 13 and 16.
14	**high yielding fracture zone**	Section 2.5.2	Tetra Tech, 2011b. Section 2.4.
15	**reductive dechlorination has occurred**	Section 2.5.2	Tetra Tech, 2011a.
16	**LNAPL was identified in well MW-100B**	Section 2.5.2	Tetra Tech, 2010. Section 2.5, Section 2.6, Section 4.2.4.3, Section 5.3.1.8.
17	**not used for drinking water**	Section 2.6	Tetra Tech, 2010. Page 1-3.

18	**RIDEM's GA and GB groundwater classification areas**	Section 2.6	Tetra Tech, 2010. Figure 1-4.
19	**potential receptors**	Section 2.7	Tetra Tech, 2010. Section 6.2.1.3.
20	**COPCs were first identified**	Section 2.7	Tetra Tech, 2010. Tables 6-4 through 6-19.
21	**COPC screening was updated**	Section 2.7	Tetra Tech, 2011b. Tables 4-3 through 4-10.
22	**exposure assessment**	Section 2.7	Tetra Tech, 2010. Section 6.2.
23	**cancer risks and non-cancer hazards**	Section 2.7	Tetra Tech, 2010. Table 6-34.
24	**COC refinement step**	Section 2.7	Tetra Tech, 2011b. Section 6.5.
25	**RAOs for Site 8**	Section 2.8	Tetra Tech, 2012. Section 2.3.
26	**PRGs**	Section 2.8	Tetra Tech, 2012. Section 2.2.
27	**preliminary technology screening**	Section 2.9	Tetra Tech, 2012. Section 3.2.
28	**soil cover thickness**	Section 2.9.1	Tetra Tech, 2012. Section 4.1.3.
29	**In-Situ Enhanced Bioremediation**	Section 2.9.2	Tetra Tech, 2012. Section 5.1.3.
30	**25-35 Years for CVOCs plus 10-15 Years for metals**	Section 2.9.2	Tetra Tech, 2012. Appendix D.
31	**In-Situ Chemical Oxidation**	Section 2.9.2	Tetra Tech, 2012. Section 5.1.4.
32	**estimated 6,735 cubic yards of contaminated sediment**	Section 2.9.3	Tetra Tech, 2012. Section 6.2.4.
33	**nine CERCLA evaluation criteria**	Section 2.10	Tetra Tech, 2012. Page 1-2.
34	**sustainable remediation evaluation**	Section 2.10.2	Tetra Tech, 2012. Appendix E.
35	**buried drum fragments**	Section 2.12.2.1	Tetra Tech, 2012. Page 4-4.
36	**exceeded RIDEM's Soil Leachability Criteria**	Section 2.12.2.1	Tetra Tech, 2012. Page 4-4.
37	**predicted MNA timeframes**	Section 2.12.2.2	Tetra Tech, 2012. Appendix D.

ADDITIONAL REFERENCES

Tetra Tech, Inc. 2004. Five-Year Review for Naval Station Newport, Naval Station Newport, Newport, Rhode Island. Tetra Tech NUS, Inc., King of Prussia, Pennsylvania. December.

United States Environmental Protection Agency. 1995. New England Risk-Based Priority Setting Project Risk Identification Work Group Final Report. September.

United States Environmental Protection Agency. 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10. December

United States Environmental Protection Agency. 2007. Statistical Software ProUCL 4.1.00 for Environmental Applications for Data Sets with and without Nondetect Observations. Available at http://www.epa.gov/osp/hstl/tsc/software.htm.

Appendix A
Rhode Island Department of Environmental Management Concurrence Letter

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
235 Promenade Street, Providence, RI 02908-5767 TDD 401-222-4462

26 September 2012

Mr. James T. Owens, III, Director
U.S. EPA – New England Region
Office of Site Remediation and Restoration
5 Post Office Square
Suite 100 (OSRR 07-3)
Boston, MA 02109-3912

RE: Record of Decision for Site 8 (OU7), NUSC Disposal Area at Naval Station Newport, RI

Dear Mr. Owens:

On 23 March 1992 the State of Rhode Island entered into a Federal Facilities Agreement (FFA) with the Department of the Navy and the Environmental Protection Agency. One of the primary goals of the FFA is to ensure that the environmental impacts associated with past activities at Naval Station Newport located in Newport, Rhode Island are thoroughly investigated and that appropriate actions are taken to protect human health and the environment.

In accordance with the FFA, the Department of Environmental Management (Department) has completed its review of the Record of Decision (ROD) for Site 8 (OU7), NUSC Disposal Area dated September 2012 at Naval Station Newport, RI. The Department of the Navy's selected alternative for the Site, as presented in the ROD, is the following: selective excavation and off-site disposal of soil and waste anomalies; construction of a two-foot soil cover; maintenance of the existing paved area as a Waste Management Area; in-situ treatment of the most contaminated portions of groundwater using either enhanced bioremediation or chemical oxidation; monitored natural attenuation (MNA) of the residual groundwater plume; excavation and offsite disposal of sediment; land use controls to restrict groundwater and land use; and long term monitoring of groundwater and inspection/maintenance of the soil/asphalt cover system.

The Department has worked on this Site with the Department of the Navy and the Environmental Protection Agency from the early stages up through this current decision milestone. Based upon this Department's review of this ROD and the results of the remedial investigation activities conducted to date, we offer our concurrence on the decision.

The Department wishes to emphasize the following aspects of the ROD:

- The Navy will conduct pilot/bench-scale studies during the Remedial Design (RD) phase to determine which in-situ groundwater treatment technology, enhanced bioremediation or chemical oxidation, or a combination of the two, will be most effective for treating the contaminated groundwater plumes at the Site;

- It is this Department's understanding that additional soil borings will be installed in the North Meadow during a pre-design investigation to verify that a VOC source is not present in the North Meadow soil;

- The Navy will conduct additional verification sampling for SPLP analysis during the RD phase to verify that metals levels in site soil are not exceeding RIDEM's Leachability Criteria. As noted in the ROD, the Remediation Goals (RGs) for some metals may be modified if it is found that Leachability Criteria are being exceeded;

- The Paved Storage Area will be maintained as a Waste Management Area which uses existing asphalt pavement to contain and prevent exposure to COCs in the underlying soil. The Navy will initiate and maintain a long-term groundwater monitoring program to verify that COC migration is not occurring beyond the pavement perimeter;

- A geophysical survey of the Paved Storage Area was not completed due to active use of the area; therefore, it is this Department's understanding that the Navy will complete the geophysical survey in the future should the property be transferred to an entity other than the Navy or if this area becomes inactive;

- The Navy will implement groundwater use restrictions and a long-term monitoring plan for the entire site;

- The Navy will implement land use controls (LUCs) to ensure that the future use of this Site is limited to industrial use; and

- Navy will conduct five-year reviews to ensure that the remedial actions for the Site continue to provide adequate protection of human health and the environment.

Thank you for providing us with an opportunity to review and concur with this important ROD.

Sincerely,

Janet Coit
Director

cc: Terrence Gray, RIDEM
Leo Hellested, RIDEM
Matthew DeStefano, RIDEM
Pamela Crump, RIDEM
Bryan Olson, USEPA
Ginny Lombardo, USEPA
Maritza Montegross, Navy

Appendix B
Cost Estimates

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SO3: Soil Cover, Selective Excavation and Removal of Anomalies, Off-Site Disposal, LUCs, and Monitoring
Capital Cost

7/6/2012 11:27 AM

			Unit Cost				Extended Cost				
Item	Quantity	Unit	Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
1.2 Prepare Permits	300	hr			$39.00		$0	$0	$11,700	$0	$11,700
1.3 Prepare Groundwater Monitoring Plan	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
1.4 Prepare LUCs	250	hr			$39.00		$0	$0	$9,750	$0	$9,750
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	11	ea			$188.00	$566.00	$0	$0	$2,068	$6,226	$8,294
2.3 Drill Rig Mobilization/Demobilization	2	ea	$2,000.00				$4,000	$0	$0	$0	$4,000
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	3.5	mo				$365.00	$0	$0	$0	$1,278	$1,278
3.2 Field Office Equipment, Utilities, & Support	3.5	mo		$380.00			$0	$1,330	$0	$0	$1,330
3.3 Storage Trailer	3.5	mo				$94.00	$0	$0	$0	$329	$329
3.4 Survey Support	7	day	$1,150.00				$8,050	$0	$0	$0	$8,050
3.5 Site Superintendent	70	day		$220.00	$480.00		$0	$15,400	$33,600	$0	$49,000
3.6 Site Health & Safety and QA/QC	70	day		$220.00	$360.00		$0	$15,400	$25,200	$0	$40,600
3.7 Underground Utility Clearance	1	ls	$10,525.00				$10,525	$0	$0	$0	$10,525
4 DECONTAMINATION											
4.1 Decontamination Services	3	mo		$1,220.00	$2,245.00	$1,550.00	$0	$3,660	$6,735	$4,650	$15,045
4.2 Equipment Decon Pad	1	ls		$4,500.00	$3,000.00	$725.00	$0	$4,500	$3,000	$725	$8,225
4.3 Decon Water	3,000	gal		$0.20			$0	$600	$0	$0	$600
4.4 Decon Water Storage Tank, 6,000 gallon	3	mo				$813.00	$0	$0	$0	$2,439	$2,439
4.5 Clean Water Storage Tank, 4,000 gallon	3	mo				$731.00	$0	$0	$0	$2,193	$2,193
4.6 Disposal of Decon Waste (liquid & solid)	3	mo	$985.00				$2,955	$0	$0	$0	$2,955
5 SITE PREPARATION											
5.1 Excavator, 2.5 cy	10	day			$382.40	$1,652.00	$0	$0	$3,824	$16,520	$20,344
5.2 Skid-Steer	10	day			$358.00	$281.20	$0	$0	$3,580	$2,812	$6,392
5.3 Site Labor, (3 laborers)	30	day			$280.80		$0	$0	$8,424	$0	$8,424
5.4 Clear & Chip Trees	5	day			$358.00	$710.60	$0	$0	$1,790	$3,553	$5,343
5.5 Grub Stumps and Chip	5	day				$170.70	$0	$0	$0	$854	$854
5.6 Off-Site Disposal of Chipped Trees	250	ton	$45.00				$11,250	$0	$0	$0	$11,250
6 EXCAVATION, DISPOSAL, AND BACKFILL											
6.1 Excavator, 2.5 cy	3	day			$382.40	$1,652.00	$0	$0	$1,147	$4,956	$6,103
6.2 Skid-Steer	3	day			$358.00	$281.20	$0	$0	$1,074	$844	$1,918
6.3 Site Labor, (3 laborers)	9	day			$280.80		$0	$0	$2,527	$0	$2,527
6.4 Verification Samples, PCBs, PAHs, metals	12	ea	$360.00	$20.00	$50.00	$20.00	$4,320	$240	$600	$240	$5,400
6.5 T & D of Excavated Soil, non-hazardous	869	ton	$85.00				$73,865	$0	$0	$0	$73,865
6.6 Waste Disposal Characterization / Analytical	5	ea	$850.00	$30.00	$50.00	$30.00	$4,250	$150	$250	$150	$4,800
6.7 Backfill, common fill	525	cy		$18.83			$0	$9,886	$0	$0	$9,886
6.8 Backfill, vegetative soil	60	cy		$27.33			$0	$1,640	$0	$0	$1,640
6.9 Dozer, 300 hp	2	day			$382.40	$1,718.00	$0	$0	$765	$3,436	$4,201
6.10 Compactor, 120 hp	2	day			$382.40	$640.20	$0	$0	$765	$1,280	$2,045
6.11 Revegetation, seed	3.5	msf	$96.50				$338	$0	$0	$0	$338
7 SITE COVER											
7.1 Common Fill	8,298	cy		$18.83			$0	$156,251	$0	$0	$156,251
7.2 Vegetative Soil	2,769	cy		$27.33			$0	$75,677	$0	$0	$75,677
7.3 Geotextile, 10 oz	20,524	sy		$1.85	$0.22		$0	$37,969	$4,515	$0	$42,485
7.4 Riprap, D_{50}= 12" (24" thick)	2,488	cy		$31.50	$10.00	$11.05	$0	$78,372	$24,880	$27,492	$130,744
7.5 Revegetation, seed	150	msf	$96.50				$14,475	$0	$0	$0	$14,475
7.6 Dozer, 300 hp	24	day			$382.40	$1,718.00	$0	$0	$9,178	$41,232	$50,410
7.7 Compactor, 120 hp	24	day			$382.40	$640.20	$0	$0	$9,178	$15,365	$24,542
7.8 Skid-Steer	24	day			$358.00	$281.20	$0	$0	$8,592	$6,749	$15,341
7.9 Site Labor (3 laborers) (cover & riprap)	72	day			$280.80		$0	$0	$20,218	$0	$20,218

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SO3: Soil Cover, Selective Excavation and Removal of Anomalies, Off-Site Disposal, LUCs, and Monitoring
Capital Cost

			Unit Cost				Extended Cost				
Item	Quantity	Unit	Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Subtotal
8 MONITORING WELL REMOVAL AND REPLACEMENT											
8.1 Monitoring Well Removal, 25 wells	500	lf	$20.00				$10,000	$0	$0	$0	$10,000
8.2 Install Wells	200	lf	$65.00				$13,000	$0	$0	$0	$13,000
8.3 Well Covers	10	ea	$500.00				$5,000	$0	$0	$0	$5,000
8.4 Well Development (4 hours per well)	40	ea	$42.00				$1,680	$0	$0	$0	$1,680
8.5 Collect/Transport/Dispose IDW	8	drum	$195.00				$1,560	$0	$0	$0	$1,560
9 POST CONSTRUCTION COST											
9.1 Contractor Completion Report	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
9.2 Remedial Action Closeout Report	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
Subtotal							$165,268	$402,075	$222,609	$146,822	$936,774
Overhead on Labor Cost @ 30%									$66,783		$66,783
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$16,527	$40,208	$22,261	$14,682	$93,677
Tax on Materials and Equipment Cost @ 7.0%								$28,145		$10,278	$38,423
Total Direct Cost							$181,795	$470,428	$311,653	$171,782	$1,135,657
Indirects on Total Direct Cost @ 25%	(excluding transportation and disposal cost)										$261,507
Profit on Total Direct Cost @ 10%											$113,566
Subtotal											$1,510,729
Health & Safety Monitoring @ 2%											$30,215
Total Field Cost											$1,540,944
Engineering on Total Field Cost @ 5%											$77,047
Contingency on Total Field Cost @ 20%											$308,189
TOTAL CAPITAL COST											**$1,926,180**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SO3: Soil Cover, Selective Excavation and Removal of Anomalies, Off-Site Disposal, LUCs, and Monitoring
Annual Cost

Item	Item Cost Years 1 - 30	Item Cost every 5 years	Notes
Annual Site Inspection & Report	$3,170		Labor and supplies once a year to inspect Land Use Controls with Report
Five-Year Review		$25,000	
Subtotal	$3,170	$25,000	
Contingency @ 10%	$317	$2,500	
TOTAL	**$3,487**	**$27,500**	

Note: Groundwater monitoring included in Groundwater Monitoring Alternatives

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SO3: Soil Cover, Selective Excavation and Removal of Anomalies, Off-Site Disposal, LUCs, and
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$1,926,180		$1,926,180	1.000	$1,926,180
1		$3,487	$3,487	0.980	$3,419
2		$3,487	$3,487	0.961	$3,352
3		$3,487	$3,487	0.942	$3,286
4		$3,487	$3,487	0.924	$3,221
5		$30,987	$30,987	0.906	$28,066
6		$3,487	$3,487	0.888	$3,096
7		$3,487	$3,487	0.871	$3,036
8		$3,487	$3,487	0.853	$2,976
9		$3,487	$3,487	0.837	$2,918
10		$30,987	$30,987	0.820	$25,420
11		$3,487	$3,487	0.804	$2,804
12		$3,487	$3,487	0.788	$2,749
13		$3,487	$3,487	0.773	$2,696
14		$3,487	$3,487	0.758	$2,643
15		$30,987	$30,987	0.743	$23,024
16		$3,487	$3,487	0.728	$2,540
17		$3,487	$3,487	0.714	$2,490
18		$3,487	$3,487	0.700	$2,441
19		$3,487	$3,487	0.686	$2,394
20		$30,987	$30,987	0.673	$20,853
21		$3,487	$3,487	0.660	$2,301
22		$3,487	$3,487	0.647	$2,256
23		$3,487	$3,487	0.634	$2,211
24		$3,487	$3,487	0.622	$2,168
25		$30,987	$30,987	0.610	$18,888
26		$3,487	$3,487	0.598	$2,084
27		$3,487	$3,487	0.586	$2,043
28		$3,487	$3,487	0.574	$2,003
29		$3,487	$3,487	0.563	$1,964
30		$30,987	$30,987	0.552	$17,107

TOTAL PRESENT WORTH **$2,122,627**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW4: In-Situ Chemical Oxidation, Monitored Natural Attenuation, and LUCs
Capital Cost

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Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 ISCO Design	1	ls	$4,000.00				$4,000	$0	$0	$0	$4,000
1.2 Design Documents	160	hr			$39.00		$0	$0	$6,240	$0	$6,240
1.3 Prepare Documents & Plans including Permits	450	hr			$39.00		$0	$0	$17,550	$0	$17,550
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	2	ea			$188.00	$566.00	$0	$0	$376	$1,132	$1,508
2.3 Drill Rig Mobilization/Demobilization	2	ea	$2,000.00				$4,000	$0	$0	$0	$4,000
2.4 ISCO System Mobilization/Demobilization	1	ea	$15,000.00				$15,000	$0	$0	$0	$15,000
3 SITE SUPPORT											
3.1 Office Trailer	3.0	mo				$365.00	$0	$0	$0	$1,095	$1,095
3.2 Field Office Equipment, Utilities, & Support	3.0	mo		$380.00			$0	$1,140	$0	$0	$1,140
3.3 Storage Trailer	3.0	mo				$94.00	$0	$0	$0	$282	$282
3.4 Survey Support	5	day	$1,150.00				$5,750	$0	$0	$0	$5,750
3.5 Site Superintendent	68	day		$220.00	$480.00		$0	$14,960	$32,640	$0	$47,600
3.6 Site Health & Safety and QA/QC (1/2 time)	34	day		$220.00	$360.00		$0	$7,480	$12,240	$0	$19,720
3.7 Site Labor, (2 laborers)	136	day			$280.80		$0	$0	$38,189	$0	$38,189
4 DECONTAMINATION											
4.1 Decontamination Services	3	mo		$1,220.00	$2,245.00	$1,550.00	$0	$3,660	$6,735	$4,650	$15,045
4.2 Equipment Decon Pad	1	ls		$4,500.00	$3,000.00	$725.00	$0	$4,500	$3,000	$725	$8,225
4.3 Decon Water	3,000	gal		$0.20			$0	$600	$0	$0	$600
4.4 Decon Water Storage Tank, 6,000 gallon	3	mo				$813.00	$0	$0	$0	$2,439	$2,439
4.5 Clean Water Storage Tank, 4,000 gallon	3	mo				$731.00	$0	$0	$0	$2,193	$2,193
4.6 Disposal of Decon Waste (liquid & solid)	3	mo	$985.00				$2,955	$0	$0	$0	$2,955
5 BENCH TEST											
5.1 Bench Test Sampling	40	hr			$39.00		$0	$0	$1,560	$0	$1,560
5.2 Bench Test Sampling ODC	1	ls		$500.00			$0	$500	$0	$0	$500
5.3 Bench Test Analysis	5	ea	$200.00				$1,000	$0	$0	$0	$1,000
6 PILOT STUDY											
6.1 Pilot Scale Work Plan	1	ls			$15,000.00		$0	$0	$15,000	$0	$15,000
6.2 Injection Well Installation	1,440	lf	$40.00				$57,600	$0	$0	$0	$57,600
6.3 Injection Well Heads	32	ea	$150.00				$4,800	$0	$0	$0	$4,800
6.4 Injection Labor/Equipment	3	day	$4,000.00				$12,000	$0	$0	$0	$12,000
6.5 ISCO Reagent	24,000	gal		$1.50			$0	$36,000	$0	$0	$36,000
6.6 Water Tank Truck	3	day				$430.00	$0	$0	$0	$1,290	$1,290
6.7 Skid-Steer	3	day			$358.00	$281.20	$0	$0	$1,074	$844	$1,918
6.8 IDW Disposal	16	drum	$200.00				$3,200	$0	$0	$0	$3,200
6.9 Pavement Coring & Repair	0	ea	$90.00				$0	$0	$0	$0	$0
7 FULL TREATMENT											
7.1 Injection Well Installation	16,960	lf	$40.00				$678,400	$0	$0	$0	$678,400
7.2 Injection Well Heads	416	ea	$150.00				$62,400	$0	$0	$0	$62,400
7.3 Injection Labor/Equipment	42	day	$4,000.00				$168,000	$0	$0	$0	$168,000
7.4 ISCO Reagent	312,000	gal		$1.50			$0	$468,000	$0	$0	$468,000
7.5 Water Tank Truck	42	day				$430.00	$0	$0	$0	$18,060	$18,060
7.6 Skid-Steer	42	day			$358.00	$281.20	$0	$0	$15,036	$11,810	$26,846
7.7 IDW Disposal	208	drum	$200.00				$41,600	$0	$0	$0	$41,600
7.8 Pavement Coring & Repair	20	ea	$90.00				$1,800	$0	$0	$0	$1,800

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW4: In-Situ Chemical Oxidation, Monitored Natural Attenuation, and LUCs
Capital Cost

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				Unit Cost			Extended Cost				
Item	Quantity	Unit	Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Subtotal
7.9 Revegetation, seed	16.5	msf	$96.50				$1,592	$0	$0	$0	$1,592
7.10 Post-Injection Sampling Labor, 5 events	250	hr			$39.00		$0	$0	$9,750	$0	$9,750
7.11 Post-Injection Sampling ODCs	5	ea		$500.00			$0	$2,500	$0	$0	$2,500
7.12 Post-Injection Analysis	60	ea	$1,000.00				$60,000	$0	$0	$0	$60,000
7.13 Post-Injection Report	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
8 POST CONSTRUCTION COST											
8.1 Contractor Completion Report	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
8.2 Remedial Action Closeout Report	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
Subtotal							$1,124,097	$540,340	$180,840	$48,020	$1,893,297
Overhead on Labor Cost @ 30%									$54,252		$54,252
G & A on Cost @ 10%							$112,410	$54,034	$18,084	$4,802	$189,330
Tax on Materials and Equipment Cost @ 7%								$37,824		$3,361	$41,185
Total Direct Cost							$1,236,507	$632,198	$253,176	$56,183	$2,178,064
Indirects on Total Direct Cost @ 20%											$435,613
Profit on Total Direct Cost @ 10%											$217,806
Total Field Cost											$2,831,483
Engineering on Total Field Costs @ 10%											$283,148
Contingency on Total Field Costs @ 10%											$283,148
TOTAL CAPITAL COST											**$3,397,780**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW4: In-Situ Chemical Oxidation, Monitored Natural Attenuation, and LUCs
Capital Cost for Year 1

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 ISCO Design	0	ls	$4,000.00				$0	$0	$0	$0	$0
1.2 Design Documents	0	hr			$39.00		$0	$0	$0	$0	$0
1.3 Prepare Documents & Plans including Permits	100	hr			$39.00		$0	$0	$3,900	$0	$3,900
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	2	ea			$188.00	$566.00	$0	$0	$376	$1,132	$1,508
2.3 Drill Rig Mobilization/Demobilization	2	ea	$2,000.00				$4,000	$0	$0	$0	$4,000
2.4 ISCO System Mobilization/Demobilization	1	ea	$15,000.00				$15,000	$0	$0	$0	$15,000
3 SITE SUPPORT											
3.1 Office Trailer	3.0	mo				$365.00	$0	$0	$0	$1,095	$1,095
3.2 Field Office Equipment, Utilities, & Support	3.0	mo		$380.00			$0	$1,140	$0	$0	$1,140
3.3 Storage Trailer	3.0	mo				$94.00	$0	$0	$0	$282	$282
3.4 Survey Support	5	day	$1,150.00				$5,750	$0	$0	$0	$5,750
3.5 Site Superintendent	68	day		$220.00	$480.00		$0	$14,960	$32,640	$0	$47,600
3.6 Site Health & Safety and QA/QC (1/2 time)	34	day		$220.00	$360.00		$0	$7,480	$12,240	$0	$19,720
3.7 Site Labor, (2 laborers)	136	day			$280.80		$0	$0	$38,189	$0	$38,189
4 DECONTAMINATION											
4.1 Decontamination Services	3	mo		$1,220.00	$2,245.00	$1,550.00	$0	$3,660	$6,735	$4,650	$15,045
4.2 Equipment Decon Pad	1	ls		$4,500.00	$3,000.00	$725.00	$0	$4,500	$3,000	$725	$8,225
4.3 Decon Water	3,000	gal		$0.20			$0	$600	$0	$0	$600
4.4 Decon Water Storage Tank, 6,000 gallon	3	mo				$813.00	$0	$0	$0	$2,439	$2,439
4.5 Clean Water Storage Tank, 4,000 gallon	3	mo				$731.00	$0	$0	$0	$2,193	$2,193
4.6 Disposal of Decon Waste (liquid & solid)	3	mo	$985.00				$2,955	$0	$0	$0	$2,955
5 FULL TREATMENT IN YEAR 1											
5.1 Injection Labor/Equipment	45	day	$4,000.00				$180,000	$0	$0	$0	$180,000
5.2 ISCO Reagent	168,000	gal		$1.50			$0	$252,000	$0	$0	$252,000
5.3 Water Tank Truck	45	day				$430.00	$0	$0	$0	$19,350	$19,350
5.4 Skid-Steer	45	day			$358.00	$281.20	$0	$0	$16,110	$12,654	$28,764
5.5 IDW Disposal	224	drum	$200.00				$44,800	$0	$0	$0	$44,800
5.6 Post-Injection Sampling Labor, 5 events	250	hr			$39.00		$0	$0	$9,750	$0	$9,750
5.7 Post-Injection Sampling ODCs	5	ea		$500.00			$0	$2,500	$0	$0	$2,500
5.8 Post-Injection Analysis	60	ea	$1,000.00				$60,000	$0	$0	$0	$60,000
5.9 Contractor Completion Report	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
Subtotal							$312,505	$287,840	$128,790	$48,020	$777,155
Overhead on Labor Cost @ 30%									$38,637		$38,637
G & A on Cost @ 10%							$31,251	$28,784	$12,879	$4,802	$77,715
Tax on Materials and Equipment Cost @ 7%								$20,149		$3,361	$23,510
Total Direct Cost							$343,756	$336,773	$180,306	$56,183	$917,017
Indirects on Total Direct Cost @ 20%											$183,403
Profit on Total Direct Cost @ 10%											$91,702
Total Field Cost											$1,192,123
Engineering on Total Field Costs @ 15%											$178,818
Contingency on Total Field Costs @ 20%											$238,425
TOTAL CAPITAL COST											**$1,609,366**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW4: In-Situ Chemical Oxidation, Monitored Natural Attenuation, and LUCs
Sampling Cost

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Item	Item Cost Year 1	Item Cost Years 2 & 3	Item Cost Years 4 - 30	Notes
Groundwater Sampling	$136,000	$68,000	$34,000	Labor and supplies for groundwater samples using a crew of three
Groundwater Sampling for Natural Attenuation	$98,784	$49,392	$24,696	Analyze groundwater samples for natural attenuation 4 times in year 1, twice a years 2 and 3, & once a year in years 4 through 30.
Sampling Report	$14,000	$7,000	$3,500	
Subtotal	$248,784	$124,392	$62,196	
Contingency @ 10%	$24,878	$12,439	$6,220	
TOTAL	**$273,662**	**$136,831**	**$68,416**	

Note: Land Use Controls and Five Years Reviews included in Soil Alternatives.

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW4: In-Situ Chemical Oxidation, Monitored Natural Attenuation, and LUCs
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$3,397,780		$3,397,780	1.000	$3,397,780
1	$1,609,366	$273,662	$1,883,028	0.980	$1,846,106
2		$136,831	$136,831	0.961	$131,518
3		$136,831	$136,831	0.942	$128,939
4		$68,416	$68,416	0.924	$63,205
5		$68,416	$68,416	0.906	$61,966
6		$68,416	$68,416	0.888	$60,751
7		$68,416	$68,416	0.871	$59,560
8		$68,416	$68,416	0.853	$58,392
9		$68,416	$68,416	0.837	$57,247
10		$68,416	$68,416	0.820	$56,125
11		$68,416	$68,416	0.804	$55,024
12		$68,416	$68,416	0.788	$53,945
13		$68,416	$68,416	0.773	$52,887
14		$68,416	$68,416	0.758	$51,850
15		$68,416	$68,416	0.743	$50,834
16		$68,416	$68,416	0.728	$49,837
17		$68,416	$68,416	0.714	$48,860
18		$68,416	$68,416	0.700	$47,902
19		$68,416	$68,416	0.686	$46,963
20		$68,416	$68,416	0.673	$46,042
21		$68,416	$68,416	0.660	$45,139
22		$68,416	$68,416	0.647	$44,254
23		$68,416	$68,416	0.634	$43,386
24		$68,416	$68,416	0.622	$42,535
25		$68,416	$68,416	0.610	$41,701
26		$68,416	$68,416	0.598	$40,884
27		$68,416	$68,416	0.586	$40,082
28		$68,416	$68,416	0.574	$39,296
29		$68,416	$68,416	0.563	$38,526
30		$68,416	$68,416	0.552	$37,770
				TOTAL PRESENT WORTH	**$6,839,307**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW3: In-Situ Enhanced Bioremediation, Monitored Natural Attenuation, and LUCs
Capital Cost

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			Unit Cost				Extended Cost				
Item	Quantity	Unit	Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 ISEB Design	1	ls	$4,000.00				$4,000	$0	$0	$0	$4,000
1.2 Design Documents	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
1.3 Prepare Documents & Plans including Permits	350	hr			$39.00		$0	$0	$13,650	$0	$13,650
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	2	ea			$188.00	$566.00	$0	$0	$376	$1,132	$1,508
2.3 Drill Rig Mobilization/Demobilization	2	ea	$2,000.00				$4,000	$0	$0	$0	$4,000
3 SITE SUPPORT											
3.1 Office Trailer	4.0	mo				$365.00	$0	$0	$0	$1,460	$1,460
3.2 Field Office Equipment, Utilities, & Support	4.0	mo		$380.00			$0	$1,520	$0	$0	$1,520
3.3 Storage Trailer	4.0	mo				$94.00	$0	$0	$0	$376	$376
3.4 Survey Support	5	day	$1,150.00				$5,750	$0	$0	$0	$5,750
3.5 Site Superintendent	80	day		$220.00	$480.00		$0	$17,600	$38,400	$0	$56,000
3.6 Site Health & Safety and QA/QC (1/2 time)	40	day		$220.00	$360.00		$0	$8,800	$14,400	$0	$23,200
3.7 Site Labor, (2 laborers)	160	day			$280.80		$0	$0	$44,928	$0	$44,928
4 DECONTAMINATION											
4.1 Decontamination Services	4	mo		$1,220.00	$2,245.00	$1,550.00	$0	$4,880	$8,980	$6,200	$20,060
4.2 Equipment Decon Pad	1	ls		$4,500.00	$3,000.00	$725.00	$0	$4,500	$3,000	$725	$8,225
4.3 Decon Water	4,000	gal		$0.20			$0	$800	$0	$0	$800
4.4 Decon Water Storage Tank, 6,000 gallon	4	mo				$813.00	$0	$0	$0	$3,252	$3,252
4.5 Clean Water Storage Tank, 4,000 gallon	4	mo				$731.00	$0	$0	$0	$2,924	$2,924
4.6 Disposal of Decon Waste (liquid & solid)	4	mo	$985.00				$3,940	$0	$0	$0	$3,940
5 PILOT STUDY											
5.1 Pilot Scale Work Plan	1	ls			$15,000.00		$0	$0	$15,000	$0	$15,000
5.2 Injection Well Installation	1,440	lf	$40.00				$57,600	$0	$0	$0	$57,600
5.3 Injection Well Heads	32	ea	$150.00				$4,800	$0	$0	$0	$4,800
5.4 Injection Labor/Equipment	5	day	$4,000.00				$20,000	$0	$0	$0	$20,000
5.5 Emulsified Oil	6,240	lb		$3.51			$0	$21,902	$0	$0	$21,902
5.6 Injection Water	1,167	gal		$0.20			$0	$233	$0	$0	$233
5.7 Water Tank Truck	5	day				$430.00	$0	$0	$0	$2,150	$2,150
5.8 Skid-Steer	5	day			$358.00	$281.20	$0	$0	$1,790	$1,406	$3,196
5.9 IDW Disposal	16	drum	$200.00				$3,200	$0	$0	$0	$3,200
5.10 Pavement Coring & Repair	0	ea	$90.00				$0	$0	$0	$0	$0
6 FULL TREATMENT											
6.1 Injection Well Installation	21,820	lf	$40.00				$872,800	$0	$0	$0	$872,800
6.2 Injection Well Heads	524	ea	$150.00				$78,600	$0	$0	$0	$78,600
6.3 Injection Labor/Equipment	51	day	$4,000.00				$204,000	$0	$0	$0	$204,000
6.4 Emulsified Oil	100,969	lb		$3.51			$0	$354,401	$0	$0	$354,401
6.5 Injection Water	20,907	gal		$0.20			$0	$4,181	$0	$0	$4,181
6.6 Water Tank Truck	51	day				$430.00	$0	$0	$0	$21,930	$21,930
6.7 Skid-Steer	51	day			$358.00	$281.20	$0	$0	$18,258	$14,341	$32,599
6.8 IDW Disposal	262	drum	$200.00				$52,400	$0	$0	$0	$52,400
6.9 Pavement Coring & Repair	20	ea	$90.00				$1,800	$0	$0	$0	$1,800
6.10 Revegetation, seed	16.5	msf	$96.50				$1,592	$0	$0	$0	$1,592
6.11 Post-Injection Sampling Labor, 2 events	100	hr			$39.00		$0	$0	$3,900	$0	$3,900
6.12 Post-Injection Sampling ODCs	28	ea		$500.00			$0	$14,000	$0	$0	$14,000
6.13 Post-Injection Analysis	28	ea	$1,000.00				$28,000	$0	$0	$0	$28,000
6.14 Post-Injection Report	80	hr			$39.00		$0	$0	$3,120	$0	$3,120

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW3: In-Situ Enhanced Bioremediation, Monitored Natural Attenuation, and LUCs
Capital Cost

	Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
7	**POST CONSTRUCTION COST**											
7.1	Contractor Completion Report	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
7.2	Remedial Action Closeout Report	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
	Subtotal							$1,342,482	$433,818	$187,252	$59,396	$2,022,949
	Overhead on Labor Cost @ 30%									$56,176		$56,176
	G & A on Cost @ 10%							$134,248	$43,382	$18,725	$5,940	$202,295
	Tax on Materials and Equipment Cost @ 7%								$30,367		$4,158	$34,525
	Total Direct Cost							$1,476,730	$507,568	$262,153	$69,494	$2,315,944
	Indirects on Total Direct Cost @ 20%											$463,189
	Profit on Total Direct Cost @ 10%											$231,594
	Total Field Cost											$3,010,728
	Engineering on Total Field Costs @ 10%											$301,073
	Contingency on Total Field Costs @ 15%											$451,609
	TOTAL CAPITAL COST											**$3,763,410**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW3: In-Situ Enhanced Bioremediation, Monitored Natural Attenuation, and LUCs
Capital Cost (Year 2)

Item	Quantity	Unit	Unit Cost: Subcontract	Unit Cost: Material	Unit Cost: Labor	Unit Cost: Equipment	Extended Cost: Subcontract	Extended Cost: Material	Extended Cost: Labor	Extended Cost: Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Design Documents	100	hr			$39.00		$0	$0	$3,900	$0	$3,900
1.2 Prepare Documents & Plans including Permits	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	2	ea			$183.00	$518.00	$0	$0	$366	$1,036	$1,402
3 SITE SUPPORT											
3.1 Office Trailer	4.0	mo				$365.00	$0	$0	$0	$1,460	$1,460
3.2 Field Office Equipment, Utilities, & Support	4.0	mo		$380.00			$0	$1,520	$0	$0	$1,520
3.3 Storage Trailer	4.0	mo				$94.00	$0	$0	$0	$376	$376
3.4 Site Superintendent	80	day		$220.00	$480.00		$0	$17,600	$38,400	$0	$56,000
3.5 Site Labor, (2 laborers)	160	day			$280.80		$0	$0	$44,928	$0	$44,928
4 DECONTAMINATION											
4.1 Decontamination Services	6	mo		$1,220.00	$2,245.00	$1,550.00	$0	$7,320	$13,470	$9,300	$30,090
4.2 Equipment Decon Pad	0	ls		$4,500.00	$3,000.00	$725.00	$0	$0	$0	$0	$0
4.3 Decon Water	6,000	gal		$0.20			$0	$1,200	$0	$0	$1,200
4.4 Decon Water Storage Tank, 6,000 gallon	6	mo				$813.00	$0	$0	$0	$4,878	$4,878
4.5 Clean Water Storage Tank, 4,000 gallon	6	mo				$731.00	$0	$0	$0	$4,386	$4,386
4.6 Disposal of Decon Waste (liquid & solid)	6	mo	$985.00				$5,910	$0	$0	$0	$5,910
5 SECOND TREATMENT											
5.1 Injection Labor/Equipment	56	day	$4,000.00				$224,000	$0	$0	$0	$224,000
5.2 Emulsified Oil	107,209	lb		$3.51			$0	$376,304	$0	$0	$376,304
5.3 Injection Water	22,074	gal		$0.20			$0	$4,415	$0	$0	$4,415
5.4 Water Tank Truck	56	day				$430.00	$0	$0	$0	$24,080	$24,080
5.5 Skid-Steer	56	day			$358.00	$281.20	$0	$0	$20,048	$15,747	$35,795
5.6 IDW Disposal	278	drum	$200.00				$55,600	$0	$0	$0	$55,600
5.7 Contractor Completion Report	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
Subtotal							$285,510	$409,358	$132,812	$64,763	$892,444
Overhead on Labor Cost @ 30%									$39,844		$39,844
G & A on Cost @ 10%							$28,551	$40,936	$13,281	$6,476	$89,244
Tax on Materials and Equipment Cost @ 7%								$28,655		$4,533	$33,189
Total Direct Cost							$314,061	$478,949	$185,937	$75,773	$1,054,720
Indirects on Total Direct Cost @ 20%											$210,944
Profit on Total Direct Cost @ 10%											$105,472
Total Field Cost											$1,371,136
Engineering on Total Field Costs @ 2%											$27,423
Contingency on Total Field Costs @ 10%											$137,114
TOTAL CAPITAL COST											**$1,535,672**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW3: In-Situ Enhanced Bioremediation, Monitored Natural Attenuation, and LUCs
Sampling Cost

Item	Item Cost Year 1	Item Cost Years 2 & 3	Item Cost Years 4 - 30	Notes
Groundwater Sampling	$136,000	$68,000	$34,000	Labor and supplies for groundwater samples using a crew of three
Groundwater Sampling for Natural Attenuation	$98,784	$49,392	$24,696	Analyze groundwater samples for natural attenuation 4 times in year 1, twice a years 2 and 3, & once a year in years 4 through 30.
Sampling Report	$14,000	$7,000	$3,500	
Subtotal	$248,784	$124,392	$62,196	
Contingency @ 10%	$24,878	$12,439	$6,220	
TOTAL	**$273,662**	**$136,831**	**$68,416**	

Note: Land Use Controls and Five Years Reviews included in Soil Alternatives.

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Groundwater Alternative
Alternative GW3: In-Situ Enhanced Bioremediation, Monitored Natural Attenuation, and LUCs
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$3,763,410		$3,763,410	1.000	$3,763,410
1		$273,662	$273,662	0.980	$268,296
2	$1,535,672	$136,831	$1,672,504	0.961	$1,607,558
3		$136,831	$136,831	0.942	$128,939
4		$68,416	$68,416	0.924	$63,205
5		$68,416	$68,416	0.906	$61,966
6		$68,416	$68,416	0.888	$60,751
7		$68,416	$68,416	0.871	$59,560
8		$68,416	$68,416	0.853	$58,392
9		$68,416	$68,416	0.837	$57,247
10		$68,416	$68,416	0.820	$56,125
11		$68,416	$68,416	0.804	$55,024
12		$68,416	$68,416	0.788	$53,945
13		$68,416	$68,416	0.773	$52,887
14		$68,416	$68,416	0.758	$51,850
15		$68,416	$68,416	0.743	$50,834
16		$68,416	$68,416	0.728	$49,837
17		$68,416	$68,416	0.714	$48,860
18		$68,416	$68,416	0.700	$47,902
19		$68,416	$68,416	0.686	$46,963
20		$68,416	$68,416	0.673	$46,042
21		$68,416	$68,416	0.660	$45,139
22		$68,416	$68,416	0.647	$44,254
23		$68,416	$68,416	0.634	$43,386
24		$68,416	$68,416	0.622	$42,535
25		$68,416	$68,416	0.610	$41,701
26		$68,416	$68,416	0.598	$40,884
27		$68,416	$68,416	0.586	$40,082
28		$68,416	$68,416	0.574	$39,296
29		$68,416	$68,416	0.563	$38,526
30		$68,416	$68,416	0.552	$37,770
				TOTAL PRESENT WORTH	**$7,103,168**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SD4: Sediment Removal Stream and Off-Site Disposal
Capital Cost

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Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
1.2 Prepare Permits	300	hr			$39.00		$0	$0	$11,700	$0	$11,700
1.3 Prepare LUCs	250	hr			$39.00		$0	$0	$9,750	$0	$9,750
2 MOBILIZATION AND DEMOBILIZATION											
2.1 Site Support Facilities (trailers, phone, electric, etc.)	1	ls		$1,000.00		$3,500.00	$0	$1,000	$0	$3,500	$4,500
2.2 Equipment Mobilization/Demobilization	10	ea			$188.00	$566.00	$0	$0	$1,880	$5,660	$7,540
2.3 Hydraulic Dredging Mobilization/Demobilization	1	ea	$5,200.00				$5,200	$0	$0	$0	$5,200
3 FIELD SUPPORT AND SITE ACCESS											
3.1 Office Trailer	2.5	mo				$365.00	$0	$0	$0	$913	$913
3.2 Field Office Equipment, Utilities, & Support	2.5	mo		$380.00			$0	$950	$0	$0	$950
3.3 Storage Trailer	2.5	mo				$94.00	$0	$0	$0	$235	$235
3.4 Survey Support	2	day	$1,150.00				$2,300	$0	$0	$0	$2,300
3.5 Site Superintendent	50	day		$220.00	$480.00		$0	$11,000	$24,000	$0	$35,000
3.6 Site Health & Safety and QA/QC	50	day		$220.00	$360.00		$0	$11,000	$18,000	$0	$29,000
3.7 Underground Utility Clearance	1	ls	$10,525.00				$10,525	$0	$0	$0	$10,525
3.8 Temporary Access Road	275	sy		$8.30	$6.10	$1.98	$0	$2,283	$1,678	$545	$4,505
4 DECONTAMINATION											
4.1 Decontamination Services	2	mo		$1,220.00	$2,245.00	$1,550.00	$0	$2,440	$4,490	$3,100	$10,030
4.2 Equipment Decon Pad	1	ls		$4,500.00	$3,000.00	$725.00	$0	$4,500	$3,000	$725	$8,225
4.3 Decon Water	2,000	gal		$0.20			$0	$400	$0	$0	$400
4.4 Decon Water Storage Tank, 6,000 gallon	2	mo				$813.00	$0	$0	$0	$1,626	$1,626
4.5 Clean Water Storage Tank, 4,000 gallon	2	mo				$731.00	$0	$0	$0	$1,462	$1,462
4.6 Disposal of Decon Waste (liquid & solid)	2	mo	$985.00				$1,970	$0	$0	$0	$1,970
5 SITE PREPARATION											
5.1 Excavator, 2.5 cy	10	day			$382.40	$1,652.00	$0	$0	$3,824	$16,520	$20,344
5.2 Skid-Steer	10	day			$358.00	$281.20	$0	$0	$3,580	$2,812	$6,392
5.3 Site Labor, (3 laborers)	30	day			$280.80		$0	$0	$8,424	$0	$8,424
5.4 Clear & Chip Trees	5	day			$358.00	$710.60	$0	$0	$1,790	$3,553	$5,343
5.5 Off-Site Disposal of Chipped Trees	150	ton	$45.00				$6,750	$0	$0	$0	$6,750
6 STREAM SEDIMENT REMOVAL AND DISPOSAL											
6.1 Excavator, 2.5 cy	2	day			$382.40	$1,652.00	$0	$0	$765	$3,304	$4,069
6.2 Skid-Steer	2	day			$358.00	$281.20	$0	$0	$716	$562	$1,278
6.3 Site Labor, (3 laborers)	6	day			$280.80		$0	$0	$1,685	$0	$1,685
6.4 Verification Samples, PCBs, PAHs, metals	3	ea	$360.00	$20.00	$50.00	$20.00	$1,080	$60	$150	$60	$1,350
6.5 Absorbent Polymer for Trucks	3	load		$130.00			$0	$390	$0	$0	$390
6.6 T & D of Excavated Treated Soil, non-hazardous	61	ton	$85.00				$5,185	$0	$0	$0	$5,185
6.7 Waste Disposal Characterization / Analytical	2	ea	$850.00	$30.00	$50.00	$30.00	$1,700	$60	$100	$60	$1,920
7 POND SEDIMENT REMOVAL AND DISPOSAL											
7.1 Bathymetric Survey (pre-cover)	1	ea	$5,000.00				$5,000	$0	$0	$0	$5,000
7.2 Pad & Channel Liner	36,500	sf		$0.29	$0.59		$0	$10,585	$21,535	$0	$32,120
7.3 Hydraulic Dredging (incl. dewatering)	4,041	cy	$45.50				$183,866	$0	$0	$0	$183,866
7.4 Bathymetric Survey (post-cover)	1	ea	$5,000.00				$5,000	$0	$0	$0	$5,000
7.5 Verification Samples, PCBs, PAHs, metals	91	ea	$360.00	$20.00	$50.00	$20.00	$32,760	$1,820	$4,550	$1,820	$40,950
7.6 Geotube, 60' by 100'	6	ea		$5,200.00			$0	$31,200	$0	$0	$31,200
7.7 Excavator, 2.5 cy	25	day			$382.40	$1,652.00	$0	$0	$9,560	$41,300	$50,860
7.8 Skid-Steer	25	day			$358.00	$281.20	$0	$0	$8,950	$7,030	$15,980
7.9 Site Labor (3 laborers)	75	day			$280.80		$0	$0	$21,060	$0	$21,060
7.10 Absorbent Polymer for Trucks	269	load		$130.00			$0	$35,022	$0	$0	$35,022
7.11 T & D of Excavated Treated Sediment non-hazardous	4,849	ton	$85.00				$412,182	$0	$0	$0	$412,182
7.12 Waste Disposal Characterization / Analytical	4	ea	$850.00	$30.00	$50.00	$30.00	$3,400	$120	$200	$120	$3,840

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SD4: Sediment Removal Stream and Off-Site Disposal
Capital Cost

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
8 POST CONSTRUCTION COST											
8.1 T & D of Liner, non-hazardous	3	ton	$85.00				$255	$0	$0	$0	$255
8.2 Revegetation, seed	32.5	msf	$96.50				$3,136	$0	$0	$0	$3,136
8.3 Wetlands Reseeding	325	csf	$37.47				$12,178	$0	$0	$0	$12,178
9 POST CONSTRUCTION COST											
9.1 Contractor Completion Report	150	hr			$39.00		$0	$0	$5,850	$0	$5,850
9.2 Remedial Action Closeout Report	200	hr			$39.00		$0	$0	$7,800	$0	$7,800
Subtotal							$692,487	$112,830	$182,836	$94,906	$1,083,059
Overhead on Labor Cost @ 30%									$54,851		$54,851
G & A on Labor, Material, Equipment, & Subs Cost @ 10%							$69,249	$11,283	$18,284	$9,491	$108,306
Tax on Materials and Equipment Cost @ 7.0%								$7,898		$6,643	$14,542
Total Direct Cost							$761,735	$132,011	$255,971	$111,040	$1,260,757
Indirects on Total Direct Cost @ 25%		(excluding transportation and disposal cost)									$208,604
Profit on Total Direct Cost @ 10%											$126,076
Subtotal											$1,595,436
Health & Safety Monitoring @ 2%											$31,909
Total Field Cost											$1,627,345
Engineering on Total Field Cost @ 10%											$162,734
Contingency on Total Field Cost @ 25%											$406,836
TOTAL CAPITAL COST											**$2,196,915**

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative
Alternative SD4: Sediment Removal Stream and Off-Site Disposal
Annual Cost

Item	Item Cost Years 1, 2, 3, 4	Item Cost Year 5	Notes
Sediment Sampling	$6,550	$6,550	Labor and supplies to collect samples from 8 locations using a crew of two, annually for five years.
Sediment Analysis	$4,032	$4,032	Analyze sediment samples for PCBs, PAHs, & metals (for five years)
Sampling Report	$3,500	$3,500	
Completion Report		$23,000	
Subtotal	$14,082	$37,082	
Contingency @ 10%	$1,408	$3,708	
TOTAL	**$15,490**	**$40,790**	

Note: Land Use Controls and Five Years Reviews included in Soil Alternatives.

NAVAL STATION (NAVSTA) NEWPORT
NEWPORT, RI
Site 8 - Naval Undersea System Center Disposal Area
Soil Alternative

Alternative SD4: Sediment Removal Stream and Off-Site Disposal
Present Worth Analysis

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate 2.0%	Present Worth
0	$2,196,915		$2,196,915	1.000	$2,196,915
1		$15,490	$15,490	0.980	$15,186
2		$15,490	$15,490	0.961	$14,889
3		$15,490	$15,490	0.942	$14,597
4		$15,490	$15,490	0.924	$14,311
5		$40,790	$40,790	0.906	$36,945
				TOTAL PRESENT WORTH	**$2,292,843**

Appendix C
Human Health Risk Assessment Summary Tables

TABLE C-1

EXPOSURE POINT CONCENTRATIONS FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Exposed Area Surface Soil (mg/kg)	Exposed Area Subsurface Soil (mg/kg)	Paved Area Surface Soil (mg/kg)	Paved Area Subsurface Soil (mg/kg)	Groundwater (ug/L)	Surface Water (ug/L)	Sediment (mg/kg)	Fish Fillets (mg/kg)
Volatile Organic Compounds								
1,1-Dichloroethane	NA	NA	NA		310(9)	NA	NA	NA
1,2,4-Trimethylbenzene	NA	NA	NA	2.4(5)	810(9)	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	3.6(13)	290(9)	NA	NA	NA
Bromomethane	NA	NA	NA	NA	2(9)	NA	NA	NA
Carbon Tetrachloride	NA	NA	NA	NA	2(9)	NA	NA	NA
Chloroform	NA	NA	NA	NA	7(9)	NA	NA	NA
Chloromethane	NA	NA	NA	NA	16(9)	NA	NA	NA
Ethylbenzene	NA	NA	NA	NA	58(9)	NA	NA	NA
Isopropylbenzene	NA	NA	NA	NA	94(9)	NA	NA	NA
Tetrachloroethene	NA	NA	NA	NA	12(9)	NA	NA	NA
Total Xylenes	NA	NA	NA	NA	97(9)	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	730(9)	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	19(9)	NA	NA	NA
Semivolatile Organic Compounds								
Acenaphthene	NA	76.6(1)	NA	NA	NA	NA	NA	NA
Anthracene	NA	153(1)	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	3.22(1)	302(1)	2.69(13)	2.8(5)	NA	NA	1.37(6)	NA
Benzo(a)pyrene	2.44(1)	243(1)	2.32(13)	1.4(1)	NA	NA	1.13(6)	NA
Benzo(b)fluoranthene	2.55(1)	210(1)	2.75(13)	1.59(1)	4(9)	NA	1.06(6)	NA
Benzo(g,h,i)perylene	0.96(2)	134(1)	0.551(1)	0.52(13)	NA	NA	0.764(6)	NA
Benzo(k)fluoranthene	1.88(1)	199(1)	1.1(1)	1.3(1)	NA	NA	1.01(6)	NA
Chrysene	2.87(1)	269(1)	1.5(1)	2.75(13)	NA	NA	1.38(6)	NA
Dibenzo(a,h)anthracene	0.4(2)	52.7(1)	0.141(3)	0.108(3)	NA	NA	0.14(3)	NA
Fluoranthene	7.3(1)	723(1)	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1.1(2)	138(1)	1.12(13)	0.317(3)	NA	NA	0.677(13)	NA
Naphthalene	1.2(1)	35.1(1)	NA	NA	NA	NA	NA	NA
Phenanthrene	6.66(1)	563(1)	NA	NA	NA	NA	NA	NA
Pyrene	7.1(1)	569(1)	NA	NA	NA	NA	NA	NA
Pesticides/PCBs								
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	0.648(4)
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	0.021(12)
Aldrin	NA	NA	NA	NA	NA	NA	NA	0.002(5)
Dieldrin	NA	NA	NA	NA	0.0108(9)	0.013(14)	0.027(14)	0.039(10)
Total Aroclor	0.332(3)	0.535(2)	NA	1.5(12)	NA	NA	0.456(3)	0.608(10)

TABLE C-1

EXPOSURE POINT CONCENTRATIONS FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Exposed Area		Paved Area		Groundwater	Surface Water	Sediment	Fish Fillets
	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)	Surface Soil (mg/kg)	Subsurface Soil (mg/kg)	(ug/L)	(ug/L)	(mg/kg)	(mg/kg)
Inorganics								
Aluminum	12256(4)	13532(4)	10938(4)	12570(4)	564000(9)	96.7(5)	13411(4)	NA
Antimony	0.436(5)	0.574(5)	NA	NA	1.2(9)	NA	NA	NA
Arsenic	23.9(6)	17.7(4)	18.6(4)	35(6)	503(9)	2.7(14)	15.2(4)	0.005(4)
Barium	NA	NA	NA	NA	1390(9)	NA	NA	NA
Beryllium	0.434(4)	0.518(8)	0.395(5)	0.47(2)	17.8(9)	NA	0.48(8)	NA
Cadmium	1.51	0.907(3)	NA	NA	NA	NA	NA	NA
Chromium	20.5(6)	19.6(9)	15.4(4)	24.3(8)	868(9)	NA	18.8(4)	3.27(4)
Cobalt	27.1(6)	16.1(7)	12.9(4)	13.5(4)	637(9)	1.1(14)	88.1(10)	NA
Copper	47.4(3)	235(6)	NA	NA	1440(9)	NA	NA	NA
Iron	27468(4)	41374(6)	26054(4)	29083(4)	1210000(9)	612(2)	27909(4)	NA
Lead	73.1(7)	190(7)	NA	18(7)	1890(9)	NA	1797(7)	NA
Manganese	436(4)	835(6)	418(10)	1100(6)	13800(9)	156(4)	1301(4)	NA
Mercury	NA	NA	NA	NA	1.9(9)	NA	NA	0.1(4)
Molybdenum	NA	3.1(3)	NA	NA	20.3(9)	67.2(14)	NA	NA
Nickel	NA	NA	NA	NA	1160(9)	NA	NA	NA
Thallium	NA	0.15(2)	NA	NA	2.3(9)	3.53(12)	NA	NA
Vanadium	22.3(4)	21.2(10)	NA	NA	832(9)	NA	27.2(3)	NA
Zinc	NA	888(11)	NA	NA	3990(9)	NA	NA	NA

Notes:

NA - Not applicable. Not a COPC for this media.

1 - 97.5% KM (Chebyshev) UCL.
2 - 95% KM (Chebyshev) UCL.
3 - 95% KM (BCA) UCL.
4 - Student-t UCL.
5 - 95% KM(T) UCL.
6 - 95% Chebyshev(Mean, Std) UCL.
7 - Arithmetic Mean.
8 - 95% Modified t UCL.
9 - H-UCL.
10 - Approximate Gamma 95% UCL.
11 - 97.5% Chebyshev(Mean, Std) UCL.
12 - Maximum detected concentration.
13 - 99% KM(Chebyshev) UCL.
14 - 95% KM(Percentile Bootstrap).
RAGS Part D tables for the exposure point concentrations are included in Appendix H.1.

TABLE C-2
COMPARISON OF SURFACE SOIL CONCENTRATIONS FROM THE HHRA AND SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, RHODE ISLAND

Parameter	RI Report[1]				Supplemental RI	
	Exposed Area		Paved Area			
	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]
Semivolatile Organic Compounds (ug/kg)						
Benzo(a)anthracene	15 - 20,000	3,220	2.6 - 5,600	2,690	19 - 3,600	3,600
Benzo(a)pyrene	18 - 17,000	2,440	7.3 - 4,800	2,320	19 - 2,550	2,550
Benzo(b)fluoranthene	24.5 - 15,000	2,550	14 - 5,700	2,750	28 - 3,750	3,750
Benzo(g,h,i)perylene	12 - 7,400	960	3 - 2,000	551	13 - 1,350	1,350
Benzo(k)fluoranthene	13 - 12,000	1,880	6.8 - 3,900	1,100	9.7 - 1,230	1,230
Chrysene	13 - 17,000	2,870	2.8 - 5,700	1,500	20 - 3,350	3,350
Dibenzo(a,h)anthracene	5.4 - 3,500	400	10 - 760	141	12 - 445	445
Indeno(1,2,3-cd)pyrene	15 - 9,200	1,100	8.25 - 2,200	1,120	14 - 1,800	1,800
Metals (mg/kg)						
Aluminum	1,800 - 20,700	12,256	4,100 - 19,500	10,938	3,280 - 13,100	13,100
Arsenic	0.29 - 90	23.9	1.7 - 41	18.6	0.53 - 5	5
Beryllium	0.21 - 0.74	0.434	0.21 - 0.57	0.395	0.205 - 0.43	0.43
Cobalt	0.82 - 218	27.1	2.7 - 28	12.9	1.9 - 6.65	6.65
Iron	5270 - 43,700	27,468	8,540 - 38,900	26,054	6,990 - 16,600	16,600
Manganese	79.8 - 2,020	436	150 - 827	418	142 - 324	324

Notes:
1 - Remedial Investigation for Site 08, NUSC Disposal Area (Tetra Tech 2010a)
2 - The 95% UCL as calculated by EPA's ProUCL was used as the exposure point concentratinon for soil.

TABLE C-3
COMPARISON OF SUBSURFACE SOIL CONCENTRATIONS FROM THE RI AND SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, RHODE ISLAND

Parameter	RI Report[1]				Supplemental RI	
	Exposed Area		Paved Area			
	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]
Semivolatile Organic Compounds (ug/kg)						
Benzo(a)anthracene	3.2 - 1,900,000	302,000	5.4 - 7,700	2,800	5.2 - 160	78.9
Benzo(a)pyrene	6.2 - 1,500,000	243,000	5.6 - 5,700	1,400	4.9 - 140	72.2
Benzo(b)fluoranthene	7.2 - 1,300,000	210,000	12.2 - 6,500	1,590	17 - 220	73.0
Dibenzo(a,h)anthracene	4.5 - 330,000	52,700	6.9 - 700	108	2.3 - 23	10.7
Metals (mg/kg)						
Aluminum	4,450 - 27,200	13,532	3,800 - 20,700	12,570	8,230 - 21,000	13,663
Arsenic	2.7 - 40	17.7	2.25 - 122	35	2.8 - 27.3	15.5
Beryllium	0.21 - 2.5	0.518	0.2 - 0.76	0.47	0.3 - 0.6	0.433
Cobalt	3.4 - 35.6	16.1	5.7 - 21.5	13.5	4.2 - 23.8	13.3
Iron	3,800 - 134,000	41,374	13,000 - 40,000	29,083	13,300 - 40,700	27,442
Manganese	180 - 3,300	835	171 - 2,820	1,100	154 - 1,100	503

Notes:
1 - Remedial Investigation for Site 08, NUSC Disposal Area (Tetra Tech 2010a).
2 - The 95% UCL as calculated by EPA's ProUCL was used as the exposure point concentratinon for soil.

TABLE C-4
COMPARISON OF GROUNDWATER CONCENTRATIONS (DIRECT CONTACT) FOR THE RI AND SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL UNDERWATER SYSTEMS CENTER, NEWPORT, RHODE ISLAND

Parameter	RI Report[1]		Supplemental RI	
	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]
Volatile Organic Compounds (ug/L)				
1,1,1-Trichloroethane	NC	NC	0.29 - 440	440
1,1,2-Trichloroethane	NC	NC	0.48 - 0.48	0.48
1,1-Dichloroethane	0.4 - 310	310	0.28 - 1,000	1,000
1,1-Dichloroethene	NC	NC	0.45 - 52	52
1,2,4-Trimethylbenzene	0.3 - 810	810	0.51 - 3.6	3.6
Carbon Tetrachloride	2	2	1.85	1.85
Tetrachloroethene	0.5 - 12	12	0.53 - 8.3	8.3
Trichloroethene	2 - 730	730	0.37 - 1,200	1,200
Vinyl Chloride	0.3 - 19	19	0.31 - 3.7	3.7
Semivolatile Organic Compounds (ug/L)				
1,4-Dioxane	NA	NA	0.054 - 8.3	8.3
Energetics (ug/L)				
1,2-Propylene Glycol Dinitrate	NA	NA	0.11	0.11

Notes:
NC - Chemical was not a COPC for groundwater in the RI Report.
NA - Chemical was not analyzed for in samples collected for the RI report.
1 - Remedial Investigation for Site 08, NUSC Disposal Area (Tetra Tech 2010a)
2 - The maximum detected concentration is used as the exposure point concentration for groundwater.

TABLE C-5
COMPARISON OF GROUNDWATER CONCENTRATIONS (VAPOR INTRUSION) FOR THE RI AND SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, RHODE ISLAND

Parameter	RI Report[1]		Supplemental RI	
	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]
Volatile Organic Compounds (ug/L)				
1,1,1-Trichloroethane	NC	NC	440	440
1,1-Dichloroethane	NC	NC	0.48	0.48
Isopropylbenzene	NC	NC	1.3	1.3
Tetrachloroethene	0.5 - 2	2	0.58 - 8.3	8.3
Trichloroethene	0.9	0.9	0.57 - 3.9	3.9

Notes:
NC - Chemical was not a COPC for groundwater in the RI Report.
1 - Remedial Investigation for Site 08, NUSC Disposal Area (Tetra Tech 2010a)
2 - The maximum detected concentration is used as the exposure point concentration for groundwater.

TABLE C-6
COMPARISON OF SEDIMENT CONCENTRATIONS FOR THE RI AND SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, RHODE ISLAND

Parameter	RI Report[1]		Supplemental RI	
	Range of Detections	Exposure Point Concentration[2]	Range of Detections	Exposure Point Concentration[2]
Semivolatile Organic Compounds (ug/kg)				
Benzo(a)anthracene	16 - 3,400	1,370	71 - 780	780
Benzo(a)pyrene	15 - 2,600	1,130	69 - 590	590
Benzo(b)fluoranthene	27 - 2,300	1,060	120 - 845	845
Chrysene	8.7 - 3,300	1,380	74 - 735	735
Dibenzo(a,h)anthracene	11 - 640	140	12 - 81.5	81.5
Indeno(1,2,3-cd)pyrene	9.5 - 1,700	677	60 - 325	325

Notes:

1 - Remedial Investigation for Site 08, NUSC Disposal Area (Tetra Tech 2010a)

2 - The 95% UCL as calculated by EPA's ProUCL was used as the exposure point concentratinon for sediment.

TABLE C-7

SUMMARY OF EXPOSURE INPUT PARAMETERS FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident
All Exposures							
ED (years)	1[1]	25[2,17]	12[3]	6[2]	24[2]	6[2,17]	24[2,17]
BW (kg)	70[2]	70[2,17]	50[2]	15[2]	70[2]	15[2,17]	70[2,17]
AT_n (days)	365[4]	9,125[4,17]	4,380[4]	2,190[4]	8,760[4]	2,190[4,17]	8,760[4,17]
AT_c (days)	25,550[4]	25,550[4,17]	25,550[4]	25,550[4]	25,550[4]	25,550[4,17]	25,550[4,17]
Incidental Ingestion/Dermal Contact with Soil							
C_{soil} (mg/kg)	Maximum or 95% UCL[5]	Maximum or 95% UCL[5]	Maximum or 95% UCL[5]	Maximum or 95% UCL[5]	Maximum or 95% UCL[5]	Maximum or 95% UCL[5]	Maximum or 95% UCL[5]
IR (mg/day)	330[2]	100[2]	100[2]	200[2]	100[2]	200[2,17]	100[2,17]
EF-Soil (days/year)	130[1]	250[6,17]	48[7]	48[7]	48[7]	350[8,17]	350[8,17]
FI (unitless)	1	1	1	1	1	1	1
SA (cm^2/day)	3,300[6]	3,300[6]	4,050[9]	2,800[6]	5,700[6]	2,800[6]	5,700[6]
AF (mg/cm^2)	0.3[6]	0.2[6]	0.4[6]	0.2[6]	0.07[6]	0.2[6]	0.07[6]
ABS (unitless)	chemical-specific[6]	chemical-specific[6]	chemical-specific[6]	chemical-specific[6]	chemical-specific[6]	chemical-specific[6]	chemical-specific[6]
CF (kg/mg)	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06
Inhalation Fugitive Dust/Volatile Emissions from Soil							
C_{air} (mg/m^3)	calculated[10]	calculated[10]	calculated[10]	calculated[10]	calculated[10]	calculated[10]	calculated[10]
ET (hours/day)	8[1]	8[11]	8[7]	8[7]	8[7]	24	24
EF-Soil (days/year)	130[1]	250[6]	48[7]	48[7]	48[7]	350[8,17]	350[8,17]
PEF (m^3/kg)	1.4E+06[10]	1.1E+10[12]	1.1E+10[12]	1.1E+10[12]	1.1E+10[12]	1.1E+10[12]	1.1E+10[12]
Ingestion/Dermal Contact with Groundwater							
C_{gw} (µg/L)	Maximun	NA	NA	NA	NA	Maximun	Maximun
IR_{gw} (L/day)	0.05[13]	NA	NA	NA	NA	1.4[2,18]	2.0[2]
EF (days/year)	130[1]	NA	NA	NA	NA	350[8]	350[8]
ET (hours/day) and t_{event} (hours/event)	8[1]	NA	NA	NA	NA	1.0[6]	0.58[6]
EV (events/day)	1[13]	NA	NA	NA	NA	1[13]	1[13]
A (cm^2/day)	3,300[6]	NA	NA	NA	NA	6,600[6]	18,000[6]

TABLE C-7

SUMMARY OF EXPOSURE INPUT PARAMETERS FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident
Kp (cm/hour), t* (hour/event), τ (hour), and B (unitless)	chemical-specific(6)	NA	NA	NA	NA	chemical-specific(6)	chemical-specific(6)
Inhalation of Volatile Emissions from Groundwater							
C_{air} (mg/m^3)	calculated(14)	NA	NA	NA	NA	NA	NA
ET (hours/day)	8(1)	NA	NA	NA	NA	NA	NA
EF (days/year)	130(1)	NA	NA	NA	NA	NA	NA
Dermal Contact with Surface Water							
C_{sw} (µg/L)	NA	NA	Maximum or 95% UCL(5)	Maximum or 95% UCL(5)	Maximum or 95% UCL(5)	NA	NA
EF (days/year)	NA	NA	48(7)	48(7)	48(7)	NA	NA
ET (hours/day) and t_{event} (hours/event)	NA	NA	1(13)	1(13)	1(13)	NA	NA
EV (events/day)	NA	NA	1(13)	1(13)	1(13)	NA	NA
A (cm^2/day)	NA	NA	4,050(9)	2,800(6)	6,880(15)	NA	NA
K_p (cm/hour)	NA	NA	chemical-specific(6)	chemical-specific(6)	chemical-specific(6)	NA	NA
t* (hour/event), τ (hour), and B (unitless)	NA	NA	chemical-specific(6)	chemical-specific(6)	chemical-specific(6)	NA	NA
CF (L/cm^3)	NA	NA	1E-03	1E-03	1E-03	NA	NA
Incidental Ingestion/Dermal Contact with Sediment							
C_{sed} (mg/kg)	NA	NA	Maximum or 95% UCL(5)	Maximum or 95% UCL(5)	Maximum or 95% UCL(5)	NA	NA
IR (mg/day)	NA	NA	100(2)	200(2)	100(2)	NA	NA
EF-Sediment (days/year)	NA	NA	48(7)	48(7)	48(7)	NA	NA
FI (unitless)	NA	NA	1	1	1	NA	NA
SA (cm^2/day)	NA	NA	4,050(9)	2,800(6)	6,880(15)	NA	NA
AF (mg/cm^2)	NA	NA	1(6)	0.2(6)	0.07(6)	NA	NA
ABS (unitless)	NA	NA	chemical-specific(6)	chemical-specific(6)	chemical-specific(6)	NA	NA
CF (kg/mg)	NA	NA	1E-06	1E-06	1E-06	NA	NA

TABLE C-7

SUMMARY OF EXPOSURE INPUT PARAMETERS FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident
Ingestion of Fish							
C_{fish} (mg/kg)	NA	NA	NA	Maximum or 95% UCL(5)	Maximum or 95% UCL(5)	NA	NA
IR (kg/meal)	NA	NA	NA	0.00433(16)	0.013(16)	NA	NA
FI (unitless)	NA	NA	NA	1	1	NA	NA
EF (meals/year)	NA	NA	NA	350(2)	350(2)	NA	NA

Notes:

A	Skin surface area available for contact	ED	Exposure duration
ABS	Absorption factor	EF	Exposure frequency
AF	Soil-to-skin adherence factor	ET	Exposure time
AT_c	Averaging time for carcinogenic effects	EV	Event frequency
AT_n	Averaging time for noncarcinogenic effects	FI	Fraction ingested from contaminated source
B	Bunge Model partitioning coefficient	InhR	Inhalation rate
BW	Body weight	IR	Ingestion rate (soil or groundwater)
CF	Conversion factor	K_p	Permeability coefficient from water through skin
CR	Contact rate	SA	Skin surface area available for contact
$C_{soil/sed}$	Exposure concentration for soil/sediment	PEF	Particulate emission factor
$C_{gw/sw}$	Exposure concentration for groundwater/surface water	τ	Lag time
C_{air}	Exposure concentration for air	t*	Time it takes to reach steady-state conditions
C_{fish}	Exposure concentration for fish	t_{event}	Duration of event

1 - Assumes a 26 week construction project over a course of one year.
2 - USEPA, 1997: Exposure Factors Handbook. EPA/600/8-95/002FA.
3 - Adolescent ages 7 to 18 years old.
4 - USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A.
5 - USEPA, 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.
6 - USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. PA/540/R/99/005.
7 - Assumes 4 days a week for 12 weeks.
8 - Although USEPA Region 1 Risk Update No. 2 August 1994 recommends an exposure frequency of 150 days/year, this RI will follow national guidance per USEPA Region I direction September 28, 2006.
9 - Assumes 31 percent of the average total surface area of 1.31 m2 for females and males, ages 7 through 17 years (USEPA, 1997).
10 - USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9365.4-24.

TABLE C-7

SUMMARY OF EXPOSURE INPUT PARAMETERS FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Exposure Parameter	Construction Worker	Industrial Worker	Adolescent Trespasser	Child Recreational User	Adult Recreational User	Child Resident	Adult Resident

11 - Length of a typical work day.
12 - USEPA, 2008: Soil Screening Guidance calculation Internet site at http://risk.lsd.ornl.gov/calc_start.htm. Site-specific values for Hartford, Connecticut.

13 - Professional judgment.
14 - VDEQ September 2004. Virginia Department of Environmental Quality (VDEQ, online -http://www.deq.state.va.us/brownfieldweb/vrp.html).
15 - Assumes 38 percent of the total body surface area.
16 - Adult fish ingestion rates represent the 90th percentile ingestion rates for recreational freshwater anglers (all waters, all household consumers sharing catch) reported in the E.S. Ebert et al., “Estimating Consumption of Freshwater Fish among Maine Anglers.” North American Journal of Fisheries Management 13: 737-745, 1993.
17 - Rhode Island Department of Environmental Management, DEM-DSR-01-93, February 2004.
18 - The values shown in this table were used during the HHRA; however, an updated ingestion rate for the resident child scenario was used during the development of RGs in this ROD (assumed ingestion rate of 1.0 liter per day instead of 1.4 liters per day). See also Table 2-5 of this ROD.

TABLE C-8

INTERMEDIATE VARIABLES FOR CALCULATING DA(EVENT) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Media	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
			Value	Value	Units	Value	Units	Value	Units	Value	Units	Value
Volatile Organic Compounds												
1,1-Dichloroethane	Groundwater	NA	1	6.7E-03	cm/hr	(1)	hr	3.8E-01	hr	9.2E-01	hr	2.6E-02
1,2,4-Trimethylbenzene	Soil, Groundwater	0	1	8.4E-02	cm/hr	(1)	hr	4.9E-01	hr	1.2E+00	hr	3.5E-01
1,3,5-Trimethylbenzene	Soil, Groundwater	0	1	6.1E-02	cm/hr	(1)	hr	4.9E-01	hr	1.2E+00	hr	2.6E-01
Bromomethane	Groundwater	NA	1	2.8E-03	cm/hr	(1)	hr	3.6E-01	hr	8.7E-01	hr	1.1E-02
Carbon Tetrachloride	Groundwater	NA	1	1.6E-02	cm/hr	(1)	hr	7.8E-01	hr	1.9E+00	hr	7.8E-02
Chloroform	Groundwater	NA	1	6.8E-03	cm/hr	(1)	hr	5.0E-01	hr	1.2E+00	hr	2.9E-02
Chloromethane	Groundwater	NA	1	3.3E-03	cm/hr	(1)	hr	2.0E-01	hr	4.9E-01	hr	9.0E-03
Ethylbenzene	Groundwater	NA	1	4.9E-02	cm/hr	(1)	hr	4.2E-01	hr	1.0E+00	hr	2.0E-01
Isopropylbenzene	Groundwater	NA	1	8.8E-02	cm/hr	(1)	hr	4.9E-01	hr	1.2E+00	hr	3.7E-01
Tetrachloroethene	Groundwater	NA	1	3.3E-02	cm/hr	(1)	hr	9.1E-01	hr	2.2E+00	hr	1.7E-01
Total Xylenes	Groundwater	NA	1	4.6E-02	cm/hr	(1)	hr	4.1E-01	hr	9.9E-01	hr	1.8E-01
Trichloroethene	Groundwater	NA	1	1.2E-02	cm/hr	(1)	hr	5.8E-01	hr	1.4E+00	hr	5.1E-02
Vinyl Chloride	Groundwater	NA	1	5.6E-03	cm/hr	(1)	hr	2.4E-01	hr	5.7E-01	hr	1.7E-02
Semivolatile Organic Compounds												
Acenaphthene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	Soil, Groundwater, Sediment	0.13	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)	NA(2)
Benzo(g,h,i)perylene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	Soil, Sediment	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Soil	0.13	1	4.7E-02	cm/hr	(1)	hr	5.6E-01	hr	1.3E+00	hr	2.0E-01
Phenanthrene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	Soil	0.13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs												
Dieldrin	Groundwater, Surface Water, Sediment	0.1										
Total Aroclors	Soil, Sediment	0.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE C-8

INTERMEDIATE VARIABLES FOR CALCULATING DA(EVENT) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Media	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
			Value	Value	Units	Value	Units	Value	Units	Value	Units	Value
Inorganics												
Aluminum	Soil, Groundwater, Surface Water, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Antimony	Soil	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	Soil, Groundwater, Surface Water, Sediment	0.03	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Barium	Groundwater	NA	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Beryllium	Soil, Groundwater, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Cadmium	Soil	0.001	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Chromium	Soil, Groundwater, Sediment	0	1	2.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Cobalt	Soil, Groundwater, Surface Water, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Copper	Soil, Groundwater	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Iron	Soil, Groundwater, Surface Water, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Lead	Soil, Groundwater, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Manganese	Soil, Groundwater, Surface Water, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Mercury	Groundwater	NA	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Molybdenum	Soil, Groundwater, Surface Water	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Nickel	Groundwater	NA	1	2.0E-04	cm/hr	NA	NA	NA	NA	NA	NA	NA
Thallium	Soil, Groundwater, Surface Water	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Vanadium	Soil, Groundwater, Sediment	0	1	1.0E-03	cm/hr	NA	NA	NA	NA	NA	NA	NA
Zinc	Soil, Groundwater	0	1	6.0E-04	cm/hr	NA	NA	NA	NA	NA	NA	NA

Notes:
All values from EPA's Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, July 2004.
1 - T(event) is 8 hrs for RME and 2 hrs for CTE for the construction worker, 1 hr for RME and 0.5 hrs for and recreational users and adolescent trespassers, and 0.33 hrs for RME and 0.25 hr for CTE for hypothetical residents.
2 - RAGS Part E recommends not attempting to quantify risk because contaminants are outside the effective predictive domain of the model.
FA = Fraction Absorbed Water
Kp = Dermal Permeability Coefficient of Compound in Water
T(event) = Event Duration
Tau = Lag Time
T* = Time to Reach Steady-State
B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis
NA = Not applicable.

TABLE C-9

CHEMICAL PROPERTIES FOR
VOLATILIZATION FROM SOIL/GROUNDWATER TO OUTDOOR AIR MODELS FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Molecular Weight (g/mole)	Organic Carbon Partition Coefficient (cm^3/g)	Air Diffusivity (cm^2/sec)	Water Diffusivity (cm^2/sec)	Solubility Limit (mg/L)	Henry's Law Constant	
						(Dimensionless)	($atm\text{-}m^3/mol$)
1,1-Dichloroethane	9.90E+01	3.16E+01	7.42E-02	1.05E-05	5.06E+03	2.30E-01	5.61E-03
1,2,4-Trimethylbenzene	1.20E+02	3.72E+03	6.44E-02	7.92E-06	5.70E+01	2.53E-01	6.16E-03
1,3,5-Trimethylbenzene	1.20E+02	1.62E+03	6.02E-02	8.67E-06	4.82E+01	3.60E-01	8.77E-03
Bromomethane	9.50E+01	1.05E+01	7.28E-02	1.21E-05	1.52E+04	2.56E-01	6.24E-03
Carbon Tetrachloride	1.54E+02	1.74E+02	7.80E-02	8.80E-06	7.93E+02	1.25E+00	3.05E-02
Chloroform	1.19E+02	3.98E+01	1.04E-01	1.00E-05	7.92E+03	1.50E-01	3.66E-03
Chloromethane	5.05E+01	3.50E+01	1.26E-01	6.50E-06	5.33E+03	3.62E-01	8.82E-03
Ethylbenzene	1.06E+02	3.63E+02	7.50E-02	7.80E-06	1.69E+02	3.23E-01	7.88E-03
Tetrachloroethene	1.66E+02	1.55E+02	7.20E-02	8.20E-06	2.00E+02	7.54E-01	1.84E-02
Total Xylenes	1.06E+02	3.74E+02	7.14E-02	9.34E-06	1.61E+02	2.15E-01	5.25E-03
Trichloroethene	1.31E+02	1.66E+02	7.90E-02	9.10E-06	1.10E+03	4.22E-01	1.03E-02
Vinyl Chloride	6.25E+01	1.86E+01	1.06E-01	1.23E-05	2.76E+03	1.11E+00	2.71E-02
Acenaphthene	1.54E+02	7.08E+03	4.21E-02	7.69E-06	4.24E+00	6.36E-03	1.55E-04
Anthracene	1.78E+02	2.95E+04	3.24E-02	7.74E-06	4.34E-02	2.67E-03	6.51E-05
Naphthalene	1.28E+02	2.00E+03	5.90E-02	7.50E-06	3.10E+01	1.98E-02	4.83E-04
Phenanthrene	1.78E+02	4.80E+03	2.72E-02	7.24E-06	1.15E+00	3.92E-02	9.55E-04

Source:
USEPA 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

TABLE C-10

INPUT PARAMETERS FOR CALCULATION OF
THE VOLATILIZATION FROM SOIL TO OUTDOOR AIR MODELS FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Parameter	Definition	Value	Reference
Q/C	Inverse of mean concentration at center of source (g/m^2-s per kg/m^3).	73.95045	USEPA, 2009
T	Exposure interval (seconds).	9.5E+08	USEPA, 2002
pb	Dry soil bulk density (g/cm^3).	1.5	USEPA, 2002
ps	Soil particle density (g/cm^3).	2.65	USEPA, 2002
□w	Water-filled soil porosity (L_{pore}/L_{soil}).	0.15	USEPA, 2002
n	Total soil porosity (L_{pore}/L_{soil}).	0.434	USEPA, 2002
Di	Diffusivity in air (cm^2/sec).	Chemical specific	USEPA, 2002
H'	Dimensionless Henry's Law Constant.	Chemical specific	USEPA, 2002
S	Solubility limit (mg/L)	Chemical specific	USEPA, 2002
Dw	Diffusivity in water (cm^2/sec).	Chemical specific	USEPA, 2002
Koc	Soil organic carbon partition coefficient (cm^3/g).	Chemical specific	USEPA, 2002
foc	Fraction organic carbon in soil (g/g).	0.029	Site-specific value

Notes:

Chemical specific values are presented in Table 6-26.

USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2009: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/epa/ssl1.shtml.
Site-specific values for Hartford, Connecticut.

TABLE C-11

NON-CANCER TOXICITY DATA (ORAL/DERMAL) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND
PAGE 1 OF 2

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds										
1,1-Dichloroethane	Chronic	2.0E-01	mg/kg/day	1	2.0E-01	mg/kg/day	Kidney, CNS	3000/1	PPRTV	9/27/2006
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	Chronic	5.0E-02	mg/kg/day	1	5.0E-02	mg/kg/day	Body Weight, Kidney, Liver	3000/1	PPRTV	8/2003
Bromomethane	Chronic	1.4E-03	mg/kg/day	1	1.4E-03	mg/kg/day	GS	1000/1	IRIS	2/2/2009
Carbon Tetrachloride	Chronic	7.0E-04	mg/kg/day	1	7.0E-04	mg/kg/day	Liver	1000/1	IRIS	2/2/2009
Chloroform	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	100/1	IRIS	2/2/2009
Chloromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	Chronic	1.0E-01	mg/kg/day	1	1.0E-01	mg/kg/day	Liver, Kidney	1000/1	IRIS	2/2/2009
Isopropylbenzene	Chronic	1.0E-01	mg/kg/day	1	1.0E-01	mg/kg/day	Kidney	1000/1	IRIS	2/2/2009
Tetrachloroethene	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000/1	IRIS	2/2/2009
Total Xylenes	Chronic	2.0E-01	mg/kg/day	1	2.0E-01	mg/kg/day	Body Weight	1000/1	IRIS	2/2/2009
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	Chronic	3.0E-03	mg/kg/day	1	3.0E-03	mg/kg/day	Liver	30/1	IRIS	2/2/2009
Semivolatile Organic Compounds										
Acenaphthene	Chronic	6.0E-02	mg/kg/day	1	6.0E-02	mg/kg/day	Blood	3000/1	IRIS	2/2/2009
Anthracene	Chronic	3.0E-01	mg/kg/day	1	3.0E-01	mg/kg/day	None Reported	3000/1	IRIS	2/2/2009
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene[3]	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	2/2/2009
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	Liver	3000/1	IRIS	2/2/2009
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Body Weight	3000/1	IRIS	2/2/2009
Phenanthrene[3]	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	2/2/2009
Pyrene	Chronic	3.0E-02	mg/kg/day	1	3.0E-02	mg/kg/day	Kidney	3000/1	IRIS	2/2/2009
Pesticides/PCBs										
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	Chronic	5.0E-04	mg/kg/day	1	5.0E-04	mg/kg/day	Liver	100/1	IRIS	2/2/2009
Aldrin	Chronic	3.0E-05	mg/kg/day	1	3.0E-05	mg/kg/day	Liver	1000/1	IRIS	2/2/2009
Aroclor-1248	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	Chronic	2.0E-05	mg/kg/day	1	2.0E-05	mg/kg/day	Immune	300/1	IRIS	2/2/2009
Aroclor-1260	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1268	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	Chronic	5.0E-05	mg/kg/day	1	5.0E-05	mg/kg/day	Liver	100/1	IRIS	2/2/2009
Inorganics										
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	CNS	100	PPRTV	10/23/2006
Antimony										
Arsenic	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Skin, CVS	3/1	IRIS	2/2/2009
Barium	Chronic	2.0E-01	mg/kg/day	0.07	1.4E-02	mg/kg/day	Kidney	300/1	IRIS	2/2/2009
Beryllium	Chronic	2.0E-03	mg/kg/day	0.007	1.4E-05	mg/kg/day	GS	300/1	IRIS	2/2/2009
Cadmium[4]	Chronic	5.0E-04	mg/kg/day	0.05	2.5E-05	mg/kg/day	Kidney	10/1	IRIS	2/2/2009
Chromium[5]	Chronic	3.0E-03	mg/kg/day	0.025	7.5E-05	mg/kg/day	Fetotoxicity, GS, Bone	300/3	IRIS	2/2/2009
Cobalt	Chronic	3.0E-04	mg/kg/day	1	3.0E-04	mg/kg/day	Blood	NA	ORNL	9/12/2008

TABLE C-11

NON-CANCER TOXICITY DATA (ORAL/DERMAL) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal[1]	Absorbed RfD for Dermal[2]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Inorganics (continued)										
Copper	Chronic	4.0E-02	mg/kg/day	1	4.0E-02	mg/kg/day	GS	NA	HEAST	7/1997
Iron	Chronic	7.0E-01	mg/kg/day	1	7.0E-01	mg/kg/day	GS	1.5	PPRTV	9/11/2006
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (soil)[6]	Chronic	7.0E-02	mg/kg/day	0.04	2.8E-03	mg/kg/day	CNS	1/1	IRIS	2/2/2009
Manganese (water)[6]	Chronic	2.4E-02	mg/kg/day	0.04	9.6E-04	mg/kg/day	CNS	1/3	IRIS	2/2/2009
Mercury[7]	Chronic	3.0E-04	mg/kg/day	0.07	2.1E-05	mg/kg/day	Autoimmune	1000/1	IRIS	2/2/2009
Methyl Mercury	Chronic	1.0E-04	mg/kg/day	1	1.0E-04	mg/kg/day	CNS	10/1	IRIS	2/2/2009
Molybdenum	Chronic	5.0E-03	mg/kg/day	1	5.0E-03	mg/kg/day	Gout	30/1	IRIS	2/2/2009
Nickel	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	Body Weight	300/1	IRIS	2/2/2009
Thallium	Chronic	6.5E-05	mg/kg/day	1	6.5E-05	mg/kg/day	Blood	3000/1	ORNL	9/12/2008
Vanadium	Chronic	5.0E-03	mg/kg/day	0.026	1.3E-04	mg/kg/day	Kidney	300	ORNL	9/12/2008
Zinc	Chronic	3.0E-01	mg/kg/day	1	3.0E-01	mg/kg/day	Blood	3/1	IRIS	2/2/2009

Notes:

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.
2 - Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.
3 - Values are for pyrene.
4 - Values are for cadmium - water.
5 - Values are for hexavalent chromium.
6 - Adjusted IRIS value in accordance with USEPA Region I Risk Update Number 4, November 1996.
7 - Values are for mercuric chloride.

Definitions:
CNS = Central Nervous System
CVS = Cardiovascular system
GS = Gastrointestinal
HEAST = Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
NA = Not Available.
ORNL = Oak Ridge National Laboratory, Regional Screening Levels for Chemical Contaminants at Superfund Sites, September 12, 2008.

TABLE C-12

NON-CANCER TOXICITY DATA (INHALATION) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD[1]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds									
1,1-Dichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	Chronic	7.0E-03	mg/m3	2.0E-03	(mg/kg/day)	Blood	3000/1	PPRTV	6/11/2007
1,3,5-Trimethylbenzene	Chronic	6.0E-03	mg/m3	1.7E-03	(mg/kg/day)	CNS	3000/1	PPRTV	8/2003
Bromomethane	Chronic	5.0E-03	mg/m3	1.4E-03	(mg/kg/day)	Respiratory	100/1	IRIS	2/2/2009
Carbon Tetrachloride	Chronic	1.9E-01	mg/m3	5.4E-02	(mg/kg/day)	Liver	NA	ATSDR	9/12/2008
Chloroform	Chronic	9.8E-02	mg/m3	2.8E-02	(mg/kg/day)	Liver	NA	ATSDR	9/12/2008
Chloromethane	Chronic	9.0E-02	mg/m3	2.6E-02	(mg/kg/day)	CNS	1000/1	IRIS	2/2/2009
Ethylbenzene	Chronic	1.0E+00	mg/m3	2.9E-01	(mg/kg/day)	Developmental	300/1	IRIS	2/2/2009
Isopropylbenzene	Chronic	4.0E-01	mg/m3	1.1E-01	(mg/kg/day)	Kidney	1000/1	IRIS	2/2/2009
Tetrachloroethene	Chronic	2.7E-01	mg/m3	7.7E-02	(mg/kg/day)	Liver	NA	ORNL	9/12/2008
Total Xylenes	Chronic	1.0E-01	mg/m3	2.9E-02	(mg/kg/day)	CNS	300/1	IRIS	2/2/2009
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	Chronic	1.0E-01	mg/m3	2.9E-02	(mg/kg/day)	Liver	30/1	IRIS	2/2/2009
Semivolatile Organic Compounds									
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene[3]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	Chronic	3.0E-03	mg/m^3	8.6E-04	(mg/kg/day)	Respiratory	3000/1	IRIS	2/2/2009
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticides/PCBs									
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1248	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1254	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE C-12

NON-CANCER TOXICITY DATA (INHALATION) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD[1]		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Pesticides/PCBs (continued)									
Aroclor-1260	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aroclor-1268	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	NA	NA	NA	NA	NA	NA	NA	NA	NA
Inorganics									
Aluminum	Chronic	5.0E-03	mg/m3	1.4E-03	(mg/kg/day)	CNS	300	PPRTV	10/23/2006
Arsenic	Chronic	3.00E-05	mg/m3	8.6E-06	(mg/kg/day)	NA	NA	ORNL	9/12/2008
Barium	Chronic	5.0E-04	mg/m3	1.4E-04	(mg/kg/day)	Fetotoxicity	1000/1	HEAST	9/97
Beryllium	Chronic	2.0E-05	mg/m3	5.7E-06	(mg/kg/day)	Respiratory	10/1	IRIS	2/2/2009
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	Chronic	1.0E-04	mg/m^3	2.9E-05	(mg/kg/day)	Respiratory	300/1	IRIS	2/2/2009
Cobalt	Chronic	6.0E-06	mg/m^3	1.7E-06	(mg/kg/day)	Respiratory	NA	ORNL	9/12/2008
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5.0E-05	mg/m^3	1.4E-05	(mg/kg/day)	CNS	1000/1	IRIS	2/2/2009
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1 - Extrapolated RfD = RfC *$20m^3$/day / 70 kg.

Definitions:

CNS = Central Nervous System

HEAST= Health Effects Assessment Summary Tables

IRIS = Integrated Risk Information System

NA = Not Applicable

ORNL = Oak Ridge National Laboratory, Regional Screening Levels for Chemical Contaminants at Superfund Sites, September 12, 2008.

TABLE C-13

CANCER TOXICITY DATA (ORAL/DERMAL) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal(1)	Absorbed Cancer Slope Factor for Dermal(2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds								
1,1-Dichloroethane	5.7E-03	$(mg/kg/day)^{-1}$	1	5.7E-03	$(mg/kg/day)^{-1}$	C / (Possible Human Carcinogen)	ORNL	9/12/2008
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Carbon Tetrachloride	1.3E-01	$(mg/kg/day)^{-1}$	1	1.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	
Chloroform	3.1E-02	$(mg/kg/day)^{-1}$	1	3.1E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	ORNL	9/12/2008
Chloromethane	1.3E-02	$(mg/kg/day)^{-1}$	1	1.3E-02	$(mg/kg/day)^{-1}$	C / (Possible Human Carcinogen)	HEAST	7/1997
Ethylbenzene	1.1E-02	$(mg/kg/day)^{-1}$	1	1.1E-02	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Isopropylbenzene	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Tetrachloroethene	5.4E-01	$(mg/kg/day)^{-1}$	1	5.4E-01	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Total Xylenes	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	1.3E-02	$(mg/kg/day)^{-1}$	1	1.3E-02	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Vinyl Chloride (early life)	1.5E+00	$(mg/kg/day)^{-1}$	1	1.5E+00	$(mg/kg/day)^{-1}$	A / Known/likely human carcinogen	IRIS	2/2/2009
Vinyl Chloride (adult)	7.2E-01	$(mg/kg/day)^{-1}$	1	7.2E-01	$(mg/kg/day)^{-1}$	A / Known/likely human carcinogen	IRIS	2/2/2009
Semivolatile Organic Compounds								
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Benzo(a)anthracene(3)	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Benzo(a)pyrene(3)	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Benzo(b)fluoranthene(3)	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Benzo(g,h,i)perylene	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Benzo(k)fluoranthene(3)	7.3E-02	$(mg/kg/day)^{-1}$	1	7.3E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Chrysene(3)	7.3E-03	$(mg/kg/day)^{-1}$	1	7.3E-03	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Dibenzo(a,h)anthracene(3)	7.3E+00	$(mg/kg/day)^{-1}$	1	7.3E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Fluoranthene	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Indeno(1,2,3-cd)pyrene(3)	7.3E-01	$(mg/kg/day)^{-1}$	1	7.3E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(1)	7/1993
Naphthalene	NA	NA	NA	NA	NA	C / Inadequate data of carcinogenicity in humans	IRIS	2/2/2009
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009

TABLE C-13

CANCER TOXICITY DATA (ORAL/DERMAL) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal[1]	Absorbed Cancer Slope Factor for Dermal[2]		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Pesticides/PCBs								
4,4'-DDE	3.4E-01	$(mg/kg/day)^{-1}$	1	3.4E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
4,4'-DDT	3.4E-01	$(mg/kg/day)^{-1}$	1	3.4E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Aldrin	1.7E+01	$(mg/kg/day)^{-1}$	1	1.7E+01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Aroclor-1248	2.0E+00	$(mg/kg/day)^{-1}$	1	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Aroclor-1254	2.0E+00	$(mg/kg/day)^{-1}$	1	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Aroclor-1260	2.0E+00	$(mg/kg/day)^{-1}$	1	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Aroclor-1268	2.0E+00	$(mg/kg/day)^{-1}$	1	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	1	1.6E+01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Inorganics								
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	1	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	2/2/2009
Barium	NA	NA	NA	NA	NA	D (Not classifiable as to human carcinogenicity)	IRIS	2/2/2009
Beryllium	NA	NA	NA	NA	NA	B1 / Probable human carcinogen	IRIS	2/2/2009
Cadmium	NA	NA	NA	NA	NA	B1 / Probable human carcinogen	IRIS	2/2/2009
Chromium	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	B2 / Probable human carcinogen	IRIS	2/2/2009
Manganese	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Mercury	NA	NA	NA	NA	NA	C/ Possible Human Carcinogen	IRIS	2/2/2009
Methyl Mercury	NA	NA	NA	NA	NA	C/ Possible Human Carcinogen	IRIS	2/2/2009
Molybdenum	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009

TABLE C-13

CANCER TOXICITY DATA (ORAL/DERMAL) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal[1]	Absorbed Cancer Slope Factor for Dermal[2]		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)

Notes:

1 - USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005.

2 - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

3 - The carcinogenic PAHs are considered to act via the mutagenic mode of action. These chemicals are evaluated in accordance with USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (2005).

HEAST = Health Effects Assessment Summary Tables.

IRIS = Integrated Risk Information System.

NA = Not Available.

ORNL = Oak Ridge National Laboratory, Regional Screening Levels for Chemical Contaminants at Superfund Sites, September 12, 2008.

USEPA(1) = USEPA, Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, July 1993, EPA/600/R-93/089.

USEPA(2) = USEPA, PCBs: Cancer Dose-Response Assessment and Applications to Environmental Mixtures, September 1996, EPA/600/P-96/001F.

TABLE C-14

CANCER TOXICITY DATA (INHALATION) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor[(1)]		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Volatile Organic Compounds							
1,1-Dichloroethane	1.6E-06	$(ug/m^3)^{-1}$	5.6E-03	$(mg/kg/day)^{-1}$	C / (Possible Human Carcinogen)	ORNL	9/12/2008
1,2,4-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	NA	NA	NA	NA	NA	NA	NA
Bromomethane	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Carbon Tetrachloride	1.5E-05	$(ug/m^3)^{-1}$	5.3E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	8.1E-02	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Chloromethane	1.8E-06	$(ug/m^3)^{-1}$	6.3E-03	$(mg/kg/day)^{-1}$	C / (Possible Human Carcinogen)	HEAST	7/1997
Ethylbenzene	2.5E-06	$(ug/m^3)^{-1}$	8.8E-03	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Isopropylbenzene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Tetrachloroethene	5.9E-06	$(ug/m^3)^{-1}$	2.1E-02	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Total Xylenes	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	2.0E-06	$(ug/m^3)^{-1}$	7.0E-03	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Vinyl Chloride (early life)	8.8E-06	$(ug/m^3)^{-1}$	3.1E-02	$(mg/kg/day)^{-1}$	A / Known/likely human carcinogen	IRIS	2/2/2009
Vinyl Chloride (adult)	4.4E-06	$(ug/m^3)^{-1}$	1.5E-02	$(mg/kg/day)^{-1}$	A / Known/likely human carcinogen	IRIS	2/2/2009
Semivolatile Organic Compounds							
Acenaphthene	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Benzo(a)anthracene[(2)]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Benzo(a)pyrene[(2)]	1.1E-03	$(ug/m^3)^{-1}$	3.9E+00	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Benzo(b)fluoranthene[(2)]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Benzo(g,h,i)perylene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Benzo(k)fluoranthene[(2)]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Chrysene[(2)]	1.1E-05	$(ug/m^3)^{-1}$	3.9E-02	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Dibenzo(a,h)anthracene[(2)]	1.2E-03	$(ug/m^3)^{-1}$	4.2E+00	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Fluoranthene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Indeno(1,2,3-cd)pyrene[(2)]	1.1E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Naphthalene	3.4E-05	$(ug/m3)^{-1}$	1.2E-01	$(mg/kg/day)^{-1}$	C/ Possible Human Carcinogen	ORNL	9/12/2008

TABLE C-14

CANCER TOXICITY DATA (INHALATION) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor(1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Semivolatile Organic Compounds (continued)							
Phenanthrene	NA	NA	NA	NA	NA	NA	9/12/2008
Pyrene	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Pesticides/PCBs							
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	9.7E-05	$(ug/m3)^{-1}$	3.4E-01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Aldrin	4.9E-03	$(ug/m3)^{-1}$	1.7E+01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Aroclor-1248	5.7E-04	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Aroclor-1254	5.7E-04	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Aroclor-1260	5.7E-04	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Aroclor-1268	5.7E-04	$(ug/m^3)^{-1}$	2.0E+00	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	USEPA(2)	9/1996
Dieldrin	4.6E-03	$(ug/m3)^{-1}$	1.6E+01	$(mg/kg/day)^{-1}$	B2 / Probable human carcinogen	IRIS	2/2/2009
Inorganics							
Aluminum	NA	NA	NA	NA	NA	NA	NA
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	1.5E+01	$(mg/kg/day)^{-1}$	A / Known human carcinogen	IRIS	2/2/2009
Barium	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Beryllium	2.4E-03	$(ug/m^3)^{-1}$	8.4E+00	$(mg/kg/day)^{-1}$	Carcinogenic potential cannot be determined (Oral route)	IRIS	2/2/2009
Cadmium	1.8E-03	$(ug/m^3)^{-1}$	6.3E+00	$(mg/kg/day)^{-1}$	B1 / Probable human carcinogen	IRIS	2/2/2009
Chromium	1.2E-02	$(ug/m^3)^{-1}$	4.2E+01	$(mg/kg/day)^{-1}$	A / Known human carcinogen	IRIS	2/2/2009
Cobalt	9.0E-03	$(ug/m^3)^{-1}$	3.2E+01	$(mg/kg/day)^{-1}$	NA	ORNL	9/12/2008
Copper	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	B2 / Probable human carcinogen	IRIS	2/2/2009
Manganese	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Mercury	NA	NA	NA	NA	C/ Possible Human Carcinogen	IRIS	2/2/2009
Methyl Mercury	NA	NA	NA	NA	C/ Possible Human Carcinogen	IRIS	2/2/2009
Molybdenum	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA

TABLE C-14

CANCER TOXICITY DATA (INHALATION) FROM THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor[1]		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Inorganics (continued)							
Thallium	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009
Vanadium	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	D / Not classifiable as to human carcinogenicity	IRIS	2/2/2009

Notes:

1 - Inhalation CSF = Unit Risk * 70 kg / 20m^3/day.

2 - The carcinogenic PAHs are considered to act via the mutagenic mode of action. These chemicals are evaluated in accordance with USEPA's Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (2005).

Definitions:

IRIS = Integrated Risk Information System.

NA = Not Available.

ORNL = Oak Ridge National Laboratory, Regional Screening Levels for Chemical Contaminants at Superfund Sites, July 7, 2008.

USEPA(1) = OSWER Directive No.9285.7-75.

USEPA(2) = USEPA, PCBs: Cancer Dose-Response Assessment and Applications to Environmental Mixtures, September 1996, EPA/600/P-96/001F.

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Construction Workers	Surface Soil - Exposed Area	Incidental Ingestion	1E-06	- -	- -	- -	0.4	- -
		Dermal Contact	3E-07	- -	- -	- -	0.01	- -
		Inhalation	7E-07	- -	- -	- -	1	- -
		Total	3E-06	- -	- -	- -	2	Target Organ HIs ≤ 1
	Subsurface Soil - Exposed Area	Incidental Ingestion	6E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	0.5	- -
		Dermal Contact	2E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Dibenzo(a,h)anthracene	0.05	- -
		Inhalation	1E-06	- -	- -	- -	2	Aluminum, ***Manganese***
		Total	9E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	2	Aluminum, ***Manganese***
	Surface Soil - Paved Area	Incidental Ingestion	1E-06	- -	- -	- -	0.3	- -
		Dermal Contact	3E-07	- -	- -	- -	0.009	- -
		Inhalation	5E-07	- -	- -	- -	1	- -
		Total	2E-06	- -	- -	- -	1	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	2E-06	- -	- -	- -	0.4	- -
		Dermal Contact	3E-07	- -	- -	- -	0.02	- -
		Inhalation	7E-07	- -	- -	- -	2	Aluminum, ***Manganese***
		Total	3E-06	- -	- -	Arsenic	3	Aluminum, ***Manganese***
	Groundwater	Incidental Ingestion	3E-06	- -	- -	Arsenic	2	Target Organ HIs ≤ 1
		Dermal Contact	3E-06	- -	- -	- -	7	Beryllium, Chromium, Iron, Manganese
		Inhalation	1E-07	- -	- -	- -	0.7	- -
		Total	5E-06	- -	- -	Arsenic	10	Aluminum, Beryllium, Chromium, Iron, Manganese
Total Exposed Area Surface Soil and Groundwater			8E-06				11	
Total Exposed Area Subsurface Soil and Groundwater			1E-04				12	
Total Paved Area Surface Soil and Groundwater			7E-06				11	
Total Paved Area Subsurface Soil and Groundwater			8E-06				12	

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Industrial Workers	Surface Soil - Exposed Area	Incidental Ingestion	2E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.2	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.02	- -
		Inhalation	3E-08	- -	- -	- -	0.0003	- -
		Total	3E-05	- -	- -	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.3	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	9E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	0.3	- -
		Dermal Contact	8E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	0.07	- -
		Inhalation	8E-07	- -	- -	- -	0.0005	- -
		Total	2E-03	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	0.3	- -
	Surface Soil - Paved Area	Incidental Ingestion	2E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.2	- -
		Dermal Contact	9E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.01	- -
		Inhalation	3E-09	- -	- -	- -	0.0003	- -
		Total	3E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.2	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	2E-05	- -	Arsenic	Benzo(a)pyrene	0.2	- -
		Dermal Contact	9E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.02	- -
		Inhalation	4E-09	- -	- -	- -	0.01	- -
		Total	3E-05	- -	Arsenic	Benzo(a)pyrene, Total Aroclors	0.3	- -

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Adolescent Trespassers	Surface Soil - Exposed Area	Incidental Ingestion	5E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.06	- -
		Dermal Contact	8E-06	- -	- -	Benzo(a)pyrene	0.01	- -
		Inhalation	3E-09	- -	- -	- -	0.00007	- -
		Total	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.08	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	4E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	0.08	- -
		Dermal Contact	8E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene,, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene	0.04	- -
		Inhalation	7E-08	- -	- -	- -	0.00009	- -
		Total	1E-03	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene,, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	0.1	- -
	Surface Soil - Paved Area	Incidental Ingestion	4E-06	- -	- -	Benzo(a)pyrene	0.04	- -
		Dermal Contact	7E-06	- -	- -	Benzo(a)pyrene	0.008	- -
		Inhalation	3E-10	- -	- -	- -	0.00005	- -
		Total	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.05	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	4E-06	- -	- -	Arsenic	0.06	- -
		Dermal Contact	6E-06	- -	- -	Benzo(a)pyrene	0.01	- -
		Inhalation	4E-10	- -	- -	- -	0.001	- -
		Total	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.08	- -
	Surface Water	Dermal Contact	5E-08	- -	- -	- -	0.002	- -
	Sediment	Incidental Ingestion	3E-06	- -	- -	- -	0.1	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)pyrene	0.02	- -
		Total	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.1	- -
Total Exposed Area Surface Soil, Surface Water and Sediment			3E-05				0.2	
Total Exposed Area Subsurface Soil, Surface Water and Sediment			1E-03				0	
Total Paved Area Surface Soil, Surface Water and Sediment			2E-05				0.2	
Total Paved Area Subsurface Soil, Surface Water and Sediment			2E-05				0.2	

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SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Child Recreational Users	Surface Soil - Exposed Area	Incidental Ingestion	3E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	0.4	- -
		Dermal Contact	8E-06	- -	- -	Benzo(a)pyrene	0.01	- -
		Inhalation	1E-09	- -	- -	- -	0.00007	- -
		Total	3E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.4	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	2E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Chrysene, Arsenic	0.5	- -
		Dermal Contact	8E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene	0.05	- -
		Inhalation	4E-08	- -	- -	- -	0.00009	- -
		Total	3E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	Chrysene, Arsenic	0.6	- -
	Surface Soil - Paved Area	Incidental Ingestion	2E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	0.3	- -
		Dermal Contact	7E-06	- -	- -	Benzo(a)pyrene	0.009	- -
		Inhalation	1E-10	- -	- -	- -	0.00005	- -
		Total	3E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	0.3	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	2E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	0.4	- -
		Dermal Contact	5E-06	- -	- -	Benzo(a)pyrene	0.02	- -
		Inhalation	2E-10	- -	- -	- -	0.001	- -
		Total	3E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	0.4	- -
	Surface Water	Dermal Contact	5E-08	- -	- -	- -	0.008	- -
	Sediment	Incidental Ingestion	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.8	- -
		Dermal Contact	4E-06	- -	- -	Benzo(a)pyrene	0.008	- -
		Total	2E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.8	- -
	Fish	Ingestion	5E-05	- -	Total Aroclors	4,4'-DDE, Dieldrin	0.8	- -
Total Exposed Area Surface Soil, Surface Water, Sediment, and Fish			1E-04				2	
Total Exposed Area Subsurface Soil, Surface Water, Sediment and Fish			3E-03				2	
Total Paved Area Surface Soil, Surface Water, Sediment and Fish			1E-04				2	
Total Paved Area Subsurface Soil, Surface Water, Sediment and Fish			1E-04				2	

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Adult Recreational Users	Surface Soil - Exposed Area	Incidental Ingestion	5E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.05	- -
		Dermal Contact	2E-06	- -	- -	- -	0.002	- -
		Inhalation	6E-09				0.00007	- -
		Total	7E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.05	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Arsenic	0.05	- -
		Dermal Contact	2E-04	- -	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	0.01	- -
		Inhalation	1E-07	- -	- -	- -	0.00009	- -
		Total	5E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	0.06	- -
	Surface Soil - Paved Area	Incidental Ingestion	4E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.03	- -
		Dermal Contact	2E-06	- -	- -	- -	0.001	- -
		Inhalation	5E-10	- -	- -	- -	0.00005	- -
		Total	6E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.03	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	5E-06	- -	- -	Arsenic	0.04	- -
		Dermal Contact	1E-06	- -	- -	- -	0.003	- -
		Inhalation	8E-10	- -	- -	- -	0.001	- -
		Total	7E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.05	- -
	Surface Water	Dermal Contact	1E-07	- -	- -	- -	0.003	- -
	Sediment	Incidental Ingestion	3E-06	- -	- -	- -	0.08	- -
		Dermal Contact	1E-06	- -	- -	- -	0.001	- -
		Total	4E-06	- -	- -	Benzo(a)pyrene, Arsenic	0.08	- -
	Fish	Ingestion	1E-04		Total Aroclors, Dieldrin	Aldrin, 4,4'-DDE	0.5	- -
Total Exposed Area Surface Soil, Surface Water, Sediment, and Fish			2E-04				1	
Total Exposed Area Subsurface Soil, Surface Water, Sediment and Fish			6E-04				1	
Total Paved Area Surface Soil, Surface Water, Sediment and Fish			2E-04				1	
Total Paved Area Subsurface Soil, Surface Water, Sediment and Fish			2E-04				1	

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SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Lifelong Recreational Users (Child and Adult)	Surface Soil - Exposed Area	Incidental Ingestion	3E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	NA	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)pyrene	NA	- -
		Inhalation	7E-09	- -	- -	- -	NA	- -
		Total	4E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	NA	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	2E-03	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Chrysene, Arsenic	NA	- -
		Dermal Contact	9E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene	NA	- -
		Inhalation	2E-07	- -	- -	- -	NA	- -
		Total	3E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	Chrysene, Arsenic	NA	- -
	Surface Soil - Paved Area	Incidental Ingestion	3E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	NA	- -
		Dermal Contact	9E-06	- -	- -	Benzo(a)pyrene	NA	- -
		Inhalation	7E-10	- -	- -	- -	NA	
		Total	4E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	NA	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	3E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	NA	- -
		Dermal Contact	6E-06	- -	- -	Benzo(a)pyrene	NA	- -
		Inhalation	1E-09	- -	- -	- -	NA	- -
		Total	3E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	NA	- -
	Surface Water	Dermal Contact	2E-07	- -	- -	- -	NA	- -
	Sediment	Incidental Ingestion	2E-05	- -	- -	Benzo(a)pyrene, Arsenic	NA	- -
		Dermal Contact	5E-06	- -	- -	Benzo(a)pyrene	NA	- -
		Total	2E-05	- -	- -	Benzo(a)pyrene, Arsenic	NA	- -
	Fish	Ingestion	2E-04	- -	Total Aroclors, 4,4'-DDE, Dieldrin	Aldrin	NA	- -
Total Exposed Area Surface Soil, Surface Water, Sediment, and Fish			3E-04				NA	
Total Exposed Area Subsurface Soil, Surface Water, Sediment and Fish			4E-03				NA	
Total Paved Area Surface Soil, Surface Water, Sediment and Fish			3E-04				NA	
Total Paved Area Subsurface Soil, Surface Water, Sediment and Fish			2E-04				NA	

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Hypothetical Child Residents	Surface Soil - Exposed Area	Incidental Ingestion	2E-04	- -	Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	3	Target Organs HI ≤ 1
		Dermal Contact	6E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.09	- -
		Inhalation	3E-08	- -	- -	- -	0.001	- -
		Total	3E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	3	Target Organs HI ≤ 1
	Subsurface Soil - Exposed Area	Incidental Ingestion	2E-02	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	Chrysene	4	- -
		Dermal Contact	6E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene	Chrysene, Arsenic	0.4	- -
		Inhalation	8E-07	- -	- -	- -	0.002	- -
		Total	2E-02	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Chrysene, Arsenic	Total Aroclors	4	Target Organs HI ≤ 1
	Surface Soil - Paved Area	Incidental Ingestion	2E-04	- -	Benzo(a)pyrene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	2	Target Organs HI ≤ 1
		Dermal Contact	5E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	0.07	- -
		Inhalation	3E-09	- -	- -	- -	0.001	- -
		Total	2E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	2	Target Organs HI ≤ 1
	Subsurface Soil - Paved Area	Incidental Ingestion	1E-04	- -	Benzo(a)pyrene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Total Aroclors	3	Target Organs HI ≤ 1
		Dermal Contact	4E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	0.1	- -
		Inhalation	4E-09	- -	- -	- -	0.03	
		Total	2E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Total Aroclors	3	Arsenic

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Hypothetical Child Residents	Groundwater	Ingestion	6E-03	Vinyl Chloride, Arsenic	PCE, TCE	1,1-DCA, Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene, Benzo(b)fluoranthene	655	1,1-DCA, 1,3,5-Trimethylbenzene, Bromomethane, Carbon Tetrachloride, PCE, Vinyl Chloride, Aluminum, Antimony, Arsenic, Barium, Beryllium, Chromium, Cobalt, Copper, Manganese, Nickel, Thallium, Vanadium, Zinc
		Dermal Contact	7E-05	- -	PCE, Arsenic	Ethylbenzene, TCE, Vinyl Chloride	22	1,3,5-Trimethylbenzene, Chromium, Manganese, Zinc
		Inhalation	4E-04	Vinyl Chloride	PCE, TCE	1,1-DCA, Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene	2	Target Organs HI ≤ 1
		Total	7E-03	TCE, Vinyl Chloride, Arsenic	1,1-DCA, PCE	Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene, Benzo(b)fluoranthene, Dieldrin	679	1,1-DCA, 1,3,5-Trimethylbenzene, Bromomethane, Carbon Tetrachloride, Chloroform, Ethyl Benzene, Isopropylbenzene, PCE, Vinyl Chloride, Total Xylenes Aluminum, Antimony, Arsenic, Barium, Beryllium, Chromium, Cobalt, Copper, Manganese, Nickel, Thallium, Vanadium, Zinc
Total Exposed Area Surface Soil and Groundwater			8E-03				682	
Total Exposed Area Subsurface Soil and Groundwater			3E-02				683	
Total Paved Area Surface Soil and Groundwater			7E-03				681	
Total Paved Area Subsurface Soil and Groundwater			7E-03				682	

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Hypothetical Adult Residents	Surface Soil - Exposed Area	Incidental Ingestion	4E-05	- -	Benzo(a)pyrene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.3	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.01	- -
		Inhalation	1E-07	- -	- -	- -	0.001	- -
		Total	5E-05	- -	Benzo(a)pyrene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	0.4	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	2E-03	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Chrysene, Arsenic	0.4	- -
		Dermal Contact	1E-03	Benzo(a)pyrene, Dibenzo(a,h)anthracene	Benzo(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene	0.06	- -
		Inhalation	3E-06	- -	- -	Naphthalene	0.002	- -
		Total	3E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene	Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene	Chrysene, Arsenic, Naphthalene	0.5	- -
	Surface Soil - Paved Area	Incidental Ingestion	3E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	0.2	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.01	- -
		Inhalation	1E-08	- -	- -	- -	0.001	- -
		Total	4E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	0.2	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	4E-05	- -	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	0.3	- -
		Dermal Contact	1E-05	- -	- -	Benzo(a)pyrene, Arsenic	0.02	- -
		Inhalation	2E-08	- -	- -	- -	0.03	- -
		Total	5E-05	- -	Arsenic	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Total Aroclors	0.4	- -

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Hypothetical Adult Residents	Groundwater	Ingestion	8E-03	Vinyl Chloride, Arsenic	1,1-DCA, PCE, TCE	Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene, Benzo(b)fluoranthene, Dieldrin	200	1,3,5-Trimethylbenzene, Vinyl Chloride, Aluminum, Arsenic, Barium, Beryllium, Chromium, Cobalt, Copper, Iron, Manganese, Nickel, Thallium, Vanadium, Zinc
		Dermal Contact	1E-04	- -	PCE, Arsenic	Ethylbenzene, TCE, Vinyl Chloride	8	Beryllium, Chromium, Iron, Manganese
		Inhalation	4E-04	Vinyl Chloride	1,1-DCA, PCE, TCE	Carbon Tetrachloride, Chloroform, Chloromethane, Ethyl Benzene	0.6	--
		Total	8E-03	PCE, TCE, Vinyl Chloride, Arsenic	1,1-DCA, Ethylbenzene	Carbon Tetrachloride, Chloroform, Chloromethane, Benzo(b)fluoranthene, Dieldrin	209	1,3,5-Trimethylbenzene, Vinyl Chloride, Aluminum, Arsenic, Barium, Beryllium, Carbon Tetrachloride, Chromium, Cobalt, Copper, Iron, Manganese, Nickel, Thallium, Vanadium, Zinc
Total Exposed Area Surface Soil and Groundwater			2E-04				209	
Total Exposed Area Subsurface Soil and Groundwater			1E-02				209	
Total Paved Area Surface Soil and Groundwater			8E-03				209	
Total Paved Area Subsurface Soil and Groundwater			8E-03				209	

TABLE C-15

**SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND**

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks > 10^{-4}	Chemicals with Cancer Risks > 10^{-5} and ≤ 10^{-4}	Chemicals with Cancer Risks > 10^{-6} and ≤ 10^{-5}	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Hypothetical Lifelong Residents (Child and Adult)	Surface Soil - Exposed Area	Incidental Ingestion	2E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Arsenic	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene	NA	- -
		Dermal Contact	7E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Inhalation	2E-07	- -	- -	- -	NA	- -
		Total	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Arsenic	Indeno(1,2,3-cd)pyrene	NA	- -
	Subsurface Soil - Exposed Area	Incidental Ingestion	2E-02	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Arsenic	Chrysene, Total Aroclors	NA	- -
		Dermal Contact	7E-03	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene	Chrysene, Arsenic	NA	- -
		Inhalation	4E-06	- -	- -	Naphthalene	NA	- -
		Total	2E-02	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	Benzo(k)fluoranthene, Chrysene, Arsenic	Naphthalene, Total Aroclors	NA	- -
	Surface Soil - Paved Area	Incidental Ingestion	2E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Arsenic	Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene	NA	- -
		Dermal Contact	6E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Arsenic	NA	- -
		Inhalation	1E-08	- -	- -	- -	NA	- -
		Total	3E-04	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Arsenic	Indeno(1,2,3-cd)pyrene,	NA	- -
	Subsurface Soil - Paved Area	Incidental Ingestion	2E-04	- -	Benzo(a)pyrene, Arsenic	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Total Aroclors	NA	- -
		Dermal Contact	5E-05	- -	Benzo(a)pyrene	Benzo(a)anthracene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Total Aroclors, Arsenic	NA	- -
		Inhalation	2E-08	- -	- -	- -	NA	- -
		Total	2E-04	- -	Benzo(a)anthracene, Benzo(a)pyrene, Arsenic	Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, Total Aroclors	NA	- -

TABLE C-15

SUMMARY OF CANCER RISKS AND HAZARD INDICES FROM THE HHRA
REASONABLE MAXIMUM EXPOSURES
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $> 10^{-4}$	Chemicals with Cancer Risks $> 10^{-5}$ and $\leq 10^{-4}$	Chemicals with Cancer Risks $> 10^{-6}$ and $\leq 10^{-5}$	Hazard Index	Chemicals Contributing to an Target Organ HI > 1
Hypothetical Lifelong Residents (Child and Adult)	Groundwater	Ingestion	1E-02	TCE, Vinyl Chloride, Arsenic	1,1-DCA, PCE, Benzo(b)fluoranthene	Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene, Dieldrin	NA	- -
		Dermal Contact	2E-04	- -	PCE, TCE, Vinyl Chloride, Arsenic	1,1-DCA, Ethylbenzene, Dieldrin	NA	- -
		Inhalation	8E-04	TCE, Vinyl Chloride	1,1-DCA, PCE	Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene	NA	- -
		Total	1E-02	TCE, Vinyl Chloride, Arsenic	1,1-DCA, PCE, Benzo(b)fluoranthene	Carbon Tetrachloride, Chloroform, Chloromethane, Ethylbenzene, Dieldrin	NA	- -
Total Exposed Area Surface Soil and Groundwater			3E-04				NA	
Total Exposed Area Subsurface Soil and Groundwater			4E-02				NA	
Total Paved Area Surface Soil and Groundwater			1E-02				NA	
Total Paved Area Subsurface Soil and Groundwater			1E-02				NA	

TABLE C-16

BUILDING 179 GROUNDWATER DATA (PRIOR TO THE SRI)
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Maximum Detected Concentration			ORNL Regional Screening Level[1] Tap Water	USEPA MCL[2]	RIDEM GA Groundwater Objective[3]	USEPA Groundwater Volatilization Criteria[4]
	Building 179	Site 8					
		Overburden	Bedrock				
Volatile Organic Compounds (ug/L)							
Chloroethane	73 J	ND	130	21,000 N	NA	NA	28,000 N
Acetone	390 JB	8	13 J	22,000 N	NA	NA	220,000 N
1,1-Dichloroethene	310 J	ND	7	340 N	7	7	190 N
Methylene Chloride	230 J	ND	ND	4.8 C	5	5	6.7 C
1,1-Dichloroethane	1400	0.04 J	310	2.4 C	NA	NA	2,200 N
2-Butanone	210 EB	ND	ND	7,100 N	NA	NA	440000 N
cis-1,2-Dichloroethene	2 J	0.04 J	26	370 N	70	70	210 N
1,1,1-Trichloroethane	23000 E	1	4	9,100 N	200	200	3,100 N
Trichloroethene	2 J	0.9 J	730	1.7 C	5	5	0.053 C[5]
2-Hexanone	160 JB	ND	ND	NA	NA	NA	NA
Tetrachloroethane	9	2	12	0.11 C	5	5	1.1 C[5]
Total Xylenes	1 J	ND	97 J	200 N	10,000	10,000	22,000 N[6]
sec-Butylbenzene	1 J	ND	84	NA	NA	NA	250 N
tert-Butylbenzene	1 J	ND	0.4 J	NA	NA	NA	290 N
4-Isopropyltoluene	1 J	ND	110	NA	NA	NA	NA
1,3-Dichlorobenzene	1 J	ND	ND	NA	NA	NA	830 N
1,4-Dichlorobenzene	1 J	ND	ND	0.43 C	75	75	8,200 N
n-Butylbenzene	1 J	ND	98	NA	NA	600	260 N
1,2-Dichlorobenzene	1 J	ND	ND	370 N	600	600	830 N
1,2,4-Trichlorobenzene	120 J	ND	ND	8.2 N	70	70	3,400 N
Hexachlorobutadiene	3 J	ND	ND	0.042 C	NA	NA	NA
Naphthalene	220 JB	ND	ND	0.14 C	NA	20	150 N
1,2,3-Trichlorobenzene	150 J	ND	ND	NA	NA	NA	NA
Semivolatile Organic Compounds (ug/L)							
Phenol	4 J	ND	ND	11,000 N	NA	NA	NA
2-Methylphenol	2 J	ND	ND	1,800 N	NA	NA	NA
4-Methylphenol	19	ND	ND	180 N	NA	NA	NA
Naphthalene	2 J	ND	ND	0.14 C	NA	20	150 N
Diethylphthalate	2 J	ND	ND	29,000 N	NA	NA	NA
di-n-butylphthalate	2 J	ND	5 J	3,700 N	NA	NA	NA
Bis(2-ethylhexyl)phthalate	140 E	3 J	ND	4.8 C	6	6	NA

Notes:

1 - Oak Ridge National Laboratory Regional (ORNL) Screening Levels for Chemical Contaminants at Superfund Sites,September 12, 2008.
[Cancer benchmark value = 1E-06, Hazard index (HI) = 1.0].

2 - 2006 Edition of the Drinking Water Standards and Health Advisories (USEPA, August 2006).

3 - RIDEM, DEM-DSR-01-93, February 2004.

4 - Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. November 2002. EPA530-F-02-052.
Values are from Table 2c and correspond to a target cancer risk level of 1E-6 or HI =1 and an attenuation factor of 0.001.

5 - The value presented in Table 2c of the draft vapor intrusion guidance is based on the MCL. USEPA Region I requires thescreening criteria for vapor intrusion to be risk-based.
Therefore, the value from Table 2a adjusted for a 1E-6 cancer risk level is presented here.

6 - Value is for p-xylenes.

ND - Not detected.

NA - Not available.

E - Indicates concentration exceeds calibration range.

B - Indicates the analyte is found in blank samples as well as the sample.

J - Estimated concentration.

TABLE C-17

CHEMICALS RETAINED AS CHEMICALS OF CONCERN DURING THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Receptor								
	Construction Workers	Industrial Workers	Adolescent Trespassers	Child Recreational Users	Adult Recreational Users	Lifelong Recreational Users	Child Residents	Adult Residents	Lifelong Residents
Surface Soil									
Exposed Area									
Carcinogenic PAHs		X		X		X	X	X	X
Arsenic		X		X		X	X	X	X
Paved Area									
Carcinogenic PAHs		X		X		X	X	X	X
Arsenic		X		X		X	X	X	X
Subsurface Soil									
Exposed Area									
Carcinogenic PAHs	X	X	X	X	X	X	X	X	X
Naphthalene		X						X	X
Total Aroclors							X		X
Arsenic		X	X	X	X	X	X	X	X
Paved Area									
Carcinogenic PAHs		X		X		X	X	X	X
Total Aroclors							X	X	X
Arsenic		X		X		X	X	X	X
Groundwater									
1,1-Dichloroethane							X	X	X
1,3,5,-Trimethybenzene							X	X	
Bromomethane							X	X	
Carbon Tetrachloride							X	X	X
Chloroform							X	X	X
Chloromethane							X	X	X
Ethylbenzene							X	X	X
Tetrachloroethene							X	X	X
Trichloroethene							X	X	X
Vinyl Chloride							X	X	X
Benzo(b)fluoranthene							X	X	X
Dieldrin							X	X	X
Aluminum	X						X	X	
Antimony							X		

TABLE C-17

CHEMICALS RETAINED AS CHEMICALS OF CONCERN DURING THE HHRA
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Receptor								
	Construction Workers	Industrial Workers	Adolescent Trespassers	Child Recreational Users	Adult Recreational Users	Lifelong Recreational Users	Child Residents	Adult Residents	Lifelong Residents
Groundwater (Continued)									
Arsenic							X	X	X
Barium							X	X	
Beryllium	X						X	X	
Chromium	X						X	X	
Cobalt							X	X	
Copper							X	X	
Iron	X						X	X	
Lead							X	X	X
Manganese	X						X	X	
Nickel							X	X	
Thallium							X	X	
Vanadium							X	X	
Zinc							X	X	
Surface Water									
No COCs identified for surface water.									
Sediment									
Carcinogenic PAHs				X		X			
Arsenic				X		X			
Fish Tissue									
4,4'-DDE				X	X	X			
Total Aroclors				X	X	X			
Aldrin					X	X			
Dieldrin				X	X	X			

TABLE C-18
REFINEMENT OF CHEMICALS OF CONCERN IN GROUNDWATER (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (µg/L)(1)			Target Risk Level				Chemical to be Forwarded as a COC to the FS?
	Maximum Detected Concentration (1)	95% UCL (2)	Average Concentration (2)	Incremental Cancer Risk of $1x10^{-6}$ (µg/L)	Incremental Cancer Risk of $1x10^{-5}$ (µg/L)	Incremental Cancer Risk of $1x10^{-4}$ (µg/L)	Hazard Index = 1 (µg/L)	
HYPOTHETICAL CHILD RESIDENTS								
1,1-Dichloroethane	1000	154.5	80.8	22	220	2200	2116	Yes
1,3,5,-Trimethybenzene	290	41.04	145	NA	NA	NA	72	Yes
Bromomethane	2	NA	2	NA	NA	NA	15	No. Only one detection during sampling round. Also, the detection does not exceed calculated risk value (HI=1).
Carbon Tetrachloride	1.85	1.025	1.12	1.6	16	160	38	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5 and HI=1).
Chloroform	7	0.694	1.3	4	40	400	105	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5 and HI=1).
Chloromethane	16	3.682	5.13	10	100	1000	NA	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5).
Ethylbenzene	58	8.748	29.4	8.3	83	830	789	Yes
Tetrachloroethene	12	1.706	2.98	0.17	1.7	17	79.0	Yes
Trichloroethene	1200	200.8	109	20	200	2000	NA	Yes
Vinyl Chloride	19	1.429	2.27	0.08	0.8	8	32	Yes
Benzo(k)fluoranthene	4	NA	4	0.034	0.34	3.4	NA	No. Only one detection during sampling round. Also, the detection is similar to a value representing ILCR = 10-4.
Dieldrin	0.0108	NA	0.0108	0.005	0.05	0.5	0.38	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5).
Aluminum	564,000	201311	29100	NA	NA	NA	11121	No - toxicity is uncertain
Antimony	1.2	NA	1.2	NA	NA	NA	4.3	No. Only one detection during sampling round. Also, the detection does not exceed calculated risk value (HI=1).
Arsenic	503	123.7	34.8	0.09	0.9	9	3.3	Yes (Note 5).
Barium	1390	339.3	72	NA	NA	NA	2094	No. Representative site concentration does not exceed calculated risk value (HI=1).
Beryllium	17.8	8.663	9.04	NA	NA	NA	13	No. Representative site concentration does not exceed calculated risk value (HI=1).
Chromium	868	212.3	101	0.036	0.36	3.6	24	Yes (Note 3).
Cobalt	637	155	59.8	NA	NA	NA	3.3	Yes
Copper	1440	530.4	166	NA	NA	NA	445	No - Average concentration does not exceed risk criteria
Iron	1,210,000	434784	52200	NA	NA	NA	7785	No - source and toxicity is uncertain
Lead	1890	449.8	128	15				Yes (Note 6).
Manganese	13,800	4023	1850	NA	NA	NA	240	Yes (Note 5).
Nickel	1160	415.4	60.6	NA	NA	NA	218	Yes (Note 6).
Thallium	2.3	NA	2.3	NA	NA	NA	0.72	No. Only one detection during sampling round. A representative site-wide concentration (considering nondetects) would not exceed the calculated risk value (HI=1).
Vanadium	832	321.7	169	NA	NA	NA	47	Yes (Note 6).
Zinc	3990	527.5	285	NA	NA	NA	3343	No. Representative site concentration does not exceed calculated risk value (HI=1).

TABLE C-18
REFINEMENT OF CHEMICALS OF CONCERN IN GROUNDWATER (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (µg/L)(1)			Target Risk Level				
	Maximum Detected Concentration (1)	95% UCL (2)	Average Concentration (2)	Incremental Cancer Risk of $1x10^{-6}$ (µg/L)	Incremental Cancer Risk of $1x10^{-5}$ (µg/L)	Incremental Cancer Risk of $1x10^{-4}$ (µg/L)	Hazard Index = 1 (µg/L)	Chemical to be Forwarded as a COC to the FS?
HYPOTHETICAL ADULT RESIDENTS								
1,1-Dichloroethane	1000	154.5	80.8	17	170	1700	6765	Yes
1,3,5,-Trimethybenzene	290	41.04	145	NA	NA	NA	200	No. Representative site concentration does not exceed calculated risk value (HI=1).
Bromomethane	2	NA	2	NA	NA	NA	49	No. Only one detection during sampling round. Also, the detection does not exceed calculated risk value (HI=1).
Carbon Tetrachloride	1.85	1.025	1.12	1.2	12	120	115	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5 and HI=1).
Chloroform	7	0.694	1.3	3.2	32	320	334	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5 and HI=1).
Chloromethane	16	3.682	5.13	NA	NA	NA	NA	Yes
Ethylbenzene	58	8.748	29.4	6	60	600	2275	Yes
Tetrachloroethene	12	1.706	2.98	0.12	1.2	12	228	Yes
Trichloroethene	1200	200.8	109	15	150	1500	NA	Yes
Vinyl Chloride	19	1.429	2.27	0.07	0.7	7	104	Yes
Benzo(k)fluoranthene	4	NA	4	0.08	0.8	8	NA	No. Only one detection during sampling round. A representative site-wide concentration (considering nondetects) would not exceed the calculated risk value (ILCR=10-5).
Dieldrin	0.0108	NA	0.0108	0.004	0.04	0.4	NA	No. Only one detection during sampling round. A representative site-wide concentration (considering nondetects) would not exceed the calculated risk value (ILCR=10-5).
Aluminum	564,000	201311	29100	NA	NA	NA	1.1	No - toxicity is uncertain
Arsenic	503	123.7	34.8	0.07	0.7	7	36310	Yes (Note 5).
Barium	1390	339.3	72	NA	NA	NA	6793	No. Representative site concentration does not exceed calculated risk value (HI=1).
Beryllium	17.8	8.663	9.04	NA	NA	NA	42	No. Representative site concentration does not exceed calculated risk value (HI=1).
Chromium	868	212.3	101	0.15	1.5	15	77	Yes (Note 3).
Cobalt	637	155	59.8	NA	NA	NA	11	Yes
Copper	1440	530.4	166	NA	NA	NA	1452	No. Representative site concentration does not exceed calculated risk value (HI=1).
Iron	1,210,000	434784	52200	NA	NA	NA	25417	No - source and toxicity is uncertain
Lead	1890	449.8	128	15				Yes (Note 6).
Manganese	13,800	4023	1850	NA	NA	NA	775	Yes (Note 5).
Nickel	1160	415.4	60.6	NA	NA	NA	711	No. Representative site concentration does not exceed calculated risk value (HI=1).
Thallium	2.3	NA	2.3	NA	NA	NA	2.4	No. Only one detection during sampling round, and the detection is less than the calculated risk value (HI=1).
Vanadium	832	321.7	169	NA	NA	NA	152	Yes (Note 6).
Zinc	3990	527.5	285	NA	NA	NA	10916	No. Representative site concentration does not exceed calculated risk value (HI=1).

TABLE C-18
REFINEMENT OF CHEMICALS OF CONCERN IN GROUNDWATER (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (µg/L)(1)			Target Risk Level				Chemical to be Forwarded as a COC to the FS?
	Maximum Detected Concentration (1)	95% UCL (2)	Average Concentration (2)	Incremental Cancer Risk of $1x10^{-6}$ (µg/L)	Incremental Cancer Risk of $1x10^{-5}$ (µg/L)	Incremental Cancer Risk of $1x10^{-4}$ (µg/L)	Hazard Index = 1 (µg/L)	
HYPOTHETICAL LIFELONG RESIDENTS								
1,1-Dichloroethane	1000	154.5	80.8	9.6	96	960	NA	Yes
Carbon Tetrachloride	1.85	1.025	1.12	0.67	6.7	67	NA	Yes
Chloroform	7	0.694	1.3	1.8	18	180	NA	No. Representative site concentration does not exceed calculated risk value (ILCR=10-5).
Chloromethane	16	3.682	5.13	NA	NA	NA	NA	Yes
Ethylbenzene	58	8.748	29.4	3.5	35	350	NA	Yes
Tetrachloroethene	12	1.706	2.98	0.07	0.7	7	NA	Yes
Trichloroethene	1200	200.8	109	8.7	87	870	NA	Yes
Vinyl Chloride	19	1.429	2.27	0.04	0.4	4	NA	Yes
Benzo(k)fluoranthene	4	NA	4	0.24	2.4	24	NA	No. Only one detection during sampling round. Also, the detection is less than a value representing ILCR=10-4.
Dieldrin	0.0108	NA	0.0108	0.002	0.02	0.2	NA	No. Only one detection during sampling round. A representative site-wide concentration (considering nondetects) would not exceed the calculated risk value (ILCR=10-5).
Arsenic	503	123.7	34.8	0.04	0.4	4	NA	Yes (Note 5).
Lead	1890	449.8	128	15				Yes (Note 6).
CONSTRUCTION WORKERS								
Aluminum	564,000	201311	29100	NA	NA	NA	2,572,493	No. Toxicity is uncertain, and a representative site concentration does not exceed calculated risk value (HI=1).
Beryllium	17.8	8.663	9.04	NA	NA	NA	103	No. Representative site concentration does not exceed calculated risk value (HI=1).
Chromium	868	212.3	101	13	130	1300	273	Yes (Note 3).
Iron	1,210,000	434784	52200	NA	NA	NA	1,800,745	No. Toxicity is uncertain, and a representative site concentration does not exceed calculated risk value (HI=1).
Manganese	13,800	4023	1850	NA	NA	NA	6,644	No. Representative site concentration does not exceed calculated risk value (HI=1).
New COCs identified from the SRI								
1,4-Dioxane	8.3	1.832	2.25	NC	NC	NC	NC	Yes - See Section 6.4
1,1,1-Trichoroethane	1600	NC	NC	NC	NC	NC	NC	Yes - See Section 6.4
1,1-Dichloroethene	79	NC	NC	NC	NC	NC	NC	Yes - See Section 6.4

Notes:
1 - Maximum concentrations include groundwater data from the RI and SRI.
2 - 95% UCL and average values are calculated using a single (most recent) sample result from each monitoring well, combining the RI data and SRI data. Non-detect values were not considered.
3 - Chromium is being retained as a COC because, for conservative risk assessment purposes, the Chromium is assumed to be Cr^{+6}. Additional sampling may be conducted to determine the actual speciation of chromium at the Site (may be dropped as a COC if found to be present as trivalent chromium, Cr+3).
4 - "NA" = Not applicable; "NC" = Not Calculated
5 - Retained as a COC although it is believed to be associated with a "secondary release" resulting from the mobilization of naturally occurring arsenic and manganese in soil to groundwater, due to the reducing conditions resulting from the primary release of contaminants to the subsurface.
6 - Based on unfiltered sample data. If filtered metals had been used to calculate risks from residential exposures to groundwater then lead, nickel, and vanadium would not have been retained as COCs.

TABLE C-19
REFINEMENT OF CHEMICALS OF CONCERN IN SOIL (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (mg/kg) [1]			Target Risk Level				Background[2]				
	Maximum Detected Concentration	95% UCL	Average Concentration	Incremental Cancer Risk of $1x10^{-6}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-5}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-4}$ (mg/kg)	Hazard Index = 1 (mg/kg)	Maximum Detected Concentration (mg/kg)	95% UCL for PmB soil (mg/kg)	95% UCL for Se Soil (mg/kg)	Site Concentration> Background Concentration? (mg/kg)	Chemical to be Forwarded as a COC to the FS?
CONSTRUCTION WORKERS												
Benzo(a)anthracene	1,900	92.862	25.8	41	410	4,100	NA	0.079	0.066	0.079	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Benzo(a)pyrene	1,500	74.598	21.5	4.1	41	410	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	41	410	4,100	NA	0.130	0.120	0.130	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	4.1	41	410	NA	ND	ND	ND	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	41	410	4,100	NA	0.098	0.060	0.098	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
INDUSTRIAL WORKERS												
Benzo(a)anthracene	1,900	92.862	25.8	2.1	21	210	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.21	2.1	21	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	2.1	21	210	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	21	210	2,100	NA	0.110	0.069	0.110	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Chrysene	1,700	82.646	22.8	211	2,110	21,100	NA	0.140	0.090	0.140	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.21	2.1	21	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	2.1	21	210	NA	0.098	0.060	0.098	Y	Yes
Arsenic	122	17.87	16.4	1.6	16	160	256	71.7	49.8	23.2	Y	No. The representative site concentration is consistent with the calculated risk value (ILCR=10-5) and background.
ADOLESCENT TRESPASSERS												
Benzo(a)anthracene	1,900	92.862	25.8	3.3	33	330	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.33	3.3	33	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	3.3	33	330	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	33	330	3,300	NA	0.110	0.069	0.110	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.33	3.3	33	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	10	100	1,000	NA	0.098	0.060	0.098	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Arsenic	122	17.87	16.4	1.6	16	160	768	71.7	49.8	23.2	Y	No. The representative site concentration is consistent with the calculated risk value (ILCR=10-5) and background.
CHILD RECREATIONAL USERS												
Benzo(a)anthracene	1,900	92.862	25.8	1.3	13	130	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.13	1.3	13	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	1.3	13	130	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	13	130	1,300	NA	0.110	0.069	0.110	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Chrysene	1,700	82.646	22.8	125	1,250	12,500	NA	0.140	0.090	0.140	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.13	1.3	13	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	1.3	13	130	NA	0.098	0.060	0.098	Y	Yes
Arsenic	122	17.87	16.4	4.1	41	410	158	71.7	49.8	23.2	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5) and is consistent with background.

TABLE C-19
REFINEMENT OF CHEMICALS OF CONCERN IN SOIL (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (mg/kg) (1)			Target Risk Level				Background(2)				
	Maximum Detected Concentration	95% UCL	Average Concentration	Incremental Cancer Risk of $1x10^{-6}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-5}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-4}$ (mg/kg)	Hazard Index = 1 (mg/kg)	Maximum Detected Concentration (mg/kg)	95% UCL for PmB soil (mg/kg)	95% UCL for Se Soil (mg/kg)	Site Concentration> Background Concentration? (mg/kg)	Chemical to be Forwarded as a COC to the FS?
ADULT RECREATIONAL USERS												
Benzo(a)anthracene	1,900	92.862	25.8	7.6	76	760	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.76	7.6	76	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	7.6	76	760	NA	0.130	0.120	0.130	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Benzo(k)fluoranthene	1,200	61.064	17.6	76	760	7,600	NA	0.110	0.069	0.110	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.76	7.6	76	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	7.6	76	760	NA	0.098	0.060	0.098	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Arsenic	122	17.87	16.4	9.2	92	920	1,426	71.7	49.8	23.2	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5) and is consistent with background.
LIFELONG RECREATIONAL USERS												
Benzo(a)anthracene	1,900	92.862	25.8	1.1	11	110	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.11	1.1	11	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	1.1	11	110	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	11	110	1,100	NA	0.110	0.069	0.110	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Chrysene	1,700	82.646	22.8	108	1,080	10,800	NA	0.140	0.090	0.140	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.11	1.1	11	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	1.1	11	110	NA	0.098	0.060	0.098	Y	Yes
Arsenic	122	17.87	16.4	2.8	28	280	NA	71.7	49.8	23.2	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5) and is consistent with background.
HYPOTHETICAL CHILD RESIDENTS												
Benzo(a)anthracene	1,900	92.862	25.8	0.170	1.7	17	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.017	0.17	1.7	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	0.170	1.7	17	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	1.7	17	170	NA	0.110	0.069	0.110	Y	Yes
Chrysene	1,700	82.646	22.8	17	170	1,700	NA	0.140	0.090	0.140	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.017	0.17	1.7	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	0.170	1.7	17	NA	0.098	0.060	0.098	Y	Yes
Total Aroclors	5.22	0.2083	0.447	0.328	3.28	32.8	NA	0.086	0.086	0.034	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Arsenic	122	17.87	16.4	0.560	5.6	56	22	71.7	49.8	23.2	Y	Yes
HYPOTHETICAL ADULT RESIDENTS												
Benzo(a)anthracene	1,900	92.862	25.8	1	10	100	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.1	1	10	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	1	10	100	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	10	100	1,000	NA	0.110	0.069	0.110	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Chrysene	1,700	82.646	22.8	105	1,050	10,500	NA	0.140	0.090	0.140	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.1	1	10	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	1	10	100	NA	0.098	0.060	0.098	Y	Yes
Naphthalene	220	10.885	5.31	11	110	1100	9,600	ND	ND	ND	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Total Aroclors	5.22	0.2083	0.447	0.68	6.8	68	NA	0.086	0.086	0.034	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Arsenic	122	17.87	16.4	1.3	13	130	195	71.7	49.8	23.2	Y	Yes

TABLE C-19
REFINEMENT OF CHEMICALS OF CONCERN IN SOIL (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (mg/kg) (1)			Target Risk Level				Background(2)				
	Maximum Detected Concentration	95% UCL	Average Concentration	Incremental Cancer Risk of $1x10^{-6}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-5}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-4}$ (mg/kg)	Hazard Index = 1 (mg/kg)	Maximum Detected Concentration (mg/kg)	95% UCL for PmB soil (mg/kg)	95% UCL for Se Soil (mg/kg)	Site Concentration> Background Concentration? (mg/kg)	Chemical to be Forwarded as a COC to the FS?
HYPOTHETICAL LIFELONG RESIDENTS												
Benzo(a)anthracene	1,900	92.862	25.8	0.150	1.5	15	NA	0.079	0.066	0.079	Y	Yes
Benzo(a)pyrene	1,500	74.598	21.5	0.015	0.15	1.5	NA	0.095	0.078	0.095	Y	Yes
Benzo(b)fluoranthene	1,300	64.554	19.3	0.150	1.5	15	NA	0.130	0.120	0.130	Y	Yes
Benzo(k)fluoranthene	1,200	61.064	17.6	1.5	15	150	NA	0.110	0.069	0.110	Y	Yes
Chrysene	1,700	82.646	22.8	15	150	1,500	NA	0.140	0.090	0.140	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Dibenzo(a,h)anthracene	330	16.157	6.5	0.015	0.15	1.5	NA	ND	ND	ND	Y	Yes
Indeno(1,2,3-cd)pyrene	850	42.428	13.3	0.150	1.5	15	NA	0.098	0.060	0.098	Y	Yes
Naphthalene	220	10.885	5.31	9.3	93	930	NA	ND	ND	ND	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Total Aroclors	5.22	0.2083	0.447	0.221	2.21	22.1	NA	0.086	0.086	0.034	Y	No. The representative site concentration is below the calculated risk value (ILCR=10-5).
Arsenic	122	17.87	16.4	0.40	4	40	NA	71.7	21	69.3	Y	Yes

NOTES:
1 - Site maximum, 95% UCL and average values are derived from a combined data set using RI and SRI data.
2 - Background data includes soil background data from the NUSC background data report (Tetra Tech, 2006)
3 - Total Aroclors in background are represented by Aroclor-1260, detected in 22 of 60 background samples.
4 - The maximum site concentration exceeds the maximum background concentration, but the average site concentration does not exceed the average background concentration

Soil site and background values are the average of detected values, and does not use half non-detect values.

TABLE C-20
REFINEMENT OF CHEMICALS OF CONCERN IN SEDIMENT (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (mg/kg) [1]			Target Risk Level				Background[2]			Chemical to be Forwarded as a COC to the FS?
	Maximum Detected Concentration	95% UCL	Average Concentration	Incremental Cancer Risk of $1x10^{-6}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-5}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-4}$ (mg/kg)	Hazard Index = 1 (mg/kg)	Maximum Detected Concentration (mg/kg)	95% UCL (mg/kg)	Site Concentration> Background Concentration?[1] (mg/kg)	
CHILD RECREATIONAL USERS											
Benzo(a)pyrene	2.6	1.044	0.51	0.13	1.3	13	NA	2.5	2.5	No	No - site data is similar or below background
Arsenic	18	15.04	14	4.1	41	410	160	35.5	34.0	No	No - site data is below background
LIFELONG RECREATIONAL USERS											
Benzo(a)pyrene	2.6	1.044	0.51	0.11	1.1	11	NA	2.5	2.5	No	No - site data is similar or below background
Arsenic	18	15.04	14	2.8	28	280	NA	35.5	34.0	No	No - site data is below background

NOTES:
1 - Site maximum, 95% UCL and average values are derived from a combined data set using RI and SRI data.
2. Site-specific background sediment data are from Tetra Tech, 2006. Anthropogenic background concentrations of organics are considered.

TABLE C-21
REFINEMENT OF CHEMICALS OF CONCERN IN FISH TISSUE (HUMAN HEALTH) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

Constituent	Site Data (mg/kg) [1]			Target Risk Level				Background[4]			Chemical to be Forwarded as a COC to the FS?
	Maximum Detected Concentration	95% UCL	Average Concentration	Incremental Cancer Risk of $1x10^{-6}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-5}$ (mg/kg)	Incremental Cancer Risk of $1x10^{-4}$ (mg/kg)	Hazard Index = 1 (mg/kg)	Maximum Detected Concentration (mg/kg)	Average Concentration (mg/kg)	Site Concentration> Background Concentration?[1] (mg/kg)	
CHILD RECREATIONAL USERS											
4,4'-DDE	0.652	0.649	0.312	0.124	1.24	12.4	NA	0.303	0.172	Y	No - See Note 2
Dieldrin	0.040	0.039	0.015	0.0026	0.026	0.26	0.18	0.012	0.006	Y	No - See Note 2
Total Aroclors	0.654	0.608	0.287	0.021	0.21	2.1	NA	0.357	0.187	Y	No - See Note 3
ADULT RECREATIONAL USERS											
4,4'-DDE	0.652	0.649	0.312	0.048	0.48	4.8	NA	0.303	0.172	Y	No - See Note 2
Aldrin	0.002	0.002	0.001	0.001	0.01	0.1	0.17	ND	ND	Y	No - See Note 2
Dieldrin	0.040	0.039	0.015	0.001	0.01	0.1	0.28	0.012	0.006	Y	No - See Note 2
Total Aroclors	0.654	0.608	0.287	0.008	0.08	0.8	NA	0.357	0.187	Y	No - See Note 3
LIFELONG RECREATIONAL USERS											
4,4'-DDE	0.652	0.649	0.312	0.035	0.35	3.5	NA	0.303	0.172	Y	No - See Note 2
Aldrin	0.002	0.002	0.001	0.0007	0.007	0.07	NA	ND	ND	Y	No - See Note 2
Dieldrin	0.040	0.039	0.015	0.0007	0.007	0.07	NA	0.012	0.006	Y	No - See Note 2
Total Aroclors	0.654	0.608	0.287	0.006	0.06	0.6	NA	0.357	0.187	Y	No - See Note 3

Notes:
1 - Site maximum, 95% UCL and average values are derived from a combined data set using RI and SRI data.
2 - Site maximum values are similar to or below screening values and therefore do not significantly contribute to total site risks.
Also, the data distribution does not suggest disposal or releases of pesticides at the site other than normal past use at and upgradient of the site.
3 - Site maximum values are similar to or below screening values and therefore do not significantly contribute to total site risks. Also was not selected as a COC for sediment.
4 - Background fish tissue samples were taken in Melville Ponds Area.

Concentrations cited are dry-weight results only.

TABLE C-22
REFINEMENT OF CHEMICALS OF CONCERN IN SEDIMENT (ECOLOGICAL) DURING THE SRI
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, NEWPORT RI

	Site Data		Pond Invertebrates		Stream Invertebrates		Reference Pond/Stream			Background[3]			
Constituent	Maximum Detected Concentration	Average Concentration	NOEC	LOEC	NOEC	LOEC	Maximum Detected Concentration	Average Concentration	Site Concentration> Reference Concentration?[1]	Maximum Detected Concentration	Average Concentration	Site Concentration> Background Concentration?[1]	Chemical to be Forwarded as a COC to the FS?
SEDIMENT													
Organics (μg/kg)													
Total DDx	667	104	55.6	250	NA	NA	56	19.9	Yes	395	175	No	No. Site concentrations are similar to and/or below background. No indication of a CERCLA release.
Alpha Chlordane[2]	180	28.8	NA	NA	NA	NA	NZ	NZ	Yes	110	40.2	No	
Gamma Chlordane[2]	130	21.2	NA	NA	NA	NA	NZ	NZ	Yes	87	27.9	No	
Total Chlordane	NA	NA	ND	123	NA	NA	NA	NA	NA	NA	NA	NA	No: See above for alpha and gamma chlordanes.
Total Aroclors	2930	214	ND	150	220	370	NZ	NZ	Yes	89	51.2	Yes	Yes
HMW PAHs	33640	6400	1676	7790	6240	7290	6240	2920	Yes	28120	11500	No	No. Site concentrations are similar to and/or below background. No indication of a CERCLA release.
Total PAHs	45560	7750	1769	8789	6962	8110	6962	3210	Yes	30269	12600	No	
Metals (mg/kg)													
Lead	27200	1410	NA	NA	543	562	74	29.4	Yes	297	91.9	Yes	Yes
SOIL													
Constituent	**Site Samples**		**Soil Invertebrates**							**Background[4]**			
	Maximum	**Average**	**NOAEL**	**LOAEL**						Max Background	Avg Background	Site>Background?	
Metals (mg/kg)													
Cadmium	11	1.18	0.22	1.11						0.15[5]	0.05[5]	Yes	Yes
Chromium	103	16.5	3.76	22.12						28.2	12.7	Yes	Yes
Selenium	1.9	0.787	0.24	0.82						0.73 [5]	0.37 [5]	No	No. Site concentrations are similar to and/or below background.

NA - Not available/Not Applicable
NZ - Not Analyzed or Not Detected

HMW PAHs - High Molecular Weight Polycyclic Aromatic Hydrocarbons (see text)
1 - Background comparisons were presented in the RI Report (Tetra Tech 2010a).
2 - Alpha and gamma chlordane concentrations are presented because total chlordane was not calculated for the reference and background samples.
3 - Background Sediment is Hydric "Se" soil type from Background Soil Investigation for the NUSC Disposal Area.
4 - "Se" soil type unless otherwise noted (background soil investigation for NUSC Disposal area)
5 - Basewide background Investigation Report (Tetra Tech, 2008)

TABLE C-23
SUMMARY OF COCs RETAINED FOR THE FS
SITE 8, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, RHODE ISLAND

Medium	COPC	Human Health Receptors	Ecological Receptors	Maximum Concentration (a)	Units
Soil	Benzo(a)anthracene	1,2,3,5,6,7,8,9	--	1,900	mg/kg
	Benzo(a)pyrene	1,2,3,4,5,6,7,8,9	--	1,500	mg/kg
	Benzo(b)fluoranthene	1,2,3,5,6,7,9	--	1,300	mg/kg
	Benzo(k)fluoranthene	1,3	--	1,200	mg/kg
	Dibenzo(a,h)anthracene	1,2,3,5,6,7,8,9	--	330	mg/kg
	Indeno(1,2,3-cd)pyrene	1,2,3,5,7,8,9	--	850	mg/kg
	Arsenic (b)	1,2,3	--	122	mg/kg
	Cadmium	--	12	2.4 J	mg/kg
	Chromium	--	12	28.8	mg/kg
Groundwater	1,1,1-Trichloroethane	Not Quantified	--	1,600	ug/L
	1,1-Dichloroethane	1,2,3	--	1,000	µg/L
	1,1-Dichloroethene	Not Quantified	--	79	ug/L
	1,3,5-Trimethybenzene	1	--	290	µg/L
	1,4-Dioxane	Not Quantified	--	8.3	µg/L
	Carbon Tetrachloride	3	--	1.85	µg/L
	Chloromethane	2,3	--	16	µg/L
	Ethylbenzene	1,2,3	--	58	µg/L
	Tetrachloroethene	1,2,3	--	12	µg/L
	Trichloroethene	1,2,3	--	1,200	µg/L
	Vinyl Chloride	1,2,3	--	19	µg/L
	Arsenic (f)	1,2,3	--	503	µg/L
	Chromium (d)	1,2,4	--	868	µg/L
	Cobalt	1,2	--	637	µg/L
	Lead (e)	1,2,3	--	1,890	µg/L
	Manganese (f)	1,2	--	13,800	µg/L
	Nickel (e)	1	--	1,160	µg/L
	Vanadium (e)	1,2	--	832	µg/L
Sediment (c)	Total Aroclors	--	11	2.93	mg/kg
	Lead	--	11	27,200	mg/kg

(a) Maximum Concentrations are presented for illustrative purposes
(b) For type PmB surface and subsurface soil (North Meadow) and type Se surface soil (remainder of site).
(c) Alternatively, a Probable Effects Concentration Quotient (PEC-Q) approach may be considered in the FS.
(d) Pending sampling to determine whether present as Cr+6 or Cr+3 (the latter may not be identified as a COC).
(e) Based on unfiltered sample data. If filtered metals had been used to calculate risks from residential exposures to groundwater then lead, nickel, and vanadium would not have been retained as COCs.
(f) Arsenic and manganese are associated with a secondary release to groundwater.

Receptors:

1 Hypothetical Child Residents
2 Hypothetical Adult Residents
3 Hypothetical Lifelong Residents
4 Construction Workers
5 Industrial Workers
6 Adolescent Trespassers
7 Child Recreational Users
8 Adult Recreational Users
9 Lifelong Recreational Users
10 Ecological - Pond Invertebrates
11 Ecological - Stream Invertebrates
12 Ecological - Soil Invertebrates

Appendix D
Ecological Risk Assessment Summary Tables

TABLE D-1

SURFACE WATER ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND
PAGE 1 OF 2

Parameter	Frequency of Detection	Minimum Detected Concentration[1]	Maximum Detected Concentration[1]	Sample with Maximum Detection	Average Concentration[2]	Average of Positive Detects[3]	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient[4]	Retained as a COPC (yes/no)?	COPC Rationale
Volatile Organics (µg/L)												
1,1,1-TRICHLOROETHANE	4/22	0.92 J	2.4 J	DA-A-SW02-01-AVG	0.611	1.58	1.12	11	0	0.22	No	BSL
1,1-DICHLOROETHANE	4/22	0.7 J	1.6 J	DA-A-SW02-01-AVG	0.522	1.12	0.86	47	0	0.03	No	BSL
ACETONE	4/22	3 J	7 --	2 max samples	2.25	5.06	3.92	1500	0	0.005	No	BSL
BTEX	1/22	0.4 J	0.4 J	DA-SW112-LOCDEPTHMAX	0.384	0.4	0.56	NA	NA	NA	No	NSL*
CIS-1,2-DICHLOROETHENE	3/22	0.4 J	0.6 J	DA-SW-117-082108	0.332	0.5	0.53	590	0	0.001	No	BSL
TOLUENE	1/22	0.4 J	0.4 J	DA-SW112-LOCDEPTHMAX	0.354	0.4	0.51	14	0	0.03	No	BSL
TOTAL 1,2-DICHLOROETHENE	3/22	0.4 J	0.6 J	DA-SW-117-082108	0.349	0.5	0.52	590	0	0.001	No	BSL
TOTAL CHLORINATED ETHENES	4/22	0.6 J	1.5 J	DA-SW121-0508	0.506	1.08	0.85	NA	NA	NA	No	NSL*
TOTAL CHLORINATED VOCS	8/22	0.6 J	4 J	DA-A-SW02-01-AVG	0.988	1.89	1.89	NA	NA	NA	No	NSL*
TRICHLOROETHENE	4/22	0.4 J	1	DA-SW121-0508	0.401	0.7	0.62	43	0	0.02	No	BSL
Semivolatile Organics (µg/L)												
BIS(2-ETHYLHEXYL)PHTHALATE	7/22	3.6 J	5 J	DA-A-SW09-01	4.37	3.97	4.72	12	0	0.42	No	BSL
Pesticides/PCBs (µg/L)												
4,4'-DDE	1/22	0.0139 J	0.0139 J	DA-A-SW02-01-AVG	0.00434	0.0139	0.01	0.011	1	1.3	Yes	ASL
4,4'-DDT	6/22	0.0043 J	0.017925 J	DA-A-SW02-01-AVG	0.00425	0.00709	0.01	0.001	6	18	Yes	ASL
DIELDRIN	14/22	0.0033 J	0.0218 J	DA-A-SW02-01-AVG	0.00824	0.011	0.01	0.056	0	0.39	No	BSL
TOTAL DDD/DDE/DDT	6/22	0.0043 J	0.031825 J	DA-A-SW02-01-AVG	0.00539	0.0094	0.01	0.001	6	32	Yes	ASL
Total Inorganics (µg/L)												
ALUMINUM	6/22	36 J	3160	DA-SW125-0508	213	639	1621	87	3	36	Yes	ASL
ANTIMONY	1/22	1.1 J	1.1 J	DA-SW106-LOCDEPTHMAX	1.22	1.1	1.98	10	0	0.11	No	BSL
ARSENIC	7/22	1.235 J	4.9 J	DA-SW-117-082108	1.74	2.83	2.89	150	0	0.03	No	BSL
BARIUM	22/22	3.7	21.4	DA-SW125-0508	10.4	10.4	11.78	4.0	21	5.4	Yes	ASL
CALCIUM	22/22	18200	36500	DA-A-SW02-01-AVG	27100	27100	29704	NA	NA	NA	No	NUT
CHROMIUM	2/22	1.2 J	1.3 J	DA-A-SW08-01	0.546	1.25	0.73	11	0	0.12	No	BSL
COBALT	18/22	0.26 J	4.4 J	DA-SW125-0508	1.2	1.38	1.68	23	0	0.19	No	BSL
COPPER	15/22	1.8 J	14.2 J	DA-SW125-0508	2.58	3.37	5.15	9	1	1.6	Yes	ASL
IRON	21/22	70.6 J	5590	DA-SW125-0508	679	708	1078	1000	3	5.6	Yes	ASL
LEAD	8/22	0.96 J	21.5	DA-SW125-0508	2.93	6.51	4.7	2.5	6	8.6	Yes	ASL
MAGNESIUM	22/22	4850 J	9200	DA-SW-01-LOCDEPTHMAX	7280	7280	7816	NA	NA	NA	No	NUT
MANGANESE	22/22	17	600	DA-A-SW09-01	180	180	250	120	11	5.0	Yes	ASL
MERCURY	7/22	0.009 J	0.59	DA-SW121-0508	0.0437	0.118	0.3	0.77	0	0.77	No	BSL
MOLYBDENUM	10/22	2.4 J	81	DA-A-SW03-01	18.5	39.7	79	370	0	0.22	No	BSL
NICKEL	18/22	0.79 J	6.1 J	DA-SW125-0508	2.1	2.38	2.7	52	0	0.12	No	BSL
POTASSIUM	22/22	2800	4900	DA-A-SW06-01	3790	3790	4027	NA	NA	NA	No	NUT
SODIUM	22/22	13800	57600	DA-SW111-LOCDEPTHMAX	36500	36500	52583	NA	NA	NA	No	NUT
THALLIUM	1/22	3.53 J	3.53 J	DA-A-SW04-01	0.797	3.53	2.8	1.0	1	3.5	Yes	ASL
VANADIUM	5/22	0.49 J	5.3 J	DA-SW125-0508	0.756	1.68	1.7	20	0	0.27	No	BSL
ZINC	13/22	4.8 J	35.5	DA-SW125-0508	9.36	13.7	13	120	0	0.30	No	BSL
Filtered Inorganics (µg/L)												
ALUMINUM	4/22	37 J	370	DA-A-SW03-01	46.8	160	219	87	2	4.3	Yes	ASL
ANTIMONY	1/22	1.6 J	1.6 J	DA-SW125-0508	1.22	1.6	2.0	10	0	0.16	No	BSL
ARSENIC	4/22	2.43 J	3.04 J	DA-A-SW09-01	1.42	2.84	2.3	150	0	0.02	No	BSL
BARIUM	22/22	3.4	14.1	DA-SW-01-LOCDEPTHMAX	9.35	9.35	10	4.0	21	3.5	Yes	ASL
CALCIUM	22/22	18300	36000	DA-A-SW02-01-AVG	26800	26800	29294	NA	NA	NA	No	NUT
CHROMIUM	2/22	1.2 --	1.2 --	2 max samples	0.418	1.2	0.5	11	0	0.11	No	BSL
COBALT	15/22	0.29 J	2.8	DA-A-SW09-01	0.858	1.15	1.2	23	0	0.12	No	BSL
COPPER	14/22	1.1 J	4.2 J	DA-SW-01-LOCDEPTHMAX	2	2.6	2.4	9	0	0.47	No	BSL
IRON	16/22	51.6 J	980	DA-A-SW09-01	259	347	421	1000	0	0.98	No	BSL
LEAD	5/22	1 J	12.4	DA-A-SW03-01	1.37	3.47	3.7	2.5	1	5.0	Yes	ASL
MAGNESIUM	22/22	4760 J	9300	DA-SW-01-LOCDEPTHMAX	7140	7140	7686	NA	NA	NA	No	NUT
MANGANESE	22/22	17	670	DA-A-SW09-01	157	157	222	120	11	5.6	Yes	ASL
MERCURY	5/22	0.01 J	0.016 --	2 max samples	0.01	0.0134	0.01	0.77	0	0.02	No	BSL
MOLYBDENUM	9/22	3.15 J	78	DA-A-SW03-01	17.8	42.4	76	370	0	0.21	No	BSL
NICKEL	17/22	0.53 J	7.045 J	DA-A-SW02-01-AVG	1.92	2.29	2.5	52	0	0.14	No	BSL

TABLE D-1

SURFACE WATER ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Parameter	Frequency of Detection	Minimum Detected Concentration(1)	Maximum Detected Concentration(1)	Sample with Maximum Detection	Average Concentration(2)	Average of Positive Detects(3)	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient(4)	Retained as a COPC (yes/no)?	COPC Rationale
POTASSIUM	22/22	2600	4600 --	2 max samples	3750	3750	4002	NA	NA	NA	No	NUT
SODIUM	22/22	13000	59000	DA-SW112-LOCDEPTHMAX	36100	36100	52148	NA	NA	NA	No	NUT
VANADIUM	2/22	0.52 J	0.75 J	DA-SW121-0508	0.458	0.635	0.7	20	0	0.04	No	BSL
ZINC	8/22	4.8 J	17.3 J	DA-SW111-LOCDEPTHMAX	6.79	13.8	12	120	0	0.14	No	BSL

1 - Sample and duplicate are considered as one sample when determining the minimum and maximum concentrations detected concentrations and frequency of detection.
2 - Average of all analytical results are calculated using half of the detection limit for nondetects.
3 - Average of positive analytical results only.
4 - The hazard quotient is the maximum detected concentration divided by the screening level.
COPC = Chemical of Potenial Concern
NA = Not Available or Not Applicable.
TOTAL DDD/DDE/DDT = Sum of positive detections of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Rationale Codes:
For Selection as a COPC or for Further Evaluation:
ASL = Above COPC Screening Level
BSL = Below COPC Screening Level
NSL = No Screening Level Available
NSL* = No screening level, but risks are accounted for by individual constituents.
NUT = Essential Nutrient

TABLE D-2

SEDIMENT ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND
PAGE 1 OF 3

Parameter	Frequency of Detection	Minimum Detected Concentration(1)	Maximum Detected Concentration(1)	Sample with Maximum Detection	Average Concentration(2)	Average of Positive Detects(3)	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient(4)	Retained as a COPC (yes/no)?	COPC Rationale
Volatile Organics (µg/kg)												
1,1,1-TRICHLOROETHANE	7/26	1 J	5 J	DA-SD133-LOCDEPTHMAX	7.49	2.02	11.3	170	0	0.03	No	BSL
1,1-DICHLOROETHANE	1/26	0.435 J	0.435 J	DA-S-SD02-01-AVG	7.53	0.435	56.5	27	0	0.02	No	BSL
1,2,4-TRICHLOROBENZENE	2/26	4 J	6.2 J	DA-S-SD09-01	7.83	5.1	56.6	9200	0	0.001	No	BSL
2-BUTANONE	8/26	7 J	190	DA-SD119-00.5-LOCDEPTHMAX	52.1	61.9	304	270	0	0.70	No	BSL
4-ISOPROPYLTOLUENE	2/26	0.79 J	18	DA-SD111-LOCDEPTHMAX	8.12	9.4	57.2	NA	NA	NA	Yes	NSL
ACETONE	15/26	13 --	740 J	DA-SD121-LOCDEPTHMAX	99.2	165	242	9	15	82	Yes	ASL
BTEX	2/26	2.2	38 J	DA-S-SD07-01	10.1	20.1	67.6	NA	NA	NA	No	NSL*
CARBON DISULFIDE	2/26	2.7 J	5.5 J	DA-SD119-00.5-LOCDEPTHMAX	7.48	4.1	56.4	0.85	2	6.5	Yes	ASL
CHLOROETHANE	1/26	1.6 J	1.6 J	DA-SD-01-LOCDEPTHMAX	15.1	1.6	115	NA	NA	NA	Yes	NSL
CIS-1,2-DICHLOROETHENE	2/26	4 J	7.5 J	DA-SD119-00.5-LOCDEPTHMAX	7.46	5.75	56.4	400	0	0.02	No	BSL
DICHLORODIFLUOROMETHANE	6/26	5.4 J	66 J	DA-SD-01-LOCDEPTHMAX	20.2	22.5	121	NA	NA	NA	Yes	NSL
M+P-XYLENES	1/26	2.2 J	2.2 J	DA-SD-01-LOCDEPTHMAX	15.2	2.2	115	4	0	0.55	No	BSL
TETRACHLOROETHENE	3/26	3 J	33 J	DA-SD114-LOCDEPTHMAX	9.12	17	59.0	530	0	0.06	No	BSL
TOLUENE	1/26	38 J	38 J	DA-S-SD07-01	8.93	38	59.2	670	0	0.06	No	BSL
TOTAL 1,2-DICHLOROETHENE	2/26	4 J	7.5 J	DA-SD119-00.5-LOCDEPTHMAX	7.45	5.75	56.4	400	0	0.02	No	BSL
TOTAL CHLORINATED ETHENES	5/26	2 J	76 J	DA-SD114-LOCDEPTHMAX	13.5	25.9	36.0	NA	NA	NA	No	NSL*
TOTAL CHLORINATED VOCS	12/26	3 J	82 J	DA-SD114-LOCDEPTHMAX	19.8	24.2	43.7	NA	NA	NA	No	NSL*
TOTAL XYLENES	1/26	2.2	2.2	DA-SD-01-LOCDEPTHMAX	11.6	2.2	86.8	4	0	0.55	No	BSL
TRICHLOROETHENE	4/26	2 J	39 J	DA-SD114-LOCDEPTHMAX	9.65	16.8	24.3	1600	0	0.02	No	BSL
Semivolatile Organics (µg/kg)												
2-METHYLNAPHTHALENE	12/26	3.1 J	200	DA-SD111-LOCDEPTHMAX	75.2	25.4	267	20.2	1	9.9	Yes	ASL
ACENAPHTHENE	17/26	3.9 J	1000	DA-SD111-LOCDEPTHMAX	97.6	124	559	290	2	3.4	Yes	ASL
ACENAPHTHYLENE	14/26	1.8 J	24 J	DA-SD125-00.5-LOCDEPTHMAX	31.9	11.4	46	160	0	0.15	No	BSL
ANTHRACENE	19/26	17 J	2000 --	2 max samples	211	277	1243	57.2	13	35	Yes	ASL
BENZO(A)ANTHRACENE	23/26	16 J	3400	DA-S-SD03-01	579	641	866	108	20	31	Yes	ASL
BENZO(A)PYRENE	22/26	15 J	2600	DA-S-SD03-01	575	664	862	150	18	17	Yes	ASL
BENZO(B)FLUORANTHENE	20/26	27	2300	DA-S-SD03-01	648	792	938	1800	2	1.3	Yes	ASL
BENZO(G,H,I)PERYLENE	22/26	10 J	1900	DA-S-SD03-01	414	474	617	170	14	11	Yes	ASL
BENZO(K)FLUORANTHENE	24/26	2.8 J	2300 --	2 max samples	496	529	762	240	13	9.6	Yes	ASL
BENZOIC ACID	10/14	625 J	2700 J	DA-S-SD08-01	1290	1510	1620	65	10	42	Yes	ASL
BENZYL ALCOHOL	1/26	400 J	400 J	DA-SD-01-LOCDEPTHMAX	476	400	599	52	1	7.7	Yes	ASL
BIS(2-ETHYLHEXYL)PHTHALATE	11/26	470 J	2300 --	2 max samples	575	1000	1064	750	5	3.1	Yes	ASL
CARBAZOLE	2/26	1300 --	1300 --	2 max samples	314	1300	432	NA	NA	NA	Yes	NSL
CHRYSENE	24/26	8.7 J	3300	DA-S-SD03-01	717	766	1077	166	18	20	Yes	ASL
DI-N-BUTYL PHTHALATE	1/26	100 J	100 J	DA-S-SD03-01	227	100	292	11000	0	0.01	No	BSL
DIBENZO(A,H)ANTHRACENE	18/26	11 J	640 J	DA-S-SD03-01	115	114	158	33	14	19	Yes	ASL
DIBENZOFURAN	2/26	550 J	580	DA-SD111-LOCDEPTHMAX	267	565	344	2000	0	0.29	No	BSL
DIETHYL PHTHALATE	4/26	420 J	2000	DA-S-SD09-01	412	1260	804	630	3	3.2	Yes	ASL
FLUORANTHENE	25/26	24	8500	DA-S-SD03-01	1440	1490	2194	423	17	20	Yes	ASL
FLUORENE	17/26	4.2 J	1300	DA-SD111-LOCDEPTHMAX	121	159	720	77.4	2	17	Yes	ASL
HIGH MOLECULAR WEIGHT PAHS	25/26	134 J	33640 J	DA-S-SD03-01	6400	6650	9918	193	24	174	Yes	ASL
INDENO(1,2,3-CD)PYRENE	22/26	9.5 J	1700	DA-S-SD03-01	372	421	543	200	12	8.5	Yes	ASL
LOW MOLECULAR WEIGHT PAHS	23/26	12.8 J	11920 J	DA-S-SD03-01	1360	1530	3318	76.4	21	156	Yes	ASL
NAPHTHALENE	10/26	4.6 J	200	DA-SD111-LOCDEPTHMAX	22.4	41	110	176	1	1.1	Yes	ASL
PHENANTHRENE	23/26	11 J	8000	DA-S-SD03-01	942	1050	2510	204	16	39	Yes	ASL
PYRENE	23/26	21 J	7000	DA-S-SD03-01	1260	1360	1937	195	19	36	Yes	ASL
TOTAL PAHS	25/26	146.8 J	45560 J	DA-S-SD03-01	7750	8060	12239	1610	19	28	Yes	ASL

TABLE D-2

SEDIMENT ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Parameter	Frequency of Detection	Minimum Detected Concentration(1)	Maximum Detected Concentration(1)	Sample with Maximum Detection	Average Concentration(2)	Average of Positive Detects(3)	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient(4)	Retained as a COPC (yes/no)?	COPC Rationale
Pesticides/PCBs (µg/kg)												
4,4'-DDD	16/26	4.7 J	170 J	DA-SD125-00.5-LOCDEPTHMAX	32.5	40.3	47	4.88	15	35	Yes	ASL
4,4'-DDE	18/26	2.2 J	430	DA-SD125-00.5-LOCDEPTHMAX	64.7	85.2	104	3.16	17	136	Yes	ASL
4,4'-DDT	11/26	5.4 J	77 J	DA-SD125-00.5-LOCDEPTHMAX	21.5	31.6	31	4.16	11	19	Yes	ASL
ALPHA-CHLORDANE	15/26	4.5 J	180 J	DA-SD125-00.5-LOCDEPTHMAX	28.8	45.1	45	3.24	15	56	Yes	ASL
AROCLOR-1260	16/26	35	550	DA-SD116-LOCDEPTHMAX	113	173	171	59.8	12	9.2	Yes	ASL
AROCLOR-1268	2/26	64.4 J	2480	DA-S-SD07-01	117	1270	1058	59.8	2	41	Yes	ASL
DIELDRIN	18/26	2.2 J	140	DA-SD125-00.5-LOCDEPTHMAX	27.8	36.4	41	120	1	1.2	Yes	ASL
GAMMA-CHLORDANE	14/26	3.3	130	DA-SD125-00.5-LOCDEPTHMAX	21.2	34.8	33	3.24	14	40	Yes	ASL
TOTAL AROCLOR	16/26	35	2930 J	DA-S-SD07-01	214	332	381	59.8	12	49	Yes	ASL
TOTAL DDD/DDE/DDT	18/26	2.2 J	677 J	DA-SD125-00.5-LOCDEPTHMAX	104	140	168	5.28	17	128	Yes	ASL
Petroleum Hydrocarbons (mg/kg)												
GASOLINE RANGE ORGANICS	2/18	4	12 J	DA-SD119-00.5-LOCDEPTHMAX	3.99	8	5	NA	NA	NA	Yes	NSL
EXTRACTABLE TPH (C09-C36)	13/13	53	1800	DA-SD116-LOCDEPTHMAX	406	406	NA	NA	NA	NA	Yes	NSL
Inorganics (mg/kg)												
ALUMINUM	26/26	5000	32400	DA-SD125-00.5-LOCDEPTHMAX	14000	14000	16447	25500	2	1.3	Yes	ASL
ARSENIC	26/26	9.4	25	DA-S-SD09-01	15.7	15.7	17	9.79	25	2.6	Yes	ASL
BARIUM	26/26	17	107	DA-SD125-00.5-LOCDEPTHMAX	48.6	48.6	57	48	11	2.2	Yes	ASL
BERYLLIUM	26/26	0.29 --	1.1	DA-SD125-00.5-LOCDEPTHMAX	0.511	0.511	0.586	NA	NA	NA	Yes	NSL
CADMIUM	20/26	0.17 J	2.4 J	DA-S-SD06-01	0.794	1.01	0.994	0.99	9	2.4	Yes	ASL
CALCIUM	26/26	710	7040	DA-SD-130-082108	2210	2210	2610	NA	NA	NA	No	NUT
CHROMIUM	26/26	6.5	40.4	DA-SD125-00.5-LOCDEPTHMAX	19	19	22	43.4	0	0.93	No	BSL
COBALT	26/26	8.1	204	DA-SD133-LOCDEPTHMAX	58	58	79	50	9	4.1	Yes	ASL
COPPER	26/26	9.1	58 J	DA-S-SD08-01	34.4	34.4	39	31.6	13	1.8	Yes	ASL
IRON	26/26	14000 --	51100	DA-SD125-00.5-LOCDEPTHMAX	28900	28900	32163	20000	21	2.6	Yes	ASL
LEAD	43/43	14	27200	DA-SD100-071207	1410	1410	8531	35.8	39	760	Yes	ASL
MAGNESIUM	26/26	1000	5340	DA-SD125-00.5-LOCDEPTHMAX	3000	3000	3358	NA	NA	NA	No	NUT
MANGANESE	26/26	137	2800	DA-S-SD07-01	872	872	1164	460	18	6.1	Yes	ASL
MERCURY	25/26	0.02 --	0.33 J	DA-S-SD08-01	0.153	0.159	0.18	0.18	9	1.8	Yes	ASL
MOLYBDENUM	25/26	0.44 --	8.8	DA-S-SD09-01	3.2	3.33	4.0	NA	NA	NA	Yes	NSL
NICKEL	26/26	11	40.9	DA-SD125-00.5-LOCDEPTHMAX	23.9	23.9	26	22.7	14	1.8	Yes	ASL
POTASSIUM	25/26	150 --	1540 J	DA-SD125-00.5-LOCDEPTHMAX	578	600	746	NA	NA	NA	No	NUT
SELENIUM	2/26	0.48 J	0.92 J	DA-SD112-LOCDEPTHMAX	0.18	0.7	0.24	1	0	0.92	No	BSL
SILVER	21/26	0.16 J	4.8 J	DA-S-SD03-01	1.1	1.34	1.6	0.5	17	9.6	Yes	ASL
SODIUM	14/26	64.3 J	289	DA-SD-117-082108	100	152	135	NA	NA	NA	No	NUT
VANADIUM	26/26	12	54.1	DA-SD125-00.5-LOCDEPTHMAX	28	28	32	57	0	0.95	No	BSL
ZINC	26/26	36	276	DA-SD121-LOCDEPTHMAX	138	138	160	121	16	2.3	Yes	ASL
Acid Volatile Sulfides / Simultaneously Extracted Metals (umo/g)												
ACID VOLATILE SULFIDE	4/5	0.973 J	23.9 J	DA-S-SD09-01	6.02	7.52	145	NA	NA	NA	NA	NA
CADMIUM	1/9	0.012	0.012	DA-S-SD06-01	0.0043	0.012	0.007	NA	NA	NA	NA	NA
CHROMIUM	9/9	0.03	0.182	DA-S-SD09-01	0.0915	0.0915	0.12	NA	NA	NA	NA	NA
COPPER	9/9	0.075	0.521	DA-S-SD09-01	0.342	0.342	0.43	NA	NA	NA	NA	NA
LEAD	9/9	0.065	3.48	DA-S-SD06-01	1.49	1.49	2.28	NA	NA	NA	NA	NA
MERCURY	2/9	0.0058	0.0082	DA-SD-01-LOCDEPTHMAX	0.0051	0.007	0.006	NA	NA	NA	NA	NA
NICKEL	9/9	0.054	0.188	DA-S-SD09-01	0.128	0.128	0.15	NA	NA	NA	NA	NA
TOTAL SEM-AVS	9/9	-20.118	5.539	DA-S-SD06-01	0.0828	0.0828	4.01	NA	NA	NA	NA	NA
ZINC	9/9	0.246	2.15	DA-S-SD07-01	1.36	1.36	1.80	NA	NA	NA	NA	NA

TABLE D-2

SEDIMENT ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Parameter	Frequency of Detection	Minimum Detected Concentration(1)	Maximum Detected Concentration(1)	Sample with Maximum Detection	Average Concentration(2)	Average of Positive Detects(3)	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient(4)	Retained as a COPC (yes/no)?	COPC Rationale
Miscellaneous Parameters												
PERCENT CLAY (%)	21/21	0.6	23.4	DA-SD125-00.5-LOCDEPTHMAX	9.17	9.17	NA	NA	NA	NA	NA	NA
PERCENT COARSE SAND (%)	13/13	0 --	13	DA-SD110-LOCDEPTHMAX	5.71	5.71	NA	NA	NA	NA	NA	NA
PERCENT COARSE SILT (%)	9/9	5.7	24	DA-S-SD06-01	14.8	14.8	NA	NA	NA	NA	NA	NA
PERCENT FINE SAND (%)	13/13	0.3	35.4	DA-SD111-LOCDEPTHMAX	14.1	14.1	NA	NA	NA	NA	NA	NA
PERCENT FINE SILT (%)	9/9	4.8	27	DA-S-SD09-01	12.2	12.2	NA	NA	NA	NA	NA	NA
PERCENT GRAVEL (%)	13/13	0 --	85.8	DA-SD108-LOCDEPTHMAX	20.7	20.7	NA	NA	NA	NA	NA	NA
PERCENT MEDIUM SAND (%)	13/13	0.1	33.4	DA-SD107-LOCDEPTHMAX	12.1	12.1	NA	NA	NA	NA	NA	NA
PERCENT MEDIUM SILT (%)	9/9	10	38 --	2 max samples	22.1	22.1	NA	NA	NA	NA	NA	NA
PERCENT SAND (%)	9/9	15	68	DA-S-SD04-01	44.6	44.6	NA	NA	NA	NA	NA	NA
PERCENT SILT (%)	13/13	2.7	79.7	DA-SD121-LOCDEPTHMAX	36.5	36.5	NA	NA	NA	NA	NA	NA
PH (S.U.)	13/13	6.5	7.2 --	2 max samples	6.92	6.92	NA	NA	NA	NA	NA	NA
TOTAL ORGANIC CARBON (mg/kg)	21/21	3700	96000	DA-SD110-LOCDEPTHMAX	37000	37000	NA	NA	NA	NA	NA	NA
TOTAL SOLIDS (%)	38/38	20	84	DA-SD108-LOCDEPTHMAX	54.4	54.4	NA	NA	NA	NA	NA	NA

1 - Sample and duplicate are considered as one sample when determining the minimum and maximum concentrations detected concentrations and frequency of detection.
2 - Average of all analytical results are calculated using half of the detection limit for nondetects.
3 - Average of positive analytical results only.
4 - The hazard quotient is the maximum detected concentration divided by the screening level.
COPC = Chemical of Potenial Concern
NA = Not Available or Not Applicable.
TOTAL DDD/DDE/DDT = Sum of positive detections of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.
TOTAL AROCLOR = Sum of positive detections of individual Aroclors.

Rationale Codes:
For Selection as a COPC or for Further Evaluation:
ASL = Above COPC Screening Level
BSL = Below COPC Screening Level
NSL = No Screening Level Available
NSL* = No screening level, but risks are accounted for by individual constituents.
NUT = Essential Nutrient

TABLE D-3

SURFACE SOIL ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Parameter	Frequency of Detection	Minimum Detected Concentration[1]	Maximum Detected Concentration[1]	Sample with Maximum Detection	Average Concentration[2]	Average of Positive Detects[3]	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient[4]	Retained as a COPC (yes/no)?	COPC Rationale
Volatile Organics (µg/kg)												
1,2,4-TRIMETHYLBENZENE	4/74	1 J	1600	DA-S-TP01-0001-01	27.7	401	164	NA	NA	NA	Yes	NSL
1,3,5-TRIMETHYLBENZENE	1/74	860 J	860 J	DA-S-TP01-0001-01	17.7	860	94	NA	NA	NA	Yes	NSL
2-BUTANONE	3/74	2.8 J	12 J	DA-MW118B-LOCDEPTHMAX	23	6.93	79	NA	NA	NA	Yes	NSL
4-ISOPROPYLTOLUENE	5/74	8	290	DA-S-SB03-0102-01	10.7	129	44	NA	NA	NA	Yes	NSL
ACETONE	48/74	9.9	7900 J	DA-SB145-LOCDEPTHMAX	319	366	1024	NA	NA	NA	Yes	NSL
BENZENE	1/74	2 J	2 J	DA-B106B-0002	3.72	2	11	25000	0	0.0001	No	BSL
BTEX	4/74	0.79	580	DA-S-TP01-0001-01	11.2	147	60	NA	NA	NA	No	NSL*
M+P-XYLENES	3/74	0.79 J	350	DA-S-TP01-0001-01	9.79	117	39	65000	0	0.01	No	BSL
METHYLENE CHLORIDE	1/74	3 J	3 J	DA-SB141-LOCDEPTHMAX	20.1	3	55	400	0	0.01	No	BSL
N-BUTYLBENZENE	2/74	190	260	DA-S-TP01-0001-01	8.19	225	35	NA	NA	NA	Yes	NSL
N-PROPYLBENZENE	2/74	2 J	300	DA-S-TP01-0001-01	6.97	151	33	NA	NA	NA	Yes	NSL
O-XYLENE	1/74	230	230	DA-S-TP01-0001-01	6.05	230	26	65000	0	0.004	No	BSL
SEC-BUTYLBENZENE	1/74	6 J	6 J	DA-SS-B124B-0103-072108	4.05	6	12	NA	NA	NA	Yes	NSL
TOLUENE	1/74	4 J	4 J	DA-B106B-0002	4.15	4	13	75000	0	0.0001	No	BSL
TOTAL CHLORINATED ETHENES	3/74	4 J	8.5 J	DA-SB135-LOCDEPTHMAX	4.66	5.83	13	NA	NA	NA	No	NSL*
TOTAL CHLORINATED VOCS	4/74	3 J	8.5 J	DA-SB135-LOCDEPTHMAX	6.23	5.12	23	NA	NA	NA	No	NSL*
TOTAL XYLENES	3/74	0.79	580	DA-S-TP01-0001-01	11.9	194	61	65000	0	0.01	No	BSL
TRICHLOROETHENE	3/74	4 J	8.5 J	DA-SB135-LOCDEPTHMAX	3.91	5.83	11	50	0	0.170	No	BSL
Semivolatile Organics (µg/kg)												
1,1-BIPHENYL	1/55	660	660	DA-SB127-LOCDEPTHMAX	210	660	226	60000	0	0.01	No	BSL
2-METHYLNAPHTHALENE	40/74	3 J	2400 J	DA-SB127-LOCDEPTHMAX	92.5	104	300	29000	0	0.08	No	BSL
3,3'-DICHLOROBENZIDINE	1/73	110 J	110 J	DA-S-TP12-0001-01	207	110	367	NA	NA	NA	Yes	NSL
ACENAPHTHENE	57/74	2.4 J	9500	DA-SB127-LOCDEPTHMAX	293	364	432	29000	0	0.33	No	BSL
ACENAPHTHYLENE	39/74	2.05 J	290 J	DA-S-TP12A-0001-01	29.7	19.9	69	29000	0	0.01	No	BSL
ANTHRACENE	62/74	3.6 J	13000	DA-SB127-LOCDEPTHMAX	562	663	1784	29000	0	0.45	No	BSL
BENZO(A)ANTHRACENE	67/74	15 J	20000	DA-SB127-LOCDEPTHMAX	1220	1340	2430	1100	17	18	Yes	ASL
BENZO(A)PYRENE	64/74	18 J	17000	DA-SB127-LOCDEPTHMAX	883	1010	2472	1100	12	15	Yes	ASL
BENZO(B)FLUORANTHENE	64/74	24.5	15000	DA-SB127-LOCDEPTHMAX	981	1120	1708	1100	15	14	Yes	ASL
BENZO(G,H,I)PERYLENE	62/74	12 J	7400 J	DA-SB127-LOCDEPTHMAX	451	523	1193	1100	6	6.7	Yes	ASL
BENZO(K)FLUORANTHENE	65/74	13 J	12000	DA-SB127-LOCDEPTHMAX	726	817	1905	1100	10	11	Yes	ASL
BENZOIC ACID	10/73	520 J	5900 J	DA-S-TP09-0001-01	657	1740	1057	NA	NA	NA	Yes	NSL
BIS(2-ETHYLHEXYL)PHTHALATE	13/73	280 J	4500 J	DA-SB145-LOCDEPTHMAX	343	1080	698	100	13	45	Yes	ASL
BUTYL BENZYL PHTHALATE	1/73	270 J	270 J	DA-SB145-LOCDEPTHMAX	173	270	207	100	1	2.7	Yes	ASL
CARBAZOLE	15/73	160 J	7300	DA-SB127-LOCDEPTHMAX	357	1070	813	NA	NA	NA	Yes	NSL
CHRYSENE	67/74	13 J	17000	DA-SB127-LOCDEPTHMAX	1130	1240	2266	1100	18	15	Yes	ASL
DIBENZO(A,H)ANTHRACENE	48/74	5.4 J	3500	DA-SB127-LOCDEPTHMAX	185	244	510	1100	2	3.2	Yes	ASL
DIBENZOFURAN	6/73	200 J	4700	DA-SB127-LOCDEPTHMAX	255	1150	530	NA	NA	NA	Yes	NSL
FLUORANTHENE	67/74	22 J	45000	DA-SB127-LOCDEPTHMAX	2760	3040	7007	29000	1	1.6	Yes	ASL
FLUORENE	0	2.3 J	5900 J	DA-SB127-LOCDEPTHMAX	252	346	810	29000	0	0.20	No	BSL
HIGH MOLECULAR WEIGHT PAHS	67/74	66 J	193100 J	DA-SB127-LOCDEPTHMAX	11100	12300	37362	NA	NA	NA	Yes	NSL
INDENO(1,2,3-CD)PYRENE	61/74	15 --	9200	DA-SB127-LOCDEPTHMAX	517	599	1386	1100	8	8.4	Yes	ASL
LOW MOLECULAR WEIGHT PAHS	68/74	18.9 J	89800 J	DA-SB127-LOCDEPTHMAX	3560	3870	9339	NA	NA	NA	Yes	NSL
N-NITROSODIPHENYLAMINE	1/73	400 J	400 J	DA-SB146-LOCDEPTHMAX	182	400	236	20000	0	0.02	No	BSL
NAPHTHALENE	45/74	2.3 --	11000	DA-SB127-LOCDEPTHMAX	237	380	1171	29000	0	0.38	No	BSL
PHENANTHRENE	67/74	12 J	48000 J	DA-SB127-LOCDEPTHMAX	2190	2420	6741	29000	1	1.7	Yes	ASL
PYRENE	67/74	16 J	50000	DA-SB127-LOCDEPTHMAX	2460	2710	6069	1100	26	45	Yes	ASL
TOTAL PAHS	68/74	91.6 J	282900 J	DA-SB127-LOCDEPTHMAX	14700	15900	55236	NA	NA	NA	No	NSL*
Pesticides/PCBs (µg/kg)												
4,4'-DDD	4/74	2.1 J	5.2 J	DA-SS149-011708	5.7	3.75	12	21	0	0.25	No	BSL
4,4'-DDE	31/74	1.1 J	216	DA-S-TP07-0001-01	7.09	11.2	20	21	2	10	Yes	ASL
4,4'-DDT	26/74	1.2 J	184 J	DA-S-TP01-0001-01	9.54	15.5	26	21	3	8.8	Yes	ASL
ALPHA-CHLORDANE	3/74	3.2 J	235	DA-S-TP07-0001-01	5.45	84.7	25	0.03	3	7833	Yes	ASL
AROCLOR-1254	2/74	152 J	5220 J	DA-S-TP07-0001-01	83.2	2690	390	1300	1	4.02	Yes	ASL
AROCLOR-1260	32/74	26 J	350 J	DA-SB145-LOCDEPTHMAX	57	119	110	1300	0	0.27	No	BSL
AROCLOR-1268	9/74	134	620	DA-MW110B-LOCDEPTHMAX	54.6	369	149	1300	0	0.48	No	BSL
DIELDRIN	3/74	1.3 J	23	DA-SS149-011708	3.55	9.47	6.1	4.9	1	4.7	Yes	ASL
ENDRIN	1/74	2.4 J	2.4 J	DA-SB143-LOCDEPTHMAX	3.48	2.4	6.1	0.04	1	60	Yes	ASL
GAMMA-CHLORDANE	2/74	3.2	10	DA-SS149-011708	2.15	6.6	3.9	0.03	2	333	Yes	ASL
HEPTACHLOR	2/74	1.2 J	1.7 J	DA-MW115B-LOCDEPTHMAX	2.26	1.45	4.3	0.7	2	2.4	Yes	ASL
TOTAL AROCLOR	34/74	26 J	5220 J	DA-S-TP07-0001-01	175	368	625	1300	1	4.02	Yes	ASL
TOTAL DDD/DDE/DDT	34/74	1.8 J	216	DA-S-TP07-0001-01	13.3	22.5	38	21	7	10.3	Yes	ASL

TABLE D-3

SURFACE SOIL ANALYTICAL SUMMARY AND COPC SELECTION TABLE
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Parameter	Frequency of Detection	Minimum Detected Concentration[1]	Maximum Detected Concentration[1]	Sample with Maximum Detection	Average Concentration[2]	Average of Positive Detects[3]	95% UCL	Ecological Screening Level	Number of Samples Greater than Screening Level	Hazard Quotient[4]	Retained as a COPC (yes/no)?	COPC Rationale
Petroleum Hydrocarbons (µg/kg)												
DIESEL RANGE ORGANICS	11/18	11000	430000	DA-S-TP07-0001-01	68300	94800	NA	NA	NA	NA	Yes	NSL
Petroleum Hydrocarbons (mg/kg)												
GASOLINE RANGE ORGANICS	15/74	0.56 J	60	DA-SB122-LOCDEPTHMAX	10.5	3.58	NA	NA	NA	NA	Yes	NSL
EXTRACTABLE TPH (C09-C36)	65/73	11 --	1600	DA-SB127-LOCDEPTHMAX	97.4	106	NA	NA	NA	NA	Yes	NSL
Inorganics (mg/kg)												
ALUMINUM	72/72	1800	20700	DA-SS148-011708	11600	11600	12258	pH<5.5	48	NA	Yes	ASL[5]
ANTIMONY	5/72	0.19 J	5.5 J	DA-S-TP10-0001-01	0.222	1.74	0.6	0.27	4	20	Yes	ASL
ARSENIC	72/72	0.29	90	DA-S-TP13-0001-01	17.8	17.8	24	18	31	5.0	Yes	ASL
BARIUM	72/72	7.4	42.8	DA-SB145-LOCDEPTHMAX	23.7	23.7	25	330	0	0.13	No	BSL
BERYLLIUM	72/72	0.21 J	0.74 J	DA-SS148-011708	0.415	0.415	0.43	21	0	0.04	No	BSL
CADMIUM	38/72	0.09 --	11	DA-S-TP01-0001-01	0.708	1.3	3	0.36	30	31	Yes	ASL
CALCIUM	72/72	39	8940	DA-MW105B-LOCDEPTHMAX	1000	1000	1578	NA	NA	NA	No	NUT
CHROMIUM	72/72	1 J	64 J	DA-S-TP10-0001-01	16.4	16.4	21	26	5	2.5	Yes	ASL
COBALT	72/72	0.82 J	218	DA-SS149-011708	14.6	14.6	27	13	23	17	Yes	ASL
COPPER	71/72	6.7	560	DA-S-TP10-0001-01	32.3	32.7	66	28	13	20	Yes	ASL
IRON	72/72	5270	43700	DA-SS149-011708	26000	26000	27471	5<pH<8	69	NA	No	BSL[5]
LEAD	72/72	4.2	2870	DA-SS149-011708	73.8	73.8	54	11	64	261	Yes	ASL
MAGNESIUM	72/72	407	6240	DA-SB118-0002	2920	2920	3101	NA	NA	NA	No	NUT
MANGANESE	72/72	79.8 J	2020	DA-SS149-011708	387	387	439	220	64	9.2	Yes	ASL
MERCURY	67/72	0.00821 J	2	DA-SB133-LOCDEPTHMAX	0.0764	0.0817	0.20	0.1	8	20	Yes	ASL
MOLYBDENUM	46/72	0.22 J	7.6	DA-SS149-011708	0.56	0.777	0.63	2	2	3.8	Yes	ASL
NICKEL	72/72	0.98 J	38.5	DA-SB118-0002	21.1	21.1	22	38	1	1.0	Yes	ASL
POTASSIUM	72/72	125	886	DA-SB109-LOCDEPTHMAX	436	436	533	NA	NA	NA	No	NUT
SELENIUM	8/72	0.19 J	0.67 J	DA-SB131-LOCDEPTHMAX	0.173	0.471	0.25	0.52	3	1.3	Yes	ASL
SILVER	21/72	0.16 J	2 --	2 max samples	0.282	0.801	0.61	4.2	0	0.48	No	BSL
SODIUM	37/72	30 J	306	DA-SB146-LOCDEPTHMAX	38.9	59.5	44	NA	NA	NA	No	NUT
THALLIUM	1/72	0.3 J	0.3 J	DA-S-SB03-0102-01	0.122	0.3	0.25	1	0	0.30	No	BSL
VANADIUM	72/72	1.5 J	47.2	DA-SB139-LOCDEPTHMAX	20.9	20.9	22	7.8	71	6.1	Yes	ASL
ZINC	72/72	13.8	663	DA-SB122-LOCDEPTHMAX	86.7	86.7	132	46	59	14.4	Yes	ASL
Miscellaneous Parameters												
PERCENT CLAY (%)	9/9	5.5	10.8	DA-SB134-LOCDEPTHMAX	7.76	7.76	NA	NA	NA	NA	NA	NA
PERCENT COARSE SAND (%)	9/9	5.7	16.2	DA-SB108-LOCDEPTHMAX	10.4	10.4	NA	NA	NA	NA	NA	NA
PERCENT FINE SAND (%)	9/9	14.8	23.3	DA-MW103B-LOCDEPTHMAX	18	18	NA	NA	NA	NA	NA	NA
PERCENT GRAVEL (%)	9/9	10.6	34.7	DA-SB133-LOCDEPTHMAX	23.7	23.7	NA	NA	NA	NA	NA	NA
PERCENT MEDIUM SAND (%)	9/9	11	19.4	DA-MW105B-LOCDEPTHMAX	14.6	14.6	NA	NA	NA	NA	NA	NA
PERCENT SILT (%)	9/9	13.8	45.1	DA-SB134-LOCDEPTHMAX	25.5	25.5	NA	NA	NA	NA	NA	NA
PH (S.U.)	9/9	5.1 --	5.6	DA-SB130-LOCDEPTHMAX	5.35	5.35	NA	NA	NA	NA	NA	NA
TOTAL ORGANIC CARBON (mg/kg)	9/9	4900	76000	DA-SB133-LOCDEPTHMAX	28900	28900	NA	NA	NA	NA	NA	NA
TOTAL SOLIDS	70/70	72	96 --	2 max samples	86.7	86.7	NA	NA	NA	NA	NA	NA

1 - Sample and duplicate are considered as one sample when determining the minimum and maximum concentrations detected concentrations and frequency of detection.
2 - Average of all analytical results are calculated using half of the detection limit for nondetects.
3 - Average of positive analytical results only.
4 - The hazard quotient is the maximum detected concentration divided by the screening level.
5 - Eco SSL is based on the soil pH. The average soil pH is 5.35 for aluminum is selected as a COPC while iron is eliminated as a COPC.
COPC = Chemical of Potenial Concern
NA = Not Available or Not Applicable.
TOTAL DDD/DDE/DDT = Sum of positive detections of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.
TOTAL AROCLOR = Sum of positive detections of individual Aroclors.

Rationale Codes:
For Selection as a COPC or for Further Evaluation:
- ASL = Above COPC Screening Level
- BSL = Below COPC Screening Level
- NSL = No Screening Level Available
- NSL* = No screening level, but risks are accounted for by individual constituents.
- NUT = Essential Nutrient

TABLE D-4

TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
SOIL INSECTIVOROUS RECEPTORS
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

	Soil Insectivorous Receptors Hazard Quotients			
	American Robin		Short-Tailed Shrew	
Chemical	NOAEL	LOAEL	NOAEL	LOAEL
Volatile Organics				
1,2,4-TRIMETHYLBENZENE	NV	NV	NV	NV
1,3,5-TRIMETHYLBENZENE	NV	NV	NV	NV
2-BUTANONE	NV	NV	2.2E-08	8.4E-09
4-ISOPROPYLTOLUENE	NV	NV	NV	NV
ACETONE	1.0E-02	1.0E-03	2.7E-03	5.5E-04
BENZENE	NV	NV	2.4E-07	2.4E-08
M+P-XYLENES	8.7E-05	8.7E-06	5.4E-04	4.3E-04
METHYLENE CHLORIDE	NV	NV	1.6E-06	1.9E-07
N-BUTYLBENZENE	NV	NV	NV	NV
N-PROPYLBENZENE	NV	NV	NV	NV
O-XYLENE	5.7E-05	5.7E-06	3.6E-04	2.9E-04
SEC-BUTYLBENZENE	NV	NV	NV	NV
TOLUENE	NV	NV	4.9E-06	4.9E-07
TOTAL XYLENES	1.4E-04	1.4E-05	9.0E-04	7.2E-04
TRICHLOROETHENE	NV	NV	4.5E-04	4.5E-05
Semivolatile Organics				
1,1-BIPHENYL	NV	NV	1.5E-02	1.5E-03
2-METHYLNAPHTHALENE	1.9E-01	1.9E-02	3.2E-03	5.9E-04
3,3'-DICHLOROBENZIDINE	NV	NV	NV	NV
ACENAPHTHENE	5.2E-01	5.2E-02	8.4E-03	1.5E-03
ACENAPHTHYLENE	1.9E-01	1.9E-02	3.8E-03	6.9E-04
ANTHRACENE	1.0E+00	1.0E-01	1.8E-02	3.4E-03
BENZO(A)ANTHRACENE	1.2E+00	1.2E-01	2.0E+00	3.2E-02
BENZO(A)PYRENE	8.6E-01	8.6E-02	1.4E+00	2.3E-02
BENZO(B)FLUORANTHENE	1.3E+00	1.3E-01	2.4E+00	3.9E-02
BENZO(G,H,I)PERYLENE	7.1E-01	7.1E-02	1.3E+00	2.2E-02
BENZO(K)FLUORANTHENE	1.0E+00	1.0E-01	1.9E+00	3.1E-02
BENZOIC ACID	NV	NV	NV	NV
BIS(2-ETHYLHEXYL)PHTHALATE	7.6E-01	7.6E-02	2.7E-02	2.7E-03
BUTYL BENZYL PHTHALATE	NV	NV	1.9E-03	6.3E-04
CARBAZOLE	6.9E-01	6.9E-02	1.3E+00	2.1E-02
CHRYSENE	1.3E+00	1.3E-01	2.4E+00	3.9E-02
DIBENZO(A,H)ANTHRACENE	2.7E-01	2.7E-02	5.0E-01	8.1E-03
DIBENZOFURAN	4.4E-01	4.4E-02	8.4E-01	1.3E-02
FLUORANTHENE	4.4E+00	4.4E-01	7.9E-02	1.5E-02
FLUORENE	1.7E+00	1.7E-01	3.2E-02	5.9E-03
INDENO(1,2,3-CD)PYRENE	8.6E-01	8.6E-02	1.6E+00	2.6E-02
N-NITROSODIPHENYLAMINE	NV	NV	NV	NV
NAPHTHALENE	1.5E+00	1.5E-01	2.8E-02	5.1E-03
PHENANTHRENE	2.9E+00	2.9E-01	4.9E-02	9.0E-03
PYRENE	3.1E+00	3.1E-01	5.5E+00	8.8E-02
Pesticides/PCBs				
4,4'-DDD	6.1E-04	4.9E-04	1.1E-04	6.1E-05
4,4'-DDE	6.0E-02	4.9E-02	4.1E-02	2.2E-02
4,4'-DDT	2.1E-02	1.7E-02	4.0E-03	2.2E-03
ALPHA-CHLORDANE	3.3E-03	6.7E-04	3.0E-04	1.5E-04
AROCLOR-1254	9.9E-01	9.9E-02	6.3E-01	6.3E-02
AROCLOR-1260	7.1E-01	7.1E-02	1.2E+00	1.2E-01
AROCLOR-1268	2.7E-01	2.7E-02	3.5E-01	3.5E-02
DIELDRIN	7.4E-02	6.6E-03	2.1E-01	2.5E-03
ENDRIN	6.1E-03	6.1E-04	8.3E-05	8.3E-06
GAMMA-CHLORDANE	1.2E-04	2.5E-05	7.0E-06	3.5E-06
HEPTACHLOR	NV	NV	5.4E-05	5.4E-06
TOTAL AROCLOR	1.4E+00	1.4E-01	1.4E+00	1.4E-01

TABLE D-4

TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
SOIL INSECTIVOROUS RECEPTORS
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

	Soil Insectivorous Receptors Hazard Quotients			
	American Robin		Short-Tailed Shrew	
Chemical	NOAEL	LOAEL	NOAEL	LOAEL
TOTAL DDD/DDE/DDT	6.0E-02	4.9E-02	4.1E-02	2.2E-02
Inorganics				
ALUMINUM	3.3E+01	3.3E+00	1.1E+03	1.1E+02
ANTIMONY	NV	NV	1.5E+00	3.2E-02
ARSENIC	4.0E+00	2.0E+00	4.5E+00	1.0E+00
BARIUM	8.8E-01	4.4E-01	2.2E-01	1.4E-01
BERYLLIUM	NV	NV	1.8E-01	1.4E-01
CADMIUM	9.2E+01	2.1E+01	1.2E+02	1.3E+01
CHROMIUM	1.9E+01	3.2E+00	1.3E+01	5.6E-01
COBALT	1.4E+00	5.8E-01	5.4E-01	2.1E-01
COPPER	6.1E+00	7.1E-01	1.4E+00	1.0E-01
IRON	9.8E+01	9.8E+00	1.2E+02	1.2E+01
LEAD	1.3E+02	4.9E+00	2.2E+01	5.5E-01
MANGANESE	1.0E+00	4.8E-01	1.7E+00	6.2E-01
MERCURY	5.8E+01	5.8E+00	6.7E+00	1.3E+00
MOLYBDENUM	NV	NV	NV	NV
NICKEL	4.3E+00	1.5E+00	1.1E+01	1.2E+00
SELENIUM	8.6E+00	4.3E+00	1.1E+01	6.8E+00
SILVER	1.5E-01	5.1E-03	2.9E-02	1.5E-03
THALLIUM	NV	NV	2.7E-01	2.7E-02
VANADIUM	2.2E+01	4.5E+00	1.0E+00	5.6E-01
ZINC	4.8E+00	1.8E+00	2.6E+00	6.7E-01

Cells are shaded if the hazard quotient is greater than 1.0
NV - No value could be calculated because toxicity data were not available
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

TABLE D-5

TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
PISCIVOROUS RECEPTORS
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

Chemical	Piscivorous Receptor Hazard Quotients			
	Great Blue Heron		Mink	
	NOAEL	LOAEL	NOAEL	LOAEL
Volatile Organics				
1,1,1-TRICHLOROETHANE	NV	NV	5.8E-07	5.8E-08
1,1-DICHLOROETHANE	NV	NV	7.5E-07	7.5E-08
1,2,4-TRICHLOROBENZENE	NV	NV	4.3E-05	4.3E-06
2-BUTANONE	NV	NV	1.1E-06	4.3E-07
4-ISOPROPYLTOLUENE	NV	NV	NV	NV
ACETONE	8.2E-05	8.2E-06	9.2E-04	1.8E-04
CARBON DISULFIDE	NV	NV	4.5E-06	2.2E-06
CHLOROETHANE	NV	NV	NV	NV
CIS-1,2-DICHLOROETHENE	NV	NV	4.6E-06	4.6E-07
DICHLORODIFLUOROMETHANE	NV	NV	3.0E-07	3.0E-08
M+P-XYLENES	3.6E-08	3.6E-09	1.1E-05	8.8E-06
TETRACHLOROETHENE	NV	NV	2.4E-04	4.9E-05
TOLUENE	NV	NV	1.9E-05	1.9E-06
TOTAL 1,2-DICHLOROETHENE	NV	NV	4.6E-06	4.6E-07
TOTAL XYLENES	3.6E-08	3.6E-09	1.1E-05	8.8E-06
TRICHLOROETHENE	NV	NV	8.9E-04	8.9E-05
Semivolatile Organics				
2-METHYLNAPHTHALENE	1.7E-04	1.7E-05	3.2E-05	5.8E-06
ACENAPHTHENE	8.7E-04	8.7E-05	1.6E-04	2.9E-05
ACENAPHTHYLENE	2.1E-05	2.1E-06	3.8E-06	7.0E-07
ANTHRACENE	1.7E-03	1.7E-04	3.2E-04	5.8E-05
BENZO(A)ANTHRACENE	3.0E-03	3.0E-04	5.7E-02	9.2E-04
BENZO(A)PYRENE	2.3E-03	2.3E-04	4.4E-02	7.0E-04
BENZO(B)FLUORANTHENE	2.0E-03	2.0E-04	3.9E-02	6.2E-04
BENZO(G,H,I)PERYLENE	1.6E-03	1.6E-04	3.2E-02	5.1E-04
BENZO(K)FLUORANTHENE	2.0E-03	2.0E-04	3.9E-02	6.2E-04
BENZOIC ACID	NV	NV	NV	NV
BENZYL ALCOHOL	NV	NV	NV	NV
BIS(2-ETHYLHEXYL)PHTHALATE	3.8E-03	3.8E-04	1.4E-03	1.4E-04
CARBAZOLE	1.1E-03	1.1E-04	2.2E-02	3.5E-04
CHRYSENE	2.9E-03	2.9E-04	5.6E-02	8.9E-04
DI-N-BUTYL PHTHALATE	NV	NV	1.9E-06	5.7E-07
DIBENZO(A,H)ANTHRACENE	5.6E-04	5.6E-05	1.1E-02	1.7E-04
DIBENZOFURAN	5.0E-04	5.0E-05	9.8E-03	1.6E-04
DIETHYL PHTHALATE	NV	NV	4.5E-06	4.5E-07
FLUORANTHENE	7.4E-03	7.4E-04	1.3E-03	2.5E-04
FLUORENE	1.1E-03	1.1E-04	2.1E-04	3.8E-05
INDENO(1,2,3-CD)PYRENE	1.5E-03	1.5E-04	2.9E-02	4.6E-04
NAPHTHALENE	1.7E-04	1.7E-05	3.2E-05	5.8E-06
PHENANTHRENE	6.9E-03	6.9E-04	1.3E-03	2.3E-04
PYRENE	6.1E-03	6.1E-04	1.2E-01	1.9E-03

TABLE D-5

TERRESTRIAL FOOD CHAIN MODEL - CONSERVATIVE SCENARIO
PISCIVOROUS RECEPTORS
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

	Piscivorous Receptor Hazard Quotients			
	Great Blue Heron		Mink	
Chemical	**NOAEL**	**LOAEL**	**NOAEL**	**LOAEL**
Pesticides/PCBs				
4,4'-DDD	5.1E-02	4.1E-02	1.7E-01	9.3E-02
4,4'-DDE	6.9E-01	5.6E-01	2.3E+00	1.2E+00
4,4'-DDT	5.9E-04	4.8E-04	5.5E-03	2.9E-03
ALPHA-CHLORDANE	2.0E-03	4.0E-04	2.2E-03	1.1E-03
AROCLOR-1260	4.1E-01	4.1E-02	2.3E+00	2.3E-01
AROCLOR-1268	2.4E-02	2.4E-03	3.8E-01	3.8E-02
DIELDRIN	1.1E-01	1.0E-02	1.2E+00	1.4E-02
GAMMA-CHLORDANE	9.8E-04	2.0E-04	1.1E-03	5.7E-04
TOTAL AROCLOR	1.0E+00	1.0E-01	6.0E+00	6.0E-01
TOTAL DDD/DDE/DDT	7.4E-01	6.0E-01	2.4E+00	1.3E+00
Inorganics				
ALUMINUM	7.2E-01	7.2E-02	2.0E+02	2.0E+01
ARSENIC	5.5E-02	2.7E-02	4.1E-01	9.4E-02
BARIUM	4.6E-02	2.3E-02	5.3E-02	3.3E-02
BERYLLIUM	NV	NV	2.1E-02	1.7E-02
CADMIUM	1.5E-02	3.5E-03	8.2E-02	9.1E-03
CHROMIUM	2.7E-01	4.6E-02	7.3E-01	3.0E-02
COBALT	6.3E-02	2.6E-02	3.2E-01	1.3E-01
COPPER	7.1E-02	8.3E-03	1.7E-01	1.2E-02
IRON	1.6E+00	1.6E-01	1.4E+01	1.4E+00
LEAD	2.9E+01	1.1E+00	6.0E+01	1.5E+00
MANGANESE	2.3E-01	1.1E-01	2.0E+00	7.2E-01
MERCURY	1.3E+00	1.3E-01	6.1E-01	1.2E-01
MOLYBDENUM	NV	NV	NV	NV
NICKEL	8.3E-02	3.0E-02	8.5E-01	9.7E-02
SELENIUM	3.3E-01	1.6E-01	1.4E+00	8.5E-01
SILVER	4.1E-03	1.4E-04	8.3E-03	4.2E-04
VANADIUM	4.3E-01	8.7E-02	1.6E-01	8.7E-02
ZINC	1.3E-01	4.8E-02	2.5E-01	6.5E-02

Cells are shaded if the value is greater than 1.0
NV - No value could be calculated because toxicity data were not available
NOAEL - No Observed Adverse Effects Level
LOAEL - Lowest Observed Adverse Effects Level

TABLE D-6

SUMMARY OF ECOLOGICAL COPCS IN EACH MEDIA AFTER THE SCREENING STEP
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

	Surface Soil			Sediment	
Parameter	**Screening Table(1)**	**Food Chain(2)**	**Surface Water(1)**	**Screening Table(1)**	**Food Chain(3)**
VOLATILES					
1,2,4-TRIMETHYLBENZENE	X				
1,3,5-TRIMETHYLBENZENE	X				
2-BUTANONE	X				
4-ISOPROPYLTOLUENE	X			X	
ACETONE	X			X	
CARBON DISULFIDE				X	
CHLOROETHANE				X	
DICHLORODIFLUOROMETHANE				X	
N-BUTYLBENZENE	X				
N-PROPYLBENZENE	X				
SEC-BUTYLBENZENE	X				
SEMIVOLATILES					
2-METHYLNAPHTHALENE				X	
3,3'-DICHLOROBENZIDINE	X				
ACENAPHTHENE				X	
ANTHRACENE		X		X	
BENZO(A)ANTHRACENE	X	X		X	
BENZO(A)PYRENE	X	X		X	
BENZO(B)FLUORANTHENE	X	X		X	
BENZO(G,H,I)PERYLENE	X	X		X	
BENZO(K)FLUORANTHENE	X	X		X	
BENZOIC ACID	X			X	
BENZYL ALCOHOL				X	
BIS(2-ETHYLHEXYL)PHTHALATE	X			X	
BUTYL BENZYL PHTHALATE	X				
CARBAZOLE	X	X		X	
CHRYSENE	X	X		X	
DIBENZO(A,H)ANTHRACENE	X	X		X	
DIBENZOFURAN	X				
DIETHYL PHTHALATE				X	
FLUORANTHENE	X	X		X	

TABLE D-6

SUMMARY OF ECOLOGICAL COPCS IN EACH MEDIA AFTER THE SCREENING STEP
SITE 08, NUSC DISPOSAL AREA
NAVAL STATION NEWPORT, MIDDLETOWN, RHODE ISLAND

	Surface Soil			Sediment	
Parameter	**Screening Table(1)**	**Food Chain(2)**	**Surface Water(1)**	**Screening Table(1)**	**Food Chain(3)**
FLUORENE		X		X	
INDENO(1,2,3-CD)PYRENE	X	X		X	
NAPHTHALENE		X		X	
PHENANTHRENE	X	X		X	
PYRENE	X	X		X	
LOW MOLECULAR WEIGHT PAHS	X			X	
HIGH MOLECULAR WEIGHT PAHS	X			X	
TOTAL PAHS				X	
PESTICIDES/PCBS					
4,4'-DDD				X	
4,4'-DDE	X		X	X	X
4,4'-DDT	X		X	X	
ALPHA-CHLORDANE	X			X	
AROCLOR-1260		X		X	X
AROCLOR-1268				X	
DIELDRIN	X			X	X
ENDRIN	X				
GAMMA-CHLORDANE	X			X	
HEPTACHLOR	X				
TOTAL AROCLOR		X		X	X
TOTAL DDD/DDE/DDT	X		X	X	X
METALS					
ALUMINUM	X	X	X	X	X
ANTIMONY	X	X			
ARSENIC	X	X		X	
BARIUM			X	X	
BERYLLIUM				X	
CADMIUM	X	X		X	
CHROMIUM	X	X			
COBALT	X	X		X	
COPPER	X	X	X	X	
IRON		X	X	X	X
LEAD	X	X	X	X	X
MANGANESE	X	X	X	X	X
MERCURY	X	X		X	X
MOLYBDENUM	X			X	
NICKEL	X	X		X	
SELENIUM	X	X			X
SILVER				X	
THALLIUM			X		
VANADIUM	X	X			
ZINC	X	X		X	
PETROLEUM HYDROCARBONS					
GASOLINE RANGE ORGANICS	X			X	
EXTRACTABLE TPH (C09-C36)	X			X	

1 - Includes all COPCs in the screening table regardless of the reason the chemical was selected as a COPC.
2 - Includes all COPCs for the robin or shrew.
3 - Includes all COPCs for the mink or heron.

X - Chemical retained as COPC

Appendix E
ARARs and To Be Considered Guidance

TABLE E-1

CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
EPA Carcinogenicity Slope Factor	None	To Be Considered	These are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. Slope factors are developed by EPA from health effects assessments. Carcinogenic effects present the most up-to-date information on cancer risk potency. Potency factors are developed by EPA from Health Effects Assessments of evaluation by the Carcinogenic Assessment Group.	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in site media. Risks due to carcinogens as assessed with slope factors will be addressed through remediation to industrial cleanup levels based on installing a cover over areas of contaminated soil (except in areas where an existing pavement cover will be maintained), removal of anomalies, LUCs and long-term monitoring of the area under the soil cover and the waste management area. LUCs to prevent residential development will prevent human exposure to COCs in areas exceeding residential risk levels developed using these standards.
EPA Risk Reference Dose (RfDs)	None	To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Used to calculate potential non-carcinogenic hazards caused by exposure to contaminants. Hazards due to noncarcinogens with EPA RfDs will be addressed through remediation to industrial cleanup levels based on installing a cover over areas of contaminated soil (except in areas where an existing pavement cover will be maintained), removal of anomalies, LUCs and long-term monitoring of the area under the soil cover and the waste management area. LUCs to prevent residential development will prevent human exposure to COCs in areas exceeding residential risk levels developed using these standards.

CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal (Continued)				
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	Guidance for assessing cancer risk.	Used to calculate potential carcinogenic risks caused by exposure to contaminants. Hazards due to carcinogens assessed through this guidance will be addressed through remediation to industrial cleanup levels based on installing a cover over areas of contaminated soil (except in areas where an existing pavement cover will be maintained), removal of anomalies, LUCs and long-term monitoring of the area under the soil cover and the waste management area. LUCs to prevent residential development will prevent human exposure to COCs in areas exceeding residential risk levels developed using these standards.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	To Be Considered	Guidance of assessing cancer risks to children.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants. Carcinogenic risks to children assessed through this guidance will be addressed through remediation to industrial cleanup levels based on installing a cover over areas of contaminated soil (except in areas where an existing pavement cover will be maintained), removal of anomalies, LUCs and long-term monitoring of the area under the soil cover and the waste management area. LUCs to prevent residential development will prevent human exposure to COCs in areas exceeding residential risk levels developed using these standards.

TABLE E-1

CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal (Continued)				
Recommendations of the Technical Review Workgroup for Lead for an approach to Assessing Risks Associated with Adult Exposure to Lead In Soil	EPA-540-R-03-001 (January 2003)	To Be Considered	EPA Guidance for evaluating risks posed by lead in soil.	Risks from lead assessed under this guidance will be addressed through remediation to industrial cleanup levels based on installing a cover over areas of contaminated soil (except in areas where an existing pavement cover will be maintained), removal of anomalies, LUCs and long-term monitoring of the area under the soil cover and the waste management area. LUCs to prevent residential development will prevent human exposure to COCs in areas exceeding residential risk levels developed using these standards.

CHEMICAL-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
State				
Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Short Title: Remediation Regulations)	Code of Rhode Island Rules (CRIR) 12-180-001; DEM-DSR-01-93, sections 8.01 and 8.02	Applicable	These regulations set remediation standards for direct contact and leachability for contaminated soil at NPL sites when they are more stringent than federal standards.	These standards were used to develop soil PRGs. Remediation to industrial cleanup levels based on placement of 2 feet of clean permeable cover material (except in areas where an existing pavement cover will be maintained), removal and off-site disposal of anomalies, LUCs and long-term monitoring (of the area under the soil cover and the waste management area) meets the regulations' requirements for allowing industrial use. Leachability standards will be met through excavation and off-site disposal. PRGs based on these standards will be achieved outside of the compliance zone for the waste management area (i.e., beyond the edge of the waste management area) and will be used as monitoring standards inside the compliance boundary. LUCs to prevent residential development will prevent human exposure to COCs in areas exceeding residential risk levels developed using these standards.

TABLE E-2

LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Clean Water Act, Section 404; Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; 40 C.F.R. Part 230, 231 and 33 C.F.R. Parts 320-323	Applicable	Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Controls discharges of dredged or fill material to protect aquatic ecosystems. Filling or discharge of dredged material will only occur where there is no other practicable alternative and any adverse impacts to aquatic ecosystems will be mitigated. Under these standards the Navy must solicit public comment through the Proposed Plan on its finding that one of the alternatives is the Least Environmentally Damaging Practicable Alternative.	Alternatives may involve discharge of dredged material and/or excavation. Soil remediation or other remedial actions that include dredging or filling in wetlands will be implemented to meet these requirements, including mitigation of altered wetland/aquatic resource as required. The Navy has determined that this alternative is the Least Environmentally Damaging Practicable Alternative to protect wetland resources because it provides the best balance of addressing contaminated soil within and adjacent to wetlands and waterways with minimizing both temporary and permanent alteration of wetlands and aquatic habitats on site. The Navy solicited public comment on its determination in the Proposed Plan and received no negative public comments.

TABLE E-2

LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal (Continued)				
Fish and Wildlife Coordination Act	16 U.S.C. §661 *et seq*.	Applicable	Requires Federal agencies involved in actions that will result in the control of structural modification of any stream or body of water for any purpose to take action to protect fish and wildlife resources that may be affected by the action. The Navy must coordinate with appropriate federal and state resource agencies to ascertain the means and measures necessary to mitigate, prevent, and compensate for project related losses of fish and wildlife resources and to enhance the resources.	Measures to mitigate or compensate adverse project related impacts to fish and wildlife resources will be taken, if determined necessary. The appropriate federal and state resource agencies will be consulted, in particular regarding remedial measures for contaminated soil that will impact streams, wetlands, and downstream water bodies.
Floodplain Management and Protection of Wetlands	44 C.F.R. 9	Relevant and Appropriate	Implements Executive Order 11990 (Protection of Wetlands). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.	During the remedial design stage the effects of soil remedial actions on federal jurisdictional wetlands will be evaluated. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by soil remediation, will be mitigated in accordance with requirements. No impact to downstream floodplain areas will occur. The Navy solicited public comment on its determination in the Proposed Plan and received no negative public comments.

LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal (Continued)				
Endangered Species Act	16 U.S.C. 1531 *et seq.*; 50 CFR parts 200 and 402	Applicable	Regulates activities affecting federally listed endangered or threatened species or their habitat. The federally-listed loggerhead turtle, Kemps-Ridley turtle, and Atlantic Sturgeon occur in the water of Narragansett Bay.	Appropriate federal agencies will be consulted to ensure that remedial measure taken under this alternative will prevent site contamination from migrating downstream to the Bay.
National Historic Landmarks (Historic Sites Act)	16 USC §461 *et seq.*; 36 C.F.R. Part 65	Applicable	The purpose of the National Historic Landmarks program is to identify and designate National Historic Landmarks, and encourage the long range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this remedy impact historical properties/structures determined to be protected by this standard, activities will be coordinated with the Department of the Interior.
Protection of Historic Properties (National Historic Preservation Act)	16 USC §470 *et seq.*, 36 C.F.R. Part 800	Applicable	Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this remedy impact properties/structures determined to be protected by this standard, activities will be coordinated with the Advisory Council on Historic Preservation.

TABLE E-2

LOCATION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION, REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
State				
Rhode Island Endangered Species Act	RIGL 20-37-1 *et seq.*	Relevant and Appropriate	Regulates activities affecting State-listed endangered or threatened species or their habitat. The State-listed loggerhead turtle and Kemps-Ridley turtle occur in the water of Narragansett Bay.	Appropriate State agencies will be consulted to ensure that remedial measure taken under this alternative will prevent site contamination from migrating downstream to the Bay.
Rhode Island Historical Preservation Act	RIGL 42-45 *et seq.*	Applicable	Requires action to take into account effects on properties included on or eligible for the National register of Historic Places and minimizes harm to National Historic Landmarks.	Features with potential historical/cultural significance will be evaluated during the remedial design phase. Should this remedy impact properties/structures determined to be protected by this standard, activities will be coordinated with the State Agency.
Fresh Water Wetlands Act	RIGL 2-1, Sections 2-1-18 through 2-1-20.2; Fresh Water Wetlands Act; DEM Rules And Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act (Dec 2010), Rules 4.00 and 5.00	Applicable	Rules and regulations governing the administration and enforcement of the Fresh Water Wetlands Act. Defines and establishes provisions for the protection of swamps, marshes and other fresh water wetlands in the state. Actions are required to prevent the undesirable drainage, excavation, filling, alteration, encroachment or any other form of disturbance or destruction of a wetland. Also establishes standards for land within 50 feet of the edge of state-regulated wetlands.	Cover installation and excavation activities will be conducted to minimize the disturbance of state jurisdictional wetland and perimeter wetland.

TABLE E-3

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Toxic Substances Control Act (TSCA) 15 U.S.C. 2601 *et seq.*; PCB Remediation Waste	40 C.F.R. 761.61(c)	Applicable	This section of the TSCA regulations provides risk-based cleanup and disposal options for PCB remediation waste based on the risks posed by the concentrations at which the PCBs are found. Written approval for the proposed risk-based cleanup must be obtained from the Director, Office of Site Remediation and Restoration, USEPA Region 1.	All soil exceeding identified PCB cleanup levels will either be removed, dewatered (if required) and disposed of off-site or will be placed under a cover system that meets TSCA protectiveness standards. The excavation, transportation/ dewatering, and management of PCB contaminated media will be performed in a manner to comply with TSCA, including air and surface water monitoring during remedial activities. The ROD includes a finding by the Director, Office of Site Remediation and Restoration, USEPA Region 1, that the remedy's soil PCB cleanup levels, along with the excavation, dewatering, and management of the contaminated media will not pose an unreasonable risk to human health or the environment.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subparts B and G	Relevant and Appropriate	Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources.	The MCLs will be used to develop performance standards for monitoring the compliance boundary for the waste management area. If contamination levels have been reduced enough so that no unacceptable site risk remains, monitoring can be ended.

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	The non-zero MCLGs will be used to develop performance standards for monitoring the compliance boundary for the waste management area. If contamination levels have been reduced enough so that no unacceptable site risk remains, monitoring can be ended.
Health Advisories (EPA Office of Drinking Water)		To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water. The risk-based standard for manganese is 0.3 mg/L.	The Health Advisory for manganese will be used to develop performance standards for monitoring the compliance boundary for the waste management area. If contamination levels have been reduced enough so that no unacceptable site risk remains, monitoring can be ended.
CWA National Recommended Water Quality Criteria (NRWQC)	40 C.F.R. 122.44	Applicable	Federal NRWQC are health-based and ecologically based criteria developed for carcinogenic and non-carcinogenic compounds.	Water quality standards used to develop monitoring standards both during the active remedial period and for long-term monitoring of the protectiveness of the waste management area that will be established under this alternative.
Clean Water Act - National Pollutant Discharge Elimination System (NPDES)	40 C.F.R. Parts 122 and 125	Applicable	Includes stormwater standards for activities disturbing more than one acre.	Best management practices will be used to meet stormwater standards during the remedial action.

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Management of Undesirable Plants on Federal Lands	7 U.S.C. 2814	Relevant and Appropriate	Requires federal agencies to establish integrated management systems to control or contain undesirable plant species on federal lands under the agency's jurisdiction.	Measures will be taken to control the establishment of *Phragmites*, purple loosestrife or other invasive plants within all remediated areas. An invasive species control plan will be developed as part of the long-term O&M for this site. The responsibility of control will be transitioned to NAVSTA after (1) the remedy is in place, and (2) NAVSTA develops a base-wide program for controlling undesirable plants.
State				
Clean Air Act -Emissions Detrimental to Persons or Property	RIGL 23-23 *et seq.*; CRIR 12-31-07	Applicable	Prohibits emissions of contaminants, which may be injurious to humans, plant or animal life or cause damage to property, or which reasonably interferes with the enjoyment of life and property.	Monitoring of air emissions during cover installation and O&M will be used to assess compliance with these standards if threshold levels are reached.
Clean Air Act – Air Toxics	RIGL 23-23 *et seq.*; CRIR 12-31-22	Applicable	Prohibits the emission of specified contaminants at rates which would result in ground level concentrations greater than acceptable ambient levels or acceptable ambient levels as set in the regulations.	Monitoring of air emissions during cover installation and O&M will be used to assess compliance with these standards if threshold levels are reached.
Water Pollution Control - Pollution Discharge Elimination Systems	RIGL 42-16 *et seq.*; CRIR 12-190-003 Rule 31	Applicable	Includes storm water requirements for construction projects that disturb over one acre.	Stormwater standards for construction projects over one acre will be met.

TABLE E-3

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rules and Regulations for Dredging and Management of Dredge Materials	DEM-OWR-DR-0203	Applicable	Addresses dredging activities and disposal of dredge spoils.	Any dredging of wetland soils and backfilling with cover material that is required while implementing the alternative must comply with the requirements of the regulations.
Drilling of Drinking Water Wells; Rules and Regulations Governing the Enforcement of Chapter 46-13.2 Relating to the Drilling of Drinking Water Wells	RIGL 46-13..2 *et seq.*	Applicable	Prohibits installing drinking water wells in contaminated aquifers. Establishes standards for decommissioning monitoring wells (Rule 9.03).	Under these standards drinking water wells are prohibited within the waste management area that will be established under this alternative and monitoring wells used will be properly decommissioned when no longer needed.
Rules and Regulations for Groundwater Quality	RIGL Ch. 46-12, Section 46-12-2; Ch. 46-13.1, Ch. 23-18.9, Sec. 23-18-9.1; DEM Rules and Regulations for Groundwater Quality (Mar 2005), Appendix 1	Applicable	Identifies the standards and specifications that must be followed for installation or abandonment of monitoring wells.	Under this alternative, wells installed for monitoring the waste management area will be installed and abandoned according to these standards.
Standards for Identification and Listing of Hazardous Waste	RIGL 23-19.1 *et seq.*; CRIR 12-030-003 Rule 5.8	Applicable	Defines the listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic.

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Hazardous Waste Management Standards for Generators	RIGL 23-19.1 *et seq.*; CRIR 12-030-003 Rule 5.0	Applicable	Sets standards for handling and disposal of hazardous waste.	Wastes generated will be tested to determine if they constitute hazardous waste. Any hazardous waste identified will be handled and disposed according to these standards.
Operational Requirements for Treatment, Storage, and Disposal Facilities (TSDF)	RIGL 23-19.1 *et seq.*; CRIR 12-030-003 Rule 8.0	Potentially Applicable	Outlines operational requirements for all hazardous waste TSDFs including, but not limited to, general waste analysis, security procedures, inspections, safety, groundwater monitoring. Also, sets design, construction, and operational requirements for hazardous waste containers and tanks, and closure requirements for hazardous waste facilities. The site is not a TSDF, and the Navy does not intend to treat, store or dispose of hazardous wastes in a manner that would require the site to be considered a TSDF under these regulations.	If remediation at the site results in the necessity to treat, store, or dispose of hazardous waste in the manner required of a TSDF, the substantive requirements must be met.
Rhode Island Solid Waste Regulations – Closure	DEM OWM-SW0401, 1.7.14(b)	Relevant and Appropriate	Regulation states that an approved closure plan must be implemented.	The site will be closed under a plan developed in accordance with the substantive requirements of this section of the regulations, to be incorporated into the Remedial Design and the Operations and Maintenance Plan (O&M) (including a monitoring plan). Contaminated soil beneath the Paved Storage Area will be left in place as a waste management area.

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations – Dust Control	DEM OWM-SW0401, 1.7.10	Relevant and Appropriate	Requires dust control.	Dust must be controlled at the site during cover construction and during maintenance activities.
Rhode Island Solid Waste Regulations – Health and Safety	DEM OWM-SW0401, 1.7.12 (a)	Relevant and Appropriate	Requires solid waste management facilities be designed and maintained to protect the health and safety of personnel at the facility and persons in close proximity.	Under this subsection health and safety of construction workers and persons in the proximity of the site would be maintained during construction and maintenance activities.
Rhode Island Solid Waste Regulations – Groundwater Monitoring and Closure	DEM OWM-SW0401, 1.8.01 (a) and 1.8.01 (b)	Relevant and Appropriate	Requires facilities to monitor groundwater and to meet closure requirements	The substantive requirements of this section of the regulations will be met by monitoring groundwater and meeting closure requirements. Because contaminants will be left in place , the Paved Storage Area will be closed as a waste management area, and undergo long term monitoring. Monitoring of the area under the soil cover would also be conducted. The Remedial Design, remedial action work plan (RAWP), operations and monitoring plan (O&M) (including the long term monitoring plan [LTMP]) developed for this cleanup will contain the specific monitoring and closure requirements for the waste management area that will comply with the substantive requirements.

TABLE E-3

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
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NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations – Sedimentation and Erosion Control	DEM OWM-SW0401, 2.1.04	Relevant and Appropriate	Requires a "Sedimentation and Erosion Control Plan" be developed.	An erosion and sediment control plan will be developed for this site in accordance with the substantive requirements of this section. The Remedial Design and the RAWP, to be developed for this cleanup, will contain the specific erosion and sediment controls requirements for the remedial construction.
Rhode Island Solid Waste Regulations - Monitoring Wells	DEM OWM-SW0401, 2.1.08 (a) (8)	Relevant and Appropriate	Contains requirements for construction of monitoring wells to monitor a solid waste landfill.	The substantive requirements of this section of the regulations will be met for construction of new monitoring wells.
Rhode Island Solid Waste Regulations – Long-term Monitoring	DEM OWM-SW0401, 2.1.08 (c)	Relevant and Appropriate	Contains requirements for monitoring wells.	The substantive requirements of this section of the regulations will be met by maintaining monitoring wells for the purpose of monitoring groundwater conditions at the site. Because this remedy leaves contamination in place, it will be supported with a Long Term Monitoring Plan (LTMP) for groundwater. The LTMP will be directed by a work plan that will contain the specific monitoring requirements.
Rhode Island Solid Waste Regulations – Cover Systems	DEM OWM-SW0401, 2.2.12 (d) (1) and 2.2.12 (d) (2) (ii)(iii) and (v).	Relevant and Appropriate	Contains requirements for construction and maintenance of the vegetative cover final cover system.	Remedies including cover systems will include appropriate vegetation requirements of a soil cover in compliance with these standards.

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations – Cover Permeability	DEM OWM-SW0401, 2.3.04(e), (f)	Relevant and Appropriate	Outlines the requirements for the maintenance and permeability of cover material.	The substantive requirements of this section of the regulations will be met by maintaining the asphalt cover that has been determined to provide an adequate barrier for specific areas to be used for storage (waste management area), or a soil cover that has been determined to provide an adequate barrier for the remainder of the land within the site.
Rhode Island Solid Waste Regulations – Compliance Boundaries	DEM OWM-SW0401, 2.3.05	Relevant and Appropriate	Establishes requirement for compliance boundary for pollution of ground waters or surface waters.	The substantive requirements of this section of the regulations will be met by monitoring groundwater under the soil cover and by the requirement that no contamination of groundwater be permitted outside the boundary of the waste management area. Because this remedy leaves contamination in place, groundwater monitoring will be conducted to assure that no contaminants are transported to the groundwater beyond the boundary of the waste management area.

TABLE E-3

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations – Surface Water Drainage	DEM OWM-SW0401, 2.3.10	Relevant and Appropriate	Contains requirements for surface water drainage.	The substantive requirements of this section of the regulations will be met through design of appropriate surface drainage considerations for the cover. The cover system would be designed to prevent erosion, sedimentation, and standing water on the cover. Minimum slope requirements for solid waste landfills have been determined not relevant or appropriate for a soil cover which is not intended to reduce infiltration.
Rhode Island Solid Waste Regulations - Monitoring Wells	DEM OWM-SW0401, 2.3.11	Relevant and Appropriate	Contains requirements for monitoring wells.	The substantive requirements of this section of the regulations will be met by having and maintaining monitoring wells for the purpose of monitoring groundwater conditions by the soil cover and the waste management area. Because this remedy leaves contaminants in place, it will be supported with a Long Term Monitoring Plan (LTMP) for groundwater. The LTMP will be directed by a work plan that will contain the specific monitoring well requirements.

TABLE E-3

ACTION-SPECIFIC ARARs AND TBCs
SOIL ALTERNATIVE SO3 – SOIL COVER, SELECTIVE EXCAVATION AND REMOVAL OF ANOMALIES, OFF-SITE DISPOSAL, LUCS, MONITORING
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations – Siting in and Adjacent to Wetlands and Floodplains	DEM OWM-SW0401, 2.3.14	Relevant and Appropriate	Provides requirements for new solid waste landfill units and expansions that impact wetlands and coastal wetlands, coastal flood zones, etc.	This alternative will involve alteration of land within wetlands. The substantive requirements of this section of the regulations will be met by protecting wetland and downstream floodplain resources during construction and maintenance of a cover over soil containing residual contamination. The Remedial Design, RAWP, and the LTMP will be developed and provide specific requirements, to meet the substantive requirements of this section.
Rhode Island Solid Waste Regulations – Closure in “Unstable Areas”	DEM OWM-SW0401, 2.3.23	Relevant and Appropriate	Provides requirements for closure of solid waste units in “unstable areas”, interpreted to include wetland and floodplains.	This alternative establishes a soil cover and a waste management area within and/or adjacent to “unstable areas.” The substantive requirements of this section of the regulations will be met through the closure of the cover areas. This alternative meets the intent because the site will be covered in a manner that prevents the release of contaminants during a 100-year flood event.

TABLE E-4

CHEMICAL-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subparts B and G	Relevant and Appropriate	Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources.	MCLs were considered in development of PRGs. Outside of the compliance boundary of the waste management area, PRGs would be met through bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Non-zero MCLGs were considered in development of PRGs. Outside of the compliance boundary of the waste management area, PRGs would be met through bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Health Advisories (EPA Office of Drinking Water)		To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water. The risk-based standard for manganese is 0.3 mg/L.	Health Advisory was considered in development of PRG for manganese. Outside of the compliance boundary of the waste management area, PRG would be met through natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
EPA Carcinogenicity Slope Factor		To Be Considered	These are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. Slope factors are developed by EPA from health effects assessments.	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in groundwater for COCs without MCLs, non-zero MCLGs, or Health Advisory values. Outside of the compliance boundary of the waste management area, PRG would be met through

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
			Carcinogenic effects present the most up-to-date information on cancer risk potency. Potency factors are developed by EPA from Health Effects Assessments of evaluation by the Carcinogenic Assessment Group.	bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
EPA Risk Reference Dose (RfDs)		To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in groundwater for COCs without MCLs, non-zero MCLGs, or Health Advisory values. Outside of the compliance boundary of the waste management area, PRG would be met through bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	Guidance for assessing cancer risk.	Used to calculate potential carcinogenic risks caused by exposure to contaminants. Outside of the compliance boundary of the waste management area, PRG would be met through bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F (March 2005)	To Be Considered	Guidance of assessing cancer risks to children.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants. Outside of the compliance boundary of the waste management area, PRG would be met through bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater

CHEMICAL-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
				that exceeds these standards.
State				
Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Short Title: Remediation Regulations)	Code of Rhode Island Rules (CRIR) 12-180-001; DEM-DSR-01-93, sections 8.01 and 8.03	Applicable	These regulations set remediation standards for groundwater at NPL sites when they are more stringent than federal standards.	These standards were used to develop groundwater PRGs. Outside of the compliance boundary of the waste management area, PRG would be met through bioremediation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.

TABLE E-5

LOCATION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Floodplain Management and Protection of Wetlands	44 C.F.R. 9	Relevant and Appropriate	Implements Executive Order 11990 (Protection of Wetlands)). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.	During the remedial design stage the effects of installing and maintaining monitoring wells on federal jurisdictional wetlands will be evaluated. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by well installation and maintenance will be mitigated in accordance with requirements. Public comment will be solicited in the Proposed Plan.
Clean Water Act, Section 404; Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; 40 C.F.R. Part 230, 231 and 33 C.F.R. Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystems. Filling or discharge of dredged material will only occur where there is no other practicable alternative and any adverse impacts to aquatic ecosystems will be mitigated.	Activities involving discharge of dredged material and/or excavation. Installation or maintenance of monitoring wells that include dredging or filling in wetlands will be implemented to meet these requirements, including mitigation of altered wetland/aquatic resource as required.
State				
Fresh Water Wetlands Act	RIGL 2-1, Sections 2-1-18 through 2-1-20.2; Fresh Water Wetlands Act; DEM Rules And Regulations	Applicable	Rules and regulations governing the administration and enforcement of the Fresh Water Wetlands Act. Defines and establishes provisions for the protection of swamps, marshes and other fresh water wetlands in the state. Actions are required to prevent the undesirable drainage, excavation, filling, alteration, encroachment or any	Injection well installation, injection, and monitoring activities will be conducted to minimize the disturbance of state jurisdictional wetland and perimeter wetland.

TABLE E-5

LOCATION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
	Governing the Administration and Enforcement of the Fresh Water Wetlands Act (Dec 2010), Rules 4.00 and 5.00		other form of disturbance or destruction of a wetland. Also establishes standards for land within 50 feet of the edge of a state-regulated wetland.	

TABLE E-6

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Underground Injection Control (UIC)	40 C.F.R. 144,146, and 147.2000	Applicable	These regulations address the discharge of wastes, chemicals or other substances into the subsurface. The federal UIC program designates injection wells incidental to aquifer remediation as Class V wells.	These regulations apply underground injection of electron donor substrate.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subparts B and G	Relevant and Appropriate	Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources.	The MCLs will be used to develop performance standards for monitoring the compliance boundary for the waste management area established where contamination is left in place under a cover. Exceedances of these standards within the compliance boundary will be addressed by LUCs.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	The non-zero MCLGs will be used to develop performance standards for monitoring the compliance boundary for the waste management area established where contamination is left in place under a cover. Exceedances of these standards within the compliance boundary will be addressed by LUCs.
Health Advisories (EPA Office of Drinking Water)		To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water. The risk-based standard for manganese is 0.3 mg/L.	The Health Advisory for manganese will be used to develop performance standards for monitoring the compliance boundary for the waste management area established where contamination is left in place under a cover. Exceedances of these standards (particularly for manganese) within the

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
				compliance boundary will be addressed by LUCs.
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable time frame for achieving cleanup standard though monitored attenuation would be comparable to that which could be achieved through active restoration.	Bioremediation and MNA can attain federal drinking water and risk standards as defined by this guidance within a reasonable time frame outside of the compliance boundary for the waste management area.
EPA Groundwater Protection Strategy (August 1984); NCP Preamble; Guidelines for Ground-Water Classification (November 1986)	Federal Register Vol 55, No. 46, March 8, 1990, p. 8733 (NCP Preamble)	To Be Considered	The Groundwater Protection Strategy provides a common reference for preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer and define three classes of groundwater. These documents defined Class I, II and III groundwaters.	Under federal standards, groundwater within the Site is considered a potential drinking water source except within the compliance boundary of any waste management area established under the soil or sediment alternatives; therefore, groundwater must achieve federal drinking water and risk-based standards or more stringent State groundwater standards outside of the compliance boundary. Groundwater use restrictions outside of the compliance boundary will be maintained until these standards are achieved. Inside of the compliance boundary groundwater use restrictions will be in effect for as long as the waste management area remains in place. Groundwater monitoring using these standards will be used to make sure groundwater exceeding these standards does not migrate beyond the

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
				compliance boundary. Exceedances of these standards within the compliance boundary is a basis for establishing prohibitions on the use of groundwater within the compliance boundary. An additional buffer zone beyond the compliance boundary to prevent groundwater wells from being installed that would draw contaminated groundwater beyond the compliance boundary may also be established, if required.
State				
Standards for Identification and Listing of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, Rhode Island General Laws (RIGL) 23-19 et seq,, Code of Rhode Island Rules (CRIR) 12-030-003 Rule 5.8	Applicable	Defines the listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic.

TABLE E-6

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
State (Continued)				
Standards for Generators of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, RIGL 23-19 et seq,, CRIR 12-030-003 Rule 5.0	Applicable	Establishes manifesting, pre-transport, and recordkeeping requirements for hazardous waste.	These regulations would apply to well installation and monitoring well sampling IDW, if hazardous.
Injection Control Regulations	Underground Injection Control Program Rules and Regulations; RIGL Ch. 46-12, 46-13.1; Rules for the Discharge of Non-Sanitary Wastewater and Other Fluid to or Below the Ground Surface (June 2012)	Applicable	Establishes a State Underground Injection Control Program consistent with federal requirements to preserve the quality of the groundwater of the state and to prevent contamination of groundwater resources from the discharge of non-sanitary wastewater or other fluid to or below the ground surface.	These regulations apply underground injection of electron donor substrate.
Rhode Island Solid Waste Regulations - Monitoring Wells	DEM OWM-SW0401, 2.1.08(a)(8)	Relevant and Appropriate	Contains requirements for construction of monitoring wells to monitor a solid waste landfill.	The substantive requirements of this section of the regulations will be met for construction of new monitoring wells and maintenance of all monitoring wells.

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations – Long-term Monitoring	DEM OWM-SW0401, 2.1.08(c)	Relevant and Appropriate	Contains requirements for monitoring wells.	The substantive requirements of this section of the regulations will be met by maintaining monitoring wells for the purpose of monitoring groundwater conditions at the site, including monitoring for soil contamination left in place. Groundwater monitoring for alternatives for all media will be addressed through a monitoring program under the selected groundwater alternative.
Rhode Island Solid Waste Regulations - Monitoring Wells	DEM OWM-SW0401, 2.3.11	Relevant and Appropriate	Contains requirements for monitoring wells.	The substantive requirements of this section of the regulations will be met by maintaining monitoring wells for the purpose of monitoring groundwater conditions at the site, including monitoring for soil contamination left in place. Groundwater monitoring for alternatives for all media will be addressed through a monitoring program under the selected groundwater alternative.

TABLE E-6

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW3 - IN-SITU ENHANCED BIOREMEDIATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rules and Regulations for Groundwater Quality	RIGL Ch. 46-12, Section 46-12-2; Ch. 46-13.1, Ch. 23-18.9, Sec. 23-18-9.1; DEM Rules and Regulations for Groundwater Quality (March 2005), Appendix 1	Applicable	Identifies the standards and specification that must be followed for the installation or abandonment of monitoring wells.	Wells installed for monitoring and in-situ treatment will be installed and abandoned according to these standards.

TABLE E-7

CHEMICAL-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subparts B and G	Relevant and Appropriate	Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources.	MCLs were considered in development of PRGs. Outside of the compliance boundary of the waste management area, PRGs would be met through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	Non-zero MCLGs were considered in development of PRGs. Outside of the compliance boundary of the waste management area, PRGs would be met through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Health Advisories (EPA Office of Drinking Water)		To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water. The risk-based standard for manganese is 0.3 mg/L.	Health Advisory was considered in development of PRG for manganese. Outside of the compliance boundary of the waste management area, PRG would be met through natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
EPA Carcinogenicity Slope Factor		To Be Considered	These are guidance values used to evaluate the potential carcinogenic hazard caused by exposure to contaminants. Slope factors are developed by EPA from health effects	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in groundwater for COCs without MCLs, non-zero MCLGs, or Health Advisory values. Outside of the

CHEMICAL-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCs
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
			assessments. Carcinogenic effects present the most up-to-date information on cancer risk potency. Potency factors are developed by EPA from Health Effects Assessments of evaluation by the Carcinogenic Assessment Group.	compliance boundary of the waste management area, PRG would be met through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
EPA Risk Reference Dose (RfDs)		To Be Considered	Guidance used to compute human health hazard resulting from exposure to non-carcinogens in site media. RfDs are considered to be the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	Used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants in groundwater for COCs without MCLs, non-zero MCLGs, or Health Advisory values. Outside of the compliance boundary of the waste management area, PRG would be met through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Guidelines for Carcinogen Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	Guidance for assessing cancer risk.	Used to calculate potential carcinogenic risks caused by exposure to contaminants. Outside of the compliance boundary of the waste management area, PRG would be met through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
Supplemental Guidance for Assessing Susceptibility from	EPA/630/R-03/003F (March 2005)	To Be Considered	Guidance of assessing cancer risks to children.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants. Outside of the compliance boundary of the waste management area, PRG would be met

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Early-Life Exposure to Carcinogens				through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.
State				
Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Short Title: Remediation Regulations)	Code of Rhode Island Rules (CRIR) 12-180-001; DEM-DSR-01-93, sections 8.01 and 8.03	Applicable	These regulations set remediation standards for groundwater at NPL sites when they are more stringent than federal standards.	These standards were used to develop groundwater PRGs. Outside of the compliance boundary of the waste management area, PRG would be met through chemical oxidation and natural attenuation. LUCs within the compliance boundary of the waste management area will prevent use of contaminated groundwater that exceeds these standards.

TABLE E-8

LOCATION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCS
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Floodplain Management and Protection of Wetlands	44 C.F.R. 9	Relevant and Appropriate	Implements Executive Order 11990 (Protection of Wetlands)). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.	During the remedial design stage the effects of installing and maintaining monitoring wells on federal jurisdictional wetlands will be evaluated. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by well installation and maintenance will be mitigated in accordance with requirements. Public comment will be solicited in the Proposed Plan.
Clean Water Act, Section 404; Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; 40 C.F.R. Part 230, 231 and 33 C.F.R. Parts 320-323	Applicable	Controls discharges of dredged or fill material to protect aquatic ecosystems. Filling or discharge of dredged material will only occur where there is no other practicable alternative and any adverse impacts to aquatic ecosystems will be mitigated.	Activities involving discharge of dredged material and/or excavation. Installation or maintenance of monitoring wells that include dredging or filling in wetlands will be implemented to meet these requirements, including mitigation of altered wetland/aquatic resource as required.
State				
Fresh Water Wetlands Act	RIGL 2-1, Sections 2-1-18 through 2-1-20.2; Fresh Water Wetlands Act; DEM Rules And Regulations	Applicable	Rules and regulations governing the administration and enforcement of the Fresh Water Wetlands Act. Defines and establishes provisions for the protection of swamps, marshes and other fresh water wetlands in the state. Actions are required to prevent the undesirable drainage, excavation, filling, alteration, encroachment or any	Injection well installation, injection, and monitoring activities will be conducted to minimize the disturbance of state jurisdictional wetland and perimeter wetland.

TABLE E-8

LOCATION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCS
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
	Governing the Administration and Enforcement of the Fresh Water Wetlands Act (Dec 2010), Rules 4.00 and 5.00		other form of disturbance or destruction of a wetland. Also establishes standards for land within 50 feet of the edge of a state-regulated wetlands.	

TABLE E-9

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCS
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Underground Injection Control (UIC)	40 C.F.R. 144,146, and 147.2000	Applicable	These regulations address the discharge of wastes, chemicals or other substances into the subsurface. The federal UIC program designates injection wells incidental to aquifer remediation as Class V wells.	These regulations apply underground injection of oxidizing chemical.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subparts B and G	Relevant and Appropriate	Establishes MCLs for common organic and inorganic contaminants applicable to public drinking water supplies. Used as relevant and appropriate standards for aquifers and surface water bodies that are potential drinking water sources.	The MCLs will be used to develop performance standards for monitoring the compliance boundary for the waste management area established where contamination is left in place under a cover. Exceedances of these standards within the compliance boundary will be addressed by LUCs.
Safe Drinking Water Act; National primary drinking water regulations	42 U.S.C. §300f *et seq.*; 40 C.F.R. 141, Subpart F	Relevant and Appropriate for non-zero MCLGs only	Establishes maximum contaminant level goals (MCLGs) for public water supplies. MCLGs are health goals for drinking water sources. These unenforceable health goals are available for a number of organic and inorganic compounds.	The non-zero MCLGs will be used to develop performance standards for monitoring the compliance boundary for the waste management area established where contamination is left in place under a cover. Exceedances of these standards within the compliance boundary will be addressed by LUCs.
Health Advisories (EPA Office of Drinking Water)		To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water. The risk-based standard for manganese is 0.3 mg/L.	The Health Advisory for manganese will be used to develop performance standards for monitoring the compliance boundary for the waste management area established where contamination is left in place under a cover. Exceedances of these standards (particularly for manganese) within the compliance boundary will be addressed by LUCs.

TABLE E-9

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCS
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites,	OSWER Directive 9200.4-17P (April 21, 1999)	To Be Considered	EPA guidance regarding the use of monitored natural attenuation for the cleanup of contaminated soil and groundwater. In particular, a reasonable time frame for achieving cleanup standard though monitored attenuation would be comparable to that which could be achieved through active restoration.	Chemical oxidation and MNA can attain federal drinking water and risk standards as defined by this guidance within a reasonable time frame outside of the compliance boundary for the waste management area.
EPA Groundwater Protection Strategy (August 1984); NCP Preamble; Guidelines for Ground-Water Classification (November 1986)	Federal Register Vol 55, No. 46, March 8, 1990, p. 8733 (NCP Preamble)	To Be Considered	The Groundwater Protection Strategy provides a common reference for preserving clean groundwater and protecting the public health against the effects of past contamination. Guidelines for consistency in groundwater protection programs focus on the highest beneficial use of a groundwater aquifer and define three classes of groundwater. These documents defined Class I, II and III groundwaters.	Under federal standards, groundwater within the Site is considered a potential drinking water source source except within the compliance boundary of any waste management area established under the soil or sediment alternatives; therefore, groundwater must achieve federal drinking water and risk-based standards or more stringent State groundwater standards outside of the compliance boundary. Groundwater use restrictions outside of the compliance boundary will be maintained until these standards are achieved. Inside of the compliance boundary groundwater use restrictions will be in effect for as long as the waste management area remains in place. Groundwater monitoring using these standards will be used to make sure groundwater exceeding these standards does not migrate beyond the compliance boundary. Exceedances of these standards within the compliance boundary is a basis for establishing

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
				prohibitions on the use of groundwater within the compliance boundary. An additional buffer zone beyond the compliance boundary to prevent groundwater wells from being installed that would draw contaminated groundwater beyond the compliance boundary may also be established, if required.
State				
Standards for Identification and Listing of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, Rhode Island General Laws (RIGL) 23-19 *et seq*,, Code of Rhode Island Rules (CRIR) 12-030-003 Rule 5.8	Applicable	Defines the listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic.
Standards for Generators of Hazardous Waste	Rules and Regulations for Hazardous Waste Management, RIGL 23-19 *et seq*,, CRIR 12-030-003 Rule 5.0	Applicable	Establishes manifesting, pre-transport, and recordkeeping requirements for hazardous waste.	These regulations would apply to well installation and monitoring well sampling IDW, if hazardous.

TABLE E-9

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCS
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Injection Control Regulations	Underground Injection Control Program Rules and Regulations; RIGL Ch. 46-12, 46-13.1; Rules for the Discharge of Non-Sanitary Wastewater and Other Fluid to or Below the Ground Surface (June 2012)	Applicable	Establishes a State Underground Injection Control Program consistent with federal requirements to preserve the quality of the groundwater of the state and to prevent contamination of groundwater resources from the discharge of non-sanitary wastewater or other fluid to or below the ground surface.	These regulations apply underground injection of oxidizing chemical.
Rhode Island Solid Waste Regulations - Monitoring Wells	DEM OWM-SW0401, 2.1.08(a)(8)	Relevant and Appropriate	Contains requirements for construction of monitoring wells to monitor a solid waste landfill.	The substantive requirements of this section of the regulations will be met for construction of new monitoring wells and maintenance of all monitoring wells.
Rhode Island Solid Waste Regulations – Long-term Monitoring	DEM OWM-SW0401, 2.1.08(c)	Relevant and Appropriate	Contains requirements for monitoring wells.	The substantive requirements of this section of the regulations will be met by maintaining monitoring wells for the purpose of monitoring groundwater conditions at the site, including monitoring for soil contamination left in place. Groundwater monitoring for alternatives for all media will be addressed through a monitoring program under the selected groundwater alternative.

TABLE E-9

ACTION-SPECIFIC ARARs AND TBCs
GROUNDWATER ALTERNATIVE GW4 - IN-SITU CHEMICAL OXIDATION, MNA, AND LUCS
SITE 8 – NUSC DISPOSAL AREA
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rhode Island Solid Waste Regulations - Monitoring Wells	DEM OWM-SW0401, 2.3.11	Relevant and Appropriate	Contains requirements for monitoring wells.	The substantive requirements of this section of the regulations will be met by maintaining monitoring wells for the purpose of monitoring groundwater conditions at the site, including monitoring for soil contamination left in place. Groundwater monitoring for alternatives for all media will be addressed through a monitoring program under the selected groundwater alternative.
Rules and Regulations for Groundwater Quality	RIGL Ch. 46-12, Section 46-12-2; Ch. 46-13.1, Ch. 23-18.9, Sec 23-18-9.1; DEM Rules and Regulations for Groundwater Quality (March 2005), Appendix 1	Applicable	Identifies the standards and specification that must be followed for the installation or abandonment of monitoring wells.	Wells installed for monitoring and in-situ treatment will be installed and abandoned according to these standards.

TABLE E-10

CHEMICAL-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVE SD4 – SEDIMENT REMOVAL AND OFF-SITE DISPOSAL
SITE 8 – NUSC DISPOSAL AREA
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Probable Effects Concentration Quotients (PEC-Qs)	MacDonald, *et al*., 2000 and Ingersoll *et al*., 2000.	To Be Considered	Provides guidance values for identifying potential risk to ecological receptors exposed to contaminated sediments.	Primary basis for evaluating risk to aquatic ecological receptors. This guidance can be used to develop PRGs.
Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Probable Effects Concentrations (PECs)	MacDonald *et al*., 2000	To Be Considered	The PEC value is the concentration above which the adverse effects on sediment-dwelling organisms are likely to occur.	Sediment removal will prevent exposure to COCs at concentrations greater than PRGs calculated through the use of PECs.
Recommendations of the Technical Review Workgroup for Lead for an approach to Assessing Risks Associated with Adult Exposure to Lead In Soil	EPA-540-R-03-001 (January 2003)	To Be Considered	EPA Guidance for evaluating risks posed by lead in soil.	Risks from lead assessed under this guidance will be addressed through a combination of remediation (stream sediment removal to industrial levels) and LUCs (to prevent residential/unrestricted recreational exposure to lead remaining in stream sediment above residential levels developed using these standards).
State				
There are no state chemical-specific ARARs.				

TABLE E-11

LOCATION-SPECIFIC ARARs AND TBCs
SEDIMENT ALTERNATIVE SD4 – SEDIMENT REMOVAL AND OFF-SITE DISPOSAL
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Clean Water Act, Section 404; Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material	33 U.S.C. § 1344; 40 C.F.R. Part 230, 231 and 33 C.F.R. Parts 320-323	Applicable	Under this requirement, no activity that adversely affects a wetland shall be permitted if a practicable alternative with lesser effects is available. If activity takes place, impacts must be minimized to the maximum extent. Controls discharges of dredged or fill material to protect aquatic ecosystems. Filling or discharge of dredged material will only occur where there is no other practicable alternative and any adverse impacts to aquatic ecosystems will be mitigated. Under these standards the Navy must solicit public comment through the Proposed Plan on its finding that one of the alternatives is the Least Environmentally Damaging Practicable Alternative.	Sediment remediation or other remedial actions that include dredging in wetlands/waterways will be implemented to meet these requirements, including mitigation of altered wetland/aquatic resource as required. The Navy has determined that this alternative is the Least Environmentally Damaging Practicable Alternative to protect wetland resources because it provides the best balance of addressing contaminated sediment within and adjacent to wetlands and waterways with minimizing both temporary and permanent alteration of wetlands and aquatic habitats on site. The Navy solicited public comment on its determination in the Proposed Plan and received no negative public comments.
Fish and Wildlife Coordination Act	16 U.S.C. §661 *et seq*.	Applicable	Requires Federal agencies involved in actions that will result in the control of structural modification of any stream or body of water for any purpose to take action to protect fish and wildlife resources that may be affected by the action. The Navy must coordinate with appropriate federal and state resource agencies to ascertain the means and	Measures to mitigate or compensate adverse project related impacts to fish and wildlife resources will be taken, if determined necessary. The appropriate federal and state resource agencies will be consulted, in particular regarding remedial measures for contaminated sediment that will impact streams,

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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
			measures necessary to mitigate, prevent, and compensate for project related losses of fish and wildlife resources and to enhance the resources.	wetlands, and downstream water bodies.
Floodplain Management and Protection of Wetlands	44 C.F.R. 9	Relevant and Appropriate	Implements Executive Order 11990 (Protection of Wetlands)). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.	During the remedial design stage the effects of sediment remedial actions on federal jurisdictional wetlands will be evaluated. All practicable means will be used to minimize harm to the wetlands. Wetlands disturbed by sediment remediation, will be mitigated in accordance with requirements. The remedy will not adversely impact the downstream floodplain area as contaminated sediment would be removed from the site. The Navy solicited public comment on its determination in the Proposed Plan and received no negative public comments.
Endangered Species Act	16 U.S.C. 1531 *et seq.*; 50 C.F.R. parts 200 and 402	Applicable	Regulates activities affecting federally listed endangered or threatened species or their habitat. The federally-listed loggerhead turtle, Kemps-Ridley turtle, and Atlantic Sturgeon occur in the water of Narragansett Bay.	Appropriate federal agencies will be consulted to ensure that remedial measure taken under this alternative will prevent site contamination from migrating downstream to the Bay.

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LOCATION-SPECIFIC ARARs AND TBCs
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
State				
Rhode Island Endangered Species Act	RIGL 20-37-1 *et seq.*	Relevant and Appropriate	Regulates activities affecting State-listed endangered or threatened species or their habitat. The State-listed loggerhead turtle and Kemps-Ridley turtle occur in the water of Narragansett Bay.	Appropriate State agencies will be consulted to ensure that remedial measure taken under this alternative will prevent site contamination from migrating downstream to the Bay.
Fresh Water Wetlands Act	RIGL 2-1, Sections 2-1-18 through 2-1-20.2; Fresh Water Wetlands Act; DEM Rules And Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act (Dec. 2010), Rules 4.00 and 5.00	Applicable	Rules and regulations governing the administration and enforcement of the Fresh Water Wetlands Act. Defines and establishes provisions for the protection of swamps, marshes and other fresh water wetlands in the state. Actions are required to prevent the undesirable drainage, excavation, filling, alteration, encroachment or any other form of disturbance or destruction of a wetland. Also establishes standards for land within 50 feet of the edge of a state-regulated wetlands.	Sediment removal activities will be conducted to minimize the disturbance of state jurisdictional wetland and perimeter wetland.

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ACTION-SPECIFIC ARARs AND TBCs
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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Federal				
Contaminated Sediment Remediation Guidance for Hazardous Waste Sites	EPA-540-R-05-012 OSWER 9355.0-85 (December 2005)	To Be Considered	Guidance for making remedy decisions for contaminated sediment sites. Some of the relevant sections of the guidance address Remedial Investigations (Ch. 2), FS Considerations (Ch. 3), and Dredging and Excavation (Ch. 6).	Removal of all contaminated sediment, along with dewatering and off-site disposal under this alternative meets guidance standards for addressing contaminated sediments in the wetlands/waterway (as long as habitat restoration requirements can be met).
Toxic Substances Control Act (TSCA); PCB Remediation Waste,	40 C.F.R. 761.61(c)	Applicable	This section of the TSCA regulations provides risk-based cleanup and disposal options for PCB remediation waste based on the risks posed by the *in-situ* concentrations at which the PCBs are found. Written approval for the proposed risk-based cleanup must be obtained from the Director, Office of Site Remediation and Restoration, U.S. Environmental Protection Agency (USEPA) Region 1.	All sediment exceeding identified PCB cleanup levels will be removed, dewatered (if required) and disposed of off-site. The excavation, transportation, dewatering, and management of PCB contaminated media will be performed in a manner to comply with TSCA, including air and surface water monitoring during remedial activities. This ROD contains a finding by the Director, Office of Site Remediation and Restoration, USEPA Region 1, that the remedy's sediment PCB cleanup levels, along with the excavation, dewatering, and management of the contaminated media will not pose an unreasonable risk to human health or the environment.
CWA National Recommended Water Quality Criteria (NRWQC)	40 C.F.R. 122.44	Applicable	Federal NRWQC are health-based and ecologically based criteria developed for carcinogenic and non-carcinogenic compounds.	Water quality standards used to develop monitoring standards during the sediment excavation/dredging and dewatering.

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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Clean Water Act - National Pollutant Discharge Elimination System (NPDES)	40 C.F.R. Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Includes stormwater standards for activities disturbing more than one acre.	Any water discharged to surface water bodies during remedial activities such as sediment dewatering will comply with this regulation. Best management practices will be used to meet stormwater standards during the remedial action.
Clean Water Act; General Pretreatment Regulations for Existing and New Sources of Pollution	33 U.S.C. § 1251 *et seq*., 40 CFR. Part 403	Applicable	Standards for direct discharge of waste water into a Publicly Owned Treatment Works (POTW).	These standards will apply if water from the remedial action such as from dewatering is discharged to a POTW.
Management of Undesirable Plants on Federal Lands	7 U.S.C. 2814	Relevant and Appropriate	Requires federal agencies to establish integrated management systems to control or contain undesirable plant species on federal lands under the agency's jurisdiction.	Measures will be taken to control the establishment of *Phragmites*, purple loosestrife or other invasive plants within all remediated areas. An invasive species control plan will be developed as part of the long-term O&M for this site. The responsibility of control will be transitioned to NAVSTA after (1) the remedy is in place, and (2) NAVSTA develops a base-wide program for controlling undesirable plants.
State				
Clean Air Act -Emissions Detrimental to Persons or Property	RIGL 23-23 *et seq.*; CRIR 12-31-07	Applicable	Prohibits emissions of contaminants which may be injurious to humans, plant or animal life or cause damage to property or which reasonably interferes with the enjoyment of life and property.	Monitoring of air emissions during excavation/dredging and dewatering will be used to assess compliance with these standards if threshold levels are reached.

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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Clean Air Act –Air Toxics	RIGL 23-23 *et seq.*; CRIR 12-31-22	Applicable	Prohibits the emission of specified contaminants at rates which would result in ground level concentrations greater than acceptable ambient levels or acceptable ambient levels as set in the regulations.	Monitoring of air emissions during excavation/dredging and dewatering will be used to assess compliance with these standards if threshold levels are reached.
Water Pollution Control - Pollution Discharge Elimination Systems	RIGL 42-16 *et seq.*; CRIR 12-190-003	Applicable	Contains discharge limitations, monitoring requirements and best management practices. Substantive requirements under NPDES are written such that state and federal NRWQC are met. Permits are required for off-site discharges, RI Standards apply to POTWs. Includes storm water requirements for construction projects that disturb over one acre.	Discharge of any water from remedial activities during sediment excavation/dredging into surface waters or POTW will meet applicable standards. Stormwater standards for construction projects over one acre will also be met.
Water Pollution Control - Water Quality	RIGL 42-16 *et seq.*; CRIR 12-190-001	Applicable	Establishes water use classification and water quality criteria for waters of the state.	Water quality standards will be used to develop monitoring standards during the sediment excavation/dredging and dewatering.
Pretreatment Regulations	RIGL 46-12, 4217.1, 42-45	Applicable	Rhode Island standards for discharge to POTWs.	These standards will apply if water from the remedial action such as from dewatering is discharged to a POTW.
Hazardous Waste Determination	RIGL 23-19.1 *et seq.*; CRIR 12-030-003, Rule 5.8	Applicable	Defines the listed and characteristic hazardous wastes.	These regulations would apply when determining whether or not a solid waste is hazardous, either by being listed or by exhibiting a hazardous characteristic.
Hazardous Waste Management Standards for Generators	RIGL 23-19.1 *et seq.*; CRIR 12-030-003, Rule 5.0	Applicable	Sets standards for handling, design, operation, and monitoring of hazardous waste. The standards of 40 CFR Part 264 are incorporated by reference.	Wastes generated would be tested to determine if they constitute hazardous waste. Any hazardous waste identified will be handled and disposed according to these standards.

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Requirement	Citation	Status	Synopsis of Requirement	Action to Be Taken to Attain ARAR
Rules and Regulations for Dredging and Management of Dredge Materials	DEM-OWR-DR-0203	Applicable	Addresses dredging activities and disposal of dredge spoils.	Any dredging/excavation of sediment and dewatering will comply with the requirements of the regulations.