N62661.AR.003602
NS NEWPORT
5090.3a

FINAL RECORD OF DECISION SITE 7 TANK FARM 1 DECISION UNITS 1-1, 1-2, 1-3 (DU 1-1, DU 1-2, DU 1-3) AND OPERABLE UNIT 13 (OU 13) NS NEWPORT RI
08/01/2016
RESOLUTION CONSULTANTS

FINAL
RECORD OF DECISION

SITE 7 – TANK FARM 1
DECISION UNITS 1-1, 1-2, & 1-3

(OPERABLE UNIT 13)

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

AUGUST 2016

TABLE OF CONTENTS

SECTION **PAGE NO.**

APPENDICES

TABLES

NUMBER **PAGE NO.**

FIGURES

(presented at the end of the document)

NUMBER

ACRONYMS

µg	microgram(s)
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
ARAR	Applicable or Relevant and Appropriate Requirement
ASTs	Aboveground Storage Tanks
BERA	Baseline Ecological Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act [as amended]
CFR	Code of Federal Regulations
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CS	Confirmation Study
CSF	cancer slope factor
CSGWPP	Comprehensive State Groundwater Protection Program
CSM	conceptual site model
CWA	Clean Water Act
DBCP	1,2-dibromo-3-chloropropane
DEC	[RIDEM] Direct Exposure Criteria
DGA	Data Gaps Assessment
DLA	Defense Logistics Agency
DoD	Department of Defense
DU	Decision Units
EDB	ethylene dibromide
EDC	ethylene dichloride
EEQs	Ecological Effects Quotients
EPA	United States (U.S.) Environmental Protection Agency
EPCs	Exposure Point Concentrations
ERA	Ecological Risk Assessment

ESD	Explanation of Significant Differences
FFA	Federal Facility Agreement
FS	Feasibility Study
FY	Fiscal Year
GRO	Gasoline-Range Organics
HHRA	Human Health Risk Assessment
HI	Hazard Index
His	noncancer risk estimates
HQ	Hazard Quotient
IAS	Initial Assessment Study
ILCR	incremental lifetime cancer risk
IR	Installation Restoration [Program]
IRIS	Integrated Risk Information System
IUR	inhalation unit risk
kg	kilogram
L	liter
LTM	long-term monitoring
LUC	land use control
MCL	[U.S. EPA / federal] Maximum Contaminant Level
MCLG	[U.S. EPA / federal] Maximum Contaminant Level Goal
mg	milligram(s)
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
MRP	Munitions Response Program
NAVSTA	Naval Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan, or National Contingency Plan
NETC	Naval Education and Training Center
NOAELs	No Observed Adverse Effects Levels
NPL	National Priorities List

NTCRA	non-time critical removal action
NUSC	Naval Undersea Warfare Center
OFFTA	Old Fire Fighting Training Area
O&M	operation and maintenance
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PRG	Preliminary Remediation Goal
PV	present value (a.k.a. present worth)
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RBC	Risk-Based Concentration
RD	Remedial Design
RfC	reference concentration
RfD	reference dose
RGs	Remediation Goals
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
ROD	Record of Decision
RSL	[U.S. EPA] Regional Screening Level
SI	Site Investigation
SMDP	Scientific Managment Decision Point
SSLs	Soil Screening Levels
SVOC	Semivolatile Organic Compound
SWOS	Surface Warfare Officers School
TEL	tetraethyl lead
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
UCLs	Upper Confidence Limits

UPL	Upper Predictive Limit
U.S.	United States
UU/UE	unlimited use and unrestricted exposure
VOC	volatile organic compound

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Site 7 – Operable Unit 13 – Tank Farm 1, is a 50-acre former fuel storage and distribution area in the northern portion of the Naval Station (NAVSTA) Newport facility, located in Portsmouth, Rhode Island. Within Site 7 – Tank Farm 1 are three Decision Units (DU) that are addressed by this Record of Decision (ROD). DU 1-1 is located in the southeast portion of Tank Farm 1 and DU 1-2 and DU 1-3 are located in the central portion of Tank Farm 1. The site was used by the Navy as a fuel storage area and distribution facility from 1940 until it was leased to the Defense Logistics Agency (DLA) Energy in 1974. DLA Energy continued to use the site as a fuel storage area and distribution facility until operations were terminated in 1998. NAVSTA Newport, formerly identified as the Naval Education and Training Center (NETC), has been assigned United States Environmental Protection Agency (EPA) Identification (ID) number RI6170085470.

1.2 STATEMENT OF BASIS AND PURPOSE

This ROD presents the Selected Remedy for DU 1-1, DU 1-2 and DU 1-3 at Site 7 – Tank Farm 1, Operable Unit (OU) 13, as chosen by the Navy and EPA in accordance with provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (*42 U.S.C. §9601 et seq),* as amended by the Superfund Amendments and Reauthorization Act, and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (*40 C.F.R. Part 300)*. This decision is based on information contained in the Administrative Record for DU 1-1, DU 1-2 and DU 1-3 at Site 7 – Tank Farm 1 (OU13), as listed in the Detailed Administrative Record Reference Table presented at the end of this ROD. The Rhode Island Department of Environmental Management (RIDEM) concurs with the Navy and EPA on the Selected Remedy for Site 7 – Tank Farm 1 (OU13) (see 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 releases of hazardous substances into the environment. A CERCLA action is required because the human health risk assessment (HHRA) determined that there is unacceptable human health risk associated with concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) in surface soil at DU 1-1 under a potential future residential or other unrestricted use of the site. Additionally, the ecological risk assessment (ERA) identified a potential risk to insectivorous receptors based on exposure to polychlorinated biphenyls (PCBs) (specifically, Aroclor 1260) in surface soil at DU 1-2 and DU 1-3. Current and potential future exposures to surface and subsurface soil at DU 1-2 and DU 1-3 did not result in an unacceptable human health risk, however, PCB levels in surface soil at DU 1-2 and DU 1-3 do exceed EPA guidance risk-based PCB standards for unrestricted use. There is inaccessible soil under structures at each of the three Decision Units that will be assessed if the buildings are demolished. No assessment of contamination inside these structures was conducted; therefore any demolition would be conducted so as not to pose a risk to human health or the environment.

In addition to this ROD, there are other areas and media within Tank Farm 1 that may require CERCLA decisions and response actions. These areas are:

- Five additional Areas of Concern (AOCs) – Five AOCs were identified by RIDEM and listed on page 2 of the **April 2012 dispute resolution agreement** as the inactive fuel loading area, former oil-water separator (central), former gasoline-water separator (west-side), electrical structures, and sludge pits (refer to Figure 2).
- Potential perfluorocarbons (PFCs) – The Navy is continuing an installation-wide assessment of PFCs, which will include sampling groundwater to identify whether PFCs are present.
- Tank farm wide groundwater – The Navy is implementing a tank farm wide groundwater assessment to collect sufficient information to evaluate tank farm wide groundwater.

These areas are still being assessed and a determination of a need for a CERCLA response action is pending. If required, a site-wide Tank Farm 1 ROD will address any additional areas requiring a CERCLA response.

1.4 DESCRIPTION OF SELECTED REMEDY

The major components of the Selected Remedy for soil at Site 7 – Tank Farm 1 (OU13) include the following:

- Limited soil excavation and off-site disposal will remove surface soils exceeding Industrial Remedial Goals (RGs) (including RIDEM GA Leachability Criteria) for DU 1-1 and allow for industrial and restricted recreational use. Approximately 130 cubic yards of soil will be removed.
- Limited soil excavation and off-site disposal will remove surface soils exceeding the Industrial and Ecological RGs (including RIDEM Leachability Criteria) for DU 1-2 and 1-3 and allow for industrial and restricted recreational use. Approximately 20 cubic yards of soils will be removed.
- Land use controls (LUCs) will be established to prevent residential and other unrestricted use to address soil that will remain above Residential RGs at DU 1-1, 1-2, and 1-3.
- For DU 1-1, because there is only a thin layer of soil overlying bedrock at DU 1-1, it is likely that little to no soil is present below the Ethyl Blending Plant (EBP) foundation. However, as a conservative measure, LUCs will also be required for the EBP structure footprint to prevent access to soil, if it exists, below the building.
- For DU 1-2 and DU 1-3, LUCs will be required for the Transformer Vaults 2 and 3 (TV2 and TV3) structure footprints to prevent access to soil below the buildings, since it has not been assessed.
- If the EBP (DU 1-1), TV2 (DU 1-2), and/or TV3 (DU 1-3) foundations are demolished in the future, the presence or absence of soil beneath the buildings will be assessed and if soil is present, it will be remediated, if necessary, to meet Industrial RGs for DU 1-1 and the Industrial and Ecological RGs for DU 1-2 and DU 1-3. If and when TV2 and/or TV3 are demolished in the future, the demolition will meet *Toxic Substances Control Act (TSCA) (15 U.S.C. §§ 2601 et seq.)* protectiveness standards so as not to create a threat of release to the environment.

Under this Selected Remedy, potential unacceptable human and ecological exposures to contaminated surface soil at DU 1-1, DU 1-2, and DU 1-3 will be eliminated through the combination of limited soil excavation and off-site disposal and LUCs. These actions will be supported by site inspections and five-year reviews. Implementation of this remedy will allow for continued industrial and restricted recreational use, which is consistent with the anticipated future uses for the site.

1.5 STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, and it complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action. The remedy is also cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element of the remedy for the following reasons: 1) treatment options were either not effective in treating the contaminants of concern or not as cost-effective as other process options for remediating surface soils, and 2) the fact that no source materials constituting principal threats will be addressed within the scope of this action.

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 (UU/UE), a statutory review will be conducted within 5 years of initiation of the remedial action and every 5 years thereafter to ensure that the Selected Remedy is, or will be, protective of human health and the environment.

Human health and ecological risk assessments were conducted using CERCLA risk assessment methods and guidance. Accordingly, and based on the provisions of 40 CFR § 761.61 (c), EPA has determined that the risk-based RGs for PCBs in soil at DU 1-2 and DU 1-3 will meet the no unreasonable risk standard in accordance with § 761.61 (c) through the removal and off-site disposal of all PCB-contaminated soil exceeding the Ecological and Industrial RGs; the implementation of LUCs at DU 1-2 and DU 1-3 to restrict residential and other unrestricted use of remaining areas with PCB-contaminated soil above the Residential RG and prevent exposure to soil beneath existing transformer vault foundations through maintenance of the transformer vault foundations, since that soil has not been assessed; and if the transformer vaults are demolished in the future, the assessment of the underlying soils and remediation, if needed, to meet the Ecological and Industrial RGs. If and when TV2 and/or TV3 are demolished in the future, the demolition will meet TSCA protectiveness standards so as not to create a threat of release to the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

Table 1-1 summarizes the locations of information required to be included in the ROD, as presented in Section 2.0 – Decision Summary and Appendix B (Cost Estimates). Additional information can be found in the Administrative Record file for NAVSTA Newport, available online at http://go.usa.gov/DyNw (then click Administrative Records).

TABLE 1-1. ROD DATA CERTIFICATION CHECKLIST	
DATA	**LOCATION IN ROD**
Chemicals of concern (COCs) and their respective concentrations	Sections 2.7, 2.9, 2.10
Baseline risk represented by the COCs	Section 2.9
Remediation goals established for COCs and the basis for these levels	Section 2.9 and 2.10
How source materials constituting principal threats are addressed	Section 2.13
Current and reasonably anticipated future land use assumptions used in the risk assessment	Section 2.8
Potential land uses that will be available at the site as a result of the Selected Remedy	Section 2.14.4
Estimated capital, operation/operating and maintenance (O&M), and total present value (PV) costs; discount rate; and number of years over which the remedy costs are projected	Section 2.14.3 and Appendix B
Key factors that led to the selection of the remedy	Section 2.14.1

If contamination posing an unacceptable risk to human health or the environment is discovered after execution of this ROD and is shown to be the result of Navy activities, the Navy will undertake the necessary actions to ensure continued protection of human health and the environment.

1.7 AUTHORIZING SIGNATURES

1.7.1 Navy Signature

The signature provided below validates the Selected Remedy for DUs 1-1, 1-2 and 1-3 at Site 7 – Tank Farm 1 (OU 13), located at NAVSTA Newport in Portsmouth, 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:

D.R.D Boyer
Captain, U.S. Navy
Commanding Officer
Naval Station Newport, Rhode Island

10 Aug 2016
Date

1.7.2 EPA Region 1 Signature

The signature provided below validates the Selected Remedy for DUs 1-1, 1-2 and 1-3 at Site 7 – Tank Farm 1 (OU 13), located at NAVSTA Newport in Portsmouth, Rhode Island, by the Navy and EPA. RIDEM concurs with the Selected Remedy, as indicated in Appendix A of this ROD.

Human health and ecological risk assessments were conducted using CERCLA risk assessment methods and guidance. Accordingly, and based on the provisions of 40 CFR § 761.61 (c), EPA has determined that the risk-based RGs for PCBs in soil at DU 1-2 and DU 1-3 will meet the no unreasonable risk standard in accordance with § 761.61 (c) through the removal and off-site disposal of all PCB-contaminated soil exceeding the Ecological and Industrial RGs; the implementation of LUCs at DU 1-2 and DU 1-3 to restrict residential and other unrestricted use of remaining areas with PCB-contaminated soil above the Residential RG and prevent exposure to soil beneath existing transformer vault foundations through maintenance of the transformer vault foundations, since that soil has not been assessed; and if the transformer vaults are demolished in the future, the assessment of the underlying soils and remediation, if needed, to meet the Ecological and Industrial RGs. If and when TV2 and/or TV3 are demolished in the future, the demolition will meet TSCA protectiveness standards so as not to create a threat of release to the environment.

Concur and recommend for implementation:

9/21/16

Bryan Olson
Director, Office of Site Remediation and Restoration
United States Environmental Protection Agency Region 1 – New England

Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

NAVSTA Newport is located approximately 25 miles south of Providence, Rhode Island, primarily on Aquidneck Island. The facility occupies approximately 1,000 acres, with portions of the facility located in the City of Newport and the Towns of Middletown, Portsmouth, and Jamestown, Rhode Island. The majority of the facility layout follows the western shoreline of Aquidneck Island for nearly 6 miles, facing the eastern passage of Narragansett Bay (Figure 1). The major commands currently located at NAVSTA Newport include the NETC, Surface Warfare Officers School (SWOS) Command, Naval Undersea Warfare Center (NUWC), and Naval War College. Research, development, and training are the primary activities at NAVSTA Newport.

Tank Farm 1 is an approximately 50-acre former fuel storage and distribution area that is located in the northern portion of the NAVSTA Newport facility within close proximity to Narragansett Bay (Figure 1). Tank Farm 1 is located in the Melville section of Portsmouth, Rhode Island. Tank Farm 1 consists of two 2.56-million gallon partial aboveground storage tanks (ASTs) (Tanks 9 and 10), six 1.12-million gallon capacity underground storage tanks (USTs) (Tanks 13 through 18), the EBP, and associated support utilities (including transformer vaults), roadways, and piping systems (Figure 2). Two 2.35-million gallon ASTs (Tanks 11 and 12) were decommissioned and dismantled in 2012. Underground petroleum distribution piping connects the USTs to the former Fuel Loading Area, located approximately 1,000 feet to the northwest of Tank Farm 1. Tank Farm 1 is bordered by railroad tracks and the former Fuel Loading Area to the west, Melville Pond to the north, the Melville Public Fishing and Camping Area to the north and east, an electrical substation to the southeast, and vacant Navy land to the south. Tank Farm 2 is located approximately 200 feet to the southeast of the site.

DU 1-1, which is defined as soil associated with the EBP (includes the EBP and associated previously designated AOCs TF1-004, TF1-005, and TF1-018), is an approximately 0.5-acre area in the southeast portion of Tank Farm 1 that is surrounded by Tanks 17 and 18 to the north, Tanks 9 and 10 to the west, a wooded area and Pump house 49 to the south, and a forested area to the east. DU 1-2 and DU 1-3, which each are approximately 0.014 acres, are located in the central portion of Tank Farm 1. DU 1-2, which is defined as soil associated with Transformer Vault 2 (TV2), is located southeast of Tank 16 and DU 1-3, which is defined as soil associated with Transformer Vault 3 (TV3), is located southwest of Tank 13.

Tank Farm 1 is enclosed along the perimeter with a security fence that restricts public access. The site has been inactive since the termination of Defense Logistics Agency (DLA) Energy fuel storage and distribution operations in 1998, aside from the occasional environmental-related activity performed by Navy and DLA Energy contractors and general non-recurrent landscaping activities. Tank Farm 1 is also used by Department of Defense (DoD) personnel for deer hunting during portions of the year.

Contaminants in soil were identified during past environmental assessments at DUs 1-1, 1-2, and 1-3 and were attributed to previous activities within each area. Contaminants in soil at DU 1-1 are likely attributable to former operations at the EBP, such as engine idling, operation of the heating system at the plant, use of lubricants, etc. Contaminants in soil at DU 1-2 and DU 1-3 are attributed to historical releases of PCB-containing oils adjacent to Transformer Vaults 2 and 3.

NAVSTA Newport is an active facility, with environmental investigations and remedial efforts conducted under CERCLA and funded under the Environmental Restoration, Navy program. The Navy is conducting its Environmental Restoration 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 Navy is the lead agency for the investigation and specified cleanup of designated sites within the NAVSTA Newport property, with EPA and RIDEM providing oversight.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Previous environmental investigations designed to evaluate environmental quality at Tank Farm 1 and DUs 1-1, 1-2, and 1-3 are summarized in Table 2-1. Results of these investigations indicated concentrations of contaminants in soil at DUs 1-1, 1-2, and 1-3 that exceed acceptable risk levels or state regulatory standards and background concentrations. The nature and extent of contamination identified in soil at DUs 1-1, 1-2, and 1-3 is discussed in Section 2.7.

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION

INVESTIGATION	DATE	DESCRIPTION
Initial Assessment Study (IAS)	1983	The facility-wide IAS concluded that bottom sludge from the tanks was disposed in pits and contaminated with tetraethyl lead and that groundwater and Narragansett Bay could be impacted from contaminant migration. Tank Farm 1 was recommended for further investigation.
Confirmation Study (CS)	1986	The CS concluded that the results of the studies at Tank Farm 1 indicate that some light petroleum products have entered the groundwater, but not from previous waste disposal practices. Consequently, the site does not require further study, investigation, or remedial action under the Navy Assessment and Control of Installation Pollutants (NACIP) Program.
National Priorities List (NPL) listing	1989	NAVSTA Newport (NETC at the time) was added to the National Priorities List.
Background Soil Investigation	2008	The Basewide Background Soil Investigation was conducted to provide a background data set for comparisons to soil and sediment data collected from all sites at NAVSTA Newport. The objective of the investigation was to identify levels of inorganics expected to be present had the various Navy activities not occurred. Both naturally occurring and anthropogenic metals were included in the study. Surface and subsurface soil samples were collected at off-site locations and included representative soil types mapped by the United States Department of Agriculture Natural Resources Conservation Service.
Site Investigation (SI)	2010	A Site Investigation was performed under RIDEM regulations to address the former storage tanks, distribution piping network, and releases of stored fuels. Soil samples were collected around the EBP via test pits and the samples were field screened for petroleum with laboratory analysis for total petroleum hydrocarbons (TPH) and gasoline related constituents. At the Transformer Vaults, soil samples were collected and analyzed for PCBs. Relevant data was included in the Data Gaps Assessment described below.

TABLE 2-1. PREVIOUS INVESTIGATIONS AND SITE DOCUMENTATION		
INVESTIGATION	**DATE**	**DESCRIPTION**
Data Gaps Assessment (DGA)	2012-2013	A DGA was performed to refine the characterization of the EBP and Transformer Vaults, as well as quantify potential risks posed by site contamination. The DGA Report contained a **Human Health Risk Screening Evaluation (HHRSE)**, and an **Ecological Risk Assessment (ERA)**, and completed the remedial investigation phase of CERCLA. At the EBP, the DGA Report determined that there is predicted human health risk above the USEPA target risk range for surface soil under a potential residential or other unrestricted use of the site. The DGA report also concluded that the localized areas associated with the maximum Aroclor-1260 concentrations at TV2 and TV3 should be further addressed to protect insectivorous receptors in the future if soil is spread over a larger area because of site activities.
Feasibility Study (FS)	2015	The FS identified preliminary remediation goals (PRGs), screened potential remedial technologies, and developed and evaluated remedial alternatives for DUs 1-1, 1-2, and 1-3 based on information from previous investigations. In the FS, DU 1-1 is defined as soil associated with the EBP (and associated with previously designated AOCs TF1-004, TF1-005, and TF1-018). DU 1-2 is defined as soil associated with TV2 and DU 1-3 is defined as soil associated with TV3. The final FS presented four remedial alternatives to address contamination in soil at DUs 1-1, 1-2, and 1-3.

Additional information is provided in the Detailed Administrative Record Reference Table included before the appendices at the end of this ROD.

There have been no past or pending enforcement actions pertaining to the cleanup of DUs 1-1, 1-2, and 1-3 at Site 7 – Tank Farm 1 (OU13).

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 through the Web page at http://go.usa.gov/DyNw).

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, and RIDEM and members of the local community. The RAB has met frequently since its inception and now meets bi-monthly. Site 7 – Tank Farm 1 (OU13) 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, located within the online information repository referenced above and in information repositories in the Middletown, Portsmouth, Jamestown, and Newport public libraries. For additional information about the Installation Restoration (IR) Program at NAVSTA Newport, contact Ms. Lisa Rama, Public Affairs Office, 690 Peary Street, NAVSTA Newport, Newport, Rhode Island, 02841 (lisa.rama@navy.mil).

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from May 5, 2016 to June 4, 2016, for the proposed remedial action described in the Proposed Plan for OU13 at Site 7. A public meeting to present the Proposed Plan was held on May 18, 2016, at the Courtyard Marriott, 9 Commerce Drive, Middletown, Rhode Island. A **public notice** of the meeting and availability of documents was published in the Newport Daily News on May 2, 2016. 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 is provided in Appendix E. Three comments were received during the public hearing, and no written comments were received during the 30-day comment period. The Navy's Responsiveness Summary is presented in Section 3.0 of this ROD.

2.4 SCOPE AND ROLE OF OPERABLE UNIT

Site 7 – Tank Farm 1 (OU13) 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 IRP sites have been identified at NAVSTA Newport, including McAllister Point Landfill (Site 1), Coddington Cove Rubble Fill Area (Site 4), Tank Farm 1 (Site 7), Naval Undersea Systems Center (NUSC) Disposal Area (Site 8), Old Fire Fighting Training Area (OFFTA) (Site 9), Tank Farm 2 (Site 10), Tank Farm 3 (Site 11), Tank Farm 4 (Site 12), Tank Farm 5 (Site 13), Former Building 32 at Gould Island (Site 17), Derecktor Shipyard – On-Shore and Off-Shore (Site 19), Surface Warfare Officers School (SWOS) (Site 20), Melville Water Tower (Site 21), Carr Point Storage Area (Site 22), and Coddington Point Debris Sites (Site 23). Each site progresses through the cleanup process independently, and the Selected Remedy for DUs 1-1, 1-2, and 1-3 at Site 7 – Tank Farm 1 (OU13) is not expected to have an impact on the strategy or progress of cleanup for the other sites at NAVSTA Newport.

An Initial Assessment Study completed in 1983, identified 18 sites, including Site 7 - Tank Farm 1, where contamination was suspected to pose a threat to human health and the environment (EEI, 1983). Six of the 18 sites, including Site 7 – Tank Farm 1, were investigated further in a CS completed in 1986. A Remedial Investigation (RI) completed in 1992 included McAllister Point Landfill (Site 1), Melville North Landfill (Site 2), OFFTA (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 as part of both the IAS and CS, and Tank Farm 5 was investigated during the IAS.

RODs have been signed for the McAllister Point Landfill (Site 1) and OFFTA (Site 9), the portion of Tank Farm 5 (Site 13) where Tanks 53 and 56 were located, the disposal areas of Tank Farms 4 and 5 (Sites 12 and 13), the Former Building 32 at Gould Island (Site 17), Derecktor Shipyard Off-Shore (OU5) and On-Shore (OU12) (Site 19), and the NUSC Disposal Area Site (Site 8). The SWOS site (Site 20) was originally identified as a separate site, but was added to the OFFTA site (Site 9) when it was discovered that subsurface soil contamination at the sites was similar and contiguous. The Melville Water Tower (Site 21) was addressed through a non-time-critical removal action (NTCRA). Five additional sites are also being investigated under the IR Program: Tank Farm 2 (Site 10); Tank Farm 3 (Site 11); Coddington Cove Rubble Fill Area (Site 4); Carr Point Storage Area (Site 22), and Coddington Point Debris Sites (Site 23). Another site, Carr Point Shooting Range, is being investigated as Site 1 under the Munitions Response Program (MRP).

As part of the CERCLA process, a DGA was completed for DUs 1-1, DU 1-2, and DU 1-3, which are currently the only areas within Tank Farm 1 that contain known CERCLA releases and require assessment under the CERCLA process (Tetra Tech, 2014). The DGA Report concluded that no surface water bodies are close enough to the EBP or Transformer Vaults 2 and 3 to be impacted. Groundwater was also sampled in the vicinity of the EBP as part of the DGA investigation and the analytical results indicated that no action was required for groundwater associated with releases from the EBP. However, the Navy is deferring a decision concerning sitewide groundwater until response actions are completed at the other (non-CERCLA) AOCs within the tank farm and a determination is made as to whether groundwater impacts associated with CERCLA releases have been addressed.

RIDEM identified additional petroleum-related AOCs as requiring investigation under RIDEM regulations. After investigation and/or response actions are completed for those AOCs, the Navy will subsequently evaluate the results from that work, and coordinate with EPA and RIDEM to assess whether actions are required to address remaining contamination in accordance with CERCLA or state regulations. If a CERCLA regulatory decision is required for those AOCs, a future CERCLA decision document will be issued.

The Defense Logistics Agency (DLA) is conducting closure activities for these tanks in accordance with RIDEM UST regulations. DLA's closure activities are currently anticipated to include soil remediation in the vicinity of certain tanks, followed by permanent closure of the USTs that are no longer being used in accordance with RIDEM UST and remediation regulations. Permanent closure would include demolition of the USTs, removal of fuel distribution piping and associated structures (assumed to include the EBP, TV2, and TV3), backfill, and seeding.

2.5 PHYSICAL CHARACTERISTICS

A brief discussion of the physical characteristics of the site is provided below based on information provided in the DGA Report (Tetra Tech, 2014).

The Tank Farm 1 site is located on the southeastern end of the Narragansett Basin over the Rhode Island formation. This is comprised mostly of non-marine sedimentary rocks from the Pennsylvanian age including conglomerate, sandstone, schist, carbonaceous schist, phyllite, and graphite. Overburden material at Tank Farm 1 is a glacial till comprised of silt, sand, and gravel. Bedrock is seen from surface grade to 15 feet bgs and is primarily weathered and/or metamorphosed shale. At DU 1-1, much of the overburden consists of topsoil directly above shallow bedrock. The underlying bedrock consists of phyllite seen at depths ranging from surface grade to approximately 6 feet bgs.

Groundwater at Tank Farm 1 is primarily in the bedrock. Groundwater flow follows the topographic changes in elevation and flows from the southeast towards the northwest. In the four monitoring wells located in DU 1-1, depth to groundwater ranged from approximately 36 feet to 59 feet below the ground surface during the DGA field investigation.

The nearest body of surface water is Melville Pond, which is located about 50 to 100 feet north of the northern boundary of Tank Farm 1 (see Figure 2). The pond is classified by RIDEM as a Class A surface water body, which means it can be used as a drinking water supply. Narragansett Bay is located approximately 600 feet to the west and 800 feet to the northwest of the western boundary of Tank Farm 1. The northwest portion of the bay is classified as Class SA salt water body while the western portion of the bay has an SC classification. Class SA salt water bodies are suitable for bathing and shellfish harvesting and Class SC salt water bodies are suitable for fish and shellfish habitats, but not suitable for bathing or shellfish harvesting. No federal or state jurisdictional wetlands are present within the Tank Farm 1 boundary. Additionally, the Tank Farm 1 site is not located within the 100-year or 500-year flood zone.

2.6 CONCEPTUAL SITE MODEL (CSM)

The conceptual site model for DUs 1-1, 1-2, and 1-3 is presented in this section.

Within DU 1-1, the historical use of the EBP building was to mix aviation gasoline with an anti-knock component called ethyl fluid. While site investigation results did not indicate releases of ethyl fluid, elevated concentrations of PAHs were detected in surface soil (and to a lesser extent subsurface soil) around the EBP building and are likely attributable to former operations at the EBP, such as engine idling, operation of the heating system at the plant, use of lubricants, etc. While TPH was detected in soil, concentrations were low and did not exceed RIDEM criteria. Metals detections were widespread across the sample locations, did not show a pattern of increased concentration with proximity to the EBP building, and exhibited no apparent spatial trends. The maximum concentrations for those metals that were identified as COCs (arsenic, chromium, and manganese) were not highly elevated above calculated background levels in soil (See Section 2.7). Therefore, it is concluded that metals were not likely the result of any localized spill or any other types of releases that might have occurred during former operations at DU 1-1. However, higher concentrations of these metals seen in a small number of sample locations exceed CERCLA cleanup standards.

AOCs TF1-004, TF1-005, and TF1-018, which were located in the vicinity of DU 1-1, were identified during an analysis of historical aerial photographs. AOC TF1-004 appeared to be a pipe scar or ditch leading away from the EBP to a shallow depression. AOC TF1-005 appeared to be a depression containing light-toned material or objects. The third AOC, TF1-018, appeared to be a pit containing light-toned material of liquid adjacent to AOC TF1-005. Visual observations made during the previous field investigations did not discern any surface features indicating the presence of the three historical AOCs.

Within DU 1-2 and DU 1-3, the presence of PCB Aroclors in surface soil immediately adjacent to transformers at TV2 and TV3, respectively, indicates that historical releases of PCB containing oils have occurred.

For each DU, the primary source medium for exposure is surface soil; however, contamination in surface soil could potentially migrate into subsurface soil and groundwater through infiltration. While PAHs and metals were detected in subsurface soils at DU 1-1, the concentrations do not require action.

Current site usage is industrial/commercial with some limited recreational use (hunters). Other current or reasonably foreseeable future receptors include construction workers and trespassers. The Tank Farm 1 site has been identified as excess property by the Navy and is currently undergoing the DoD Base Realignment and Closure (BRAC) process. Future use plans for Tank Farm 1, including DUs 1-1, 1-2, and 1-3, have not been finalized (Tetra Tech, 2014); however, there is no current or planned residential or unrestricted recreational use of the site. Although there is no current or planned residential or unrestricted recreational use of the site; these uses were also evaluated to provide a basis for the need for a cleanup action. Terrestrial biota were evaluated as ecological receptors.

2.7 NATURE AND EXTENT AND FATE AND TRANSPORT OF CONTAMINATION

Past operations at Site 7 – Tank Farm 1 were found to have resulted in the release of contaminants to surface soil within DUs 1-1, 1-2, and 1-3. Subsurface soil was evaluated and COCs were not identified and therefore, no remediation is proposed for subsurface soils. Groundwater was also evaluated, but is not discussed here because that medium is not addressed by this ROD. Chemicals of Potential Concern (COPCs) were identified as part of the HHRSE and ERA presented in the DGA report. COCs were determined after the risk assessment process, as further discussed in Section 2.9.1.1 of this document. A summary of sample results for the DUs 1-1, 1-2, and 1-3 COCs is presented in Table 2-2. The estimated extents of COCs exceeding remediation goals in surface soil at DUs 1-1, 1-2, and 1-3 are presented on Figures 3 through 5, respectively. The nature and extent of contamination described in this section is focused on the media and contaminants addressed by the Selected Remedy. For a full description of the nature and extent of contamination in all media, refer to the DGA report (Tetra Tech, 2014).

TABLE 2-2. SUMMARY OF MAXIMUM CONCENTRATIONS OF COCS

	MAX CONC (MG/KG)	FOD
DU1-1 Surface Soil		
Benzo(a)anthracene	8.1	30/32
Benzo(a)pyrene	6	32/32
Benzo(b)fluoranthene	8.8	31/32
Benzo(g,h,i)perylene	2.8	29/32
Benzo(k)fluoranthene	3.9	28/32
Chrysene	9.1	30/32
Dibenzo(a,h)anthracene	0.96	27/32
Fluoranthene	23	32/32
Indeno(1,2,3-cd)pyrene	4.8	29/32
Naphthalene	2	22/32
Pyrene	14	31/32
Arsenic	20.7	32/32
Chromium	24.3	32/32
Manganese	575	32/32
DU1-2 Surface Soil		
PCBs (total Aroclors)	24	6/12
DU1-3 Surface Soil		
PCBs (total Aroclors)	4.3	8/9

Notes:
Max Conc – Maximum Concentration
FOD – Frequency of Detection
mg/kg – milligrams per kilogram

2.7.1 Nature, Extent, Fate, and Transport of Contamination in Soil at DU 1-1

The locations of soil borings in the vicinity of DU 1-1 are shown on Figure 3. During the DGA, a total of 32 surface soil samples and 24 subsurface samples were taken from 29 soil borings in DU 1-1, including the areas referred to in the DGA Report as AOCs TF1-004, TF1-005, and TF1-018. Surface and subsurface soil samples were analyzed for volatile organic compounds (VOCs), ethylene dibromide (EDB), 1,2-dibromo-3-chloropropane (DBCP), semi-volatile organic compounds/polycyclic aromatic hydrocarbons (SVOC/PAHs), total metals, gasoline-range organics (GRO), and total petroleum hydrocarbons (TPH). Soil results were compared to EPA Regional Screening Levels (RSLs) and to background concentrations. TPH, which is not regulated under CERCLA, was compared to the RIDEM Residential Direct Exposure Criteria and there were no exceedances. PAHs and metals were the primary analyte groups detected and subsequently identified as COPCs. The full data set is provided in the DGA report (Tetra Tech, 2014).

Of the SVOCs detected in surface soil, the PAH compounds were detected at the highest concentrations and in the greatest number of samples (roughly two-thirds to all of the surface soil samples). Six PAHs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene, were detected at concentrations greater than their respective RSLs in surface soil.

Metals were detected in all surface soil samples. Background concentrations have been established for metals in soils at NAVSTA Newport based on soil type in an EPA-approved Basewide Background Study (Tetra Tech, 2008). Concentrations of metals in a soil type mapped by the United States Department of Agriculture within DU 1-1 prior to development of Tank Farm 1 were considered as potential background conditions for site soil. The background concentrations for arsenic (14 mg/kg), chromium (18 mg/kg), and manganese (261 mg/kg) in soil were calculated as 95-percent upper predictive limit (UPL) values for the selected data set based on soil type. The background comparison concluded that DU 1-1 surface soil concentrations of arsenic, chromium, and manganese were statistically greater than background concentrations. Arsenic, chromium, and manganese in surface soil were detected at concentrations above their respective RSLs.

The chemicals detected in subsurface soil were similar to those detected in surface soil, however, the concentrations and frequency of detection of individual PAHs and TPH were lower. Three PAHs, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene, were detected at concentrations greater than their respective RSLs in subsurface soil. Similar to surface soil, metals were detected in all subsurface soil samples. In subsurface soil, no COPCs were subsequently identified as COCs (see Section 2.9.1.4).

The distribution of selected PAHs and metals in surface and subsurface soil were plotted on figures in the DGA Report. As shown on these plots, the PAH concentrations tend to decrease with increasing distance from the EBP structure and also decrease with increasing sample depth. Because of this pattern, the DGA Report (Tetra Tech, 2014) concluded that the PAH contamination is most likely attributable to activities that occurred during former operations at the EBP. The presence of PAHs could be a result of engine idling, operation of the heating system at the plant, use of lubricants, etc. Note that elevated PAH concentrations were detected in the surface soil samples from location EBP-MW-GT-124R, which is located adjacent to an asphalt roadway and relatively far from the EBP building. These concentrations are thought to be the result of the boring's close proximity to the asphalt roadway and not the result of releases associated with the EBP. The PAHs in the soils around DU 1-1 have low volatility and low solubility. These compounds also have strong adsorptive properties, which imply that the PAHs will remain bound to the surface soils and there will be a low probability of leaching to the groundwater.

The DGA report concluded that the data does not indicate discharges or spills of tetraethyl lead (TEL) or ethyl fluid, since the primary components of that fluid (TEL, EDB, and ethylene dichloride [EDC]) were not found in quantity. Metals detections were widespread across the sample locations, did not show a pattern of increased concentration with proximity to the EBP building, and appeared to be equally dispersed throughout the area. The DGA Report concluded that metals were not likely the result of any localized spill or any other types of releases that might have occurred during former operations at the EBP (Tetra Tech, 2014). Note also that chromium speciation was not evaluated (only total chromium was analyzed); however, hexavalent chromium is not expected to be present based on the site history.

2.7.2 Nature, Extent, Fate, and Transport of Contamination in Soil at DU 1-2 and DU 1-3

The locations of soil borings in the vicinity of the TV2 and TV3 structures at DU 1-2 and DU 1-3 are shown on Figures 4 and 5, respectively. During the 2010 sampling event, one surface soil sample (0 to 0.5 ft bgs) was collected adjacent to each transformer vault and analyzed for PCBs. During the initial DGA sampling event in August 2012, soil samples were collected from the surface interval (0 to 1 feet bgs) and the subsurface (2 to 4 feet bgs). Samples were analyzed for GRO, PCBs, and TPH. During the supplemental sampling in October 2013, soil samples were collected from the surface interval (0 to 1 feet bgs) and were analyzed for PCBs only. PCB concentrations were compared to EPA RSLs. GRO and TPH results were compared to RIDEM Residential Direct Exposure Criteria and there were no exceedances. The full data set is provided in the DGA report (Tetra Tech, 2014).

At DU 1-2, Aroclor-1260, was detected in the 2010 surface soil sample and in 5 of the 11 surface soil samples collected during the DGA. The Aroclor-1260 detections were located east and north of TV2. Aroclor-1260 was detected at concentrations exceeding the RSL. Sample concentrations ranged from 180 µg/kg to 24,000 µg/kg. The concentrations of Aroclor-1260 are higher near the eastern part of the building, with the highest concentration located just outside the door. PCBs were not detected in subsurface soil at DU 1-2.

At DU 1-3, Aroclor-1260 was detected in 8 of the 9 surface soil samples collected during the 2010 sampling event and the DGA. Aroclor-1260 was detected at concentrations exceeding the RSL. Aroclor-1260 was detected at a maximum concentration of 4,300 µg/kg at SB1026. In addition, Aroclor-1254 was detected in one surface soil sample at a concentration of 380 µg/kg at SS1033. The concentrations of Aroclor-1260 are higher near the eastern part of the building, with the highest concentration located just outside the door. PCBs were not detected in subsurface soil at DU 1-3.

PCBs have a low solubility in water and have a tendency to sorb strongly to soil. As such, PCB concentrations are expected to sorb to surface soil, remain relatively immobile, and not leach to other media. This is consistent with the lack of detection of PCBs in subsurface soil. However, the highest PCB concentrations at DU 1-2 did exceed RIDEM leachability criteria. PCBs have the potential to biodegrade; however, the degradation rate is very low.

2.8 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, 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.

DUs 1-1, 1-2, and 1-3 at Site 7 – Tank Farm 1 are part of the NAVSTA Newport facility located in Portsmouth, Rhode Island. Tank Farm 1 is bordered by railroad tracks and the former Fuel Loading Area to the west, Melville Pond to the north, the Melville Public Fishing and Camping Area to the north and east, an electrical substation to the southeast, and vacant Navy land to the south. DU 1-1 is located in the southeast portion of Tank Farm 1 and DU 1-2 and DU 1-3 are located in the central portion of Tank Farm 1. The site has been inactive since the termination of DLA Energy fuel storage and distribution operations in 1998, aside from the occasional environmental-related activity performed by Navy and DLA Energy contractors and general non-recurrent landscaping activities. Tank Farm 1 is also used by DoD personnel for deer hunting during portions of the year. The Tank Farm 1 site has been identified as excess property by the Navy and is currently undergoing the DoD BRAC process. Future use plans for Tank Farm 1, including DUs 1-1, 1-2, and 1-3, have not been finalized (Tetra Tech, 2014); however, there is no current or planned residential or unrestricted recreational use of the site.

Groundwater underlying NAVSTA Newport is **not used for drinking water**. Drinking water for NAVSTA Newport and most of the residents of Newport, Portsmouth, 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. DUs 1-1, 1-2, and 1-3 are 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 DUs 1-1, 1-2, and 1-3 is downgradient of any potential or existing water sources.

RIDEM has established a state groundwater classification system to protect its groundwater resources. Site 7 – Tank Farm 1 is in **RIDEM's GB groundwater classification area**. Groundwater classified as GB may not be suitable for public or private drinking water use without treatment, due to known or presumed degradation (RIDEM, 2010). However, this classification is not recognized by EPA, because Rhode Island does not have an EPA-approved Comprehensive State Groundwater Protection Program (CSGWPP). Therefore, groundwater is federally classified as a drinking water source and, thus, the GA groundwater classification applies to the CERCLA remedial action. Groundwater classified as GA is presumed suitable for public or private drinking water use without treatment (RIDEM, 2010).

2.9 SUMMARY OF SITE RISKS

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 in Table 2-3 which assumes an unrestricted use of the site.

The baseline risk assessments estimate the site risks 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 (additional contaminants and exposure pathways may be identified based on regulatory criteria exceedances of chemicals). An HHRSE and ERA were conducted as part of the DGA Report (Tetra Tech, 2014).

2.9.1 Human Health Risk Screening Evaluation

The quantitative HHRSE was conducted using chemical concentrations detected in soil at DUs 1-1, 1-2, and 1-3 and groundwater at DU 1-1. DUs 1-1, 1-2, and 1-3 were treated as separate exposure units. Because this ROD does not address groundwater, the HHRSE for groundwater is not discussed further here. Key steps in the risk assessment process included identification of COPCs, exposure assessment, toxicity assessment, and risk characterization. A table summarizing data used in the HHRA and the associated results for primary risk drivers and pathways (i.e. residential exposures to surface soil at DU 1-1 for certain PAHs and metals) is included in Appendix C. Data and results for receptors, exposure pathways, and exposure units that were not risk drivers can be found in the DGA Report (Tetra Tech, 2014).

2.9.2 Identification of COPCs

The available validated data collected during the field investigations were used to identify COPCs for DU 1-1, DU 1-2, and DU 1-3. The USEPA RSLs for residential soil (November 2013) were used to select COPCs for surface soil and subsurface soil. Maximum chemical concentrations in soil were also compared to USEPA risk-based soil screening levels (SSLs) for protection of groundwater. Data was further screened against background concentrations for metals in soil that were established based on soil type in a EPA-approved Basewide Background Study (Tetra Tech, 2008). If a chemical concentration in soil did not exceed the background concentration, that chemical was not selected as a COPC.

Table 1 in Appendix C presents exposure point concentrations (EPCs) for the **COPCs identified** during the HHRSE for residential exposures to surface soil at DU 1-1. 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 Tank Farm 1 DU 1-1, DU 1-2, and DU 1-3 COPCs during the HHRSE:

- 95-percent upper confidence limits (UCLs) on the arithmetic mean, which are based on the distribution of each data set, were selected as the EPCs. EPCs were calculated following EPA's Calculating UCLs for EPCs at Hazardous Waste Sites and using EPA's ProUCL software Version 5.0.00 (USEPA, 2002 and 2013).

- 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 Tank Farm 1. In calculating averages, if a chemical was detected in only one sample of a duplicate pair, the average was calculated using the detected value and one-half of the detection limit.

2.9.3 Exposure Assessment

During the **exposure assessment** step of the HHRSE, 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 DU 1-1, DU 1-2, and DU 1-3 were used to refine the CSM. Surface soil and subsurface soil were identified as the media for evaluation. The evaluated potential exposure routes included dermal contact with soil, ingestion of soil, and inhalation of fugitive dust. The HHRSE 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 are summarized in Table 2-3. Potential exposures associated with current restricted recreational use of the property by hunters (restricted by season and selected by lottery) were assumed to be similar to exposures associated with industrial use. Exposure assumptions and other supporting information used in the HHRSE are presented in Appendix C and the DGA Report.

TABLE 2-3. RECEPTORS AND EXPOSURE ROUTES IDENTIFIED IN HHRSE

RECEPTOR	EXPOSURE ROUTE
Construction Workers (future land use)	Soil incidental ingestion Soil dermal contact Inhalation of fugitive dust
Industrial Workers [1] (and restricted recreational use – hunting by lottery selection) (current and future land use)	Soil incidental ingestion Soil dermal contact Inhalation of fugitive dust
Adolescent Trespassers (current and future land use)	Soil incidental ingestion Soil dermal contact Inhalation of fugitive dust
Residents (Adults/Children) [1] (hypothetical future land use) (hypothetical future land use)	Soil incidental ingestion Soil dermal contact Inhalation of fugitive dust
Adolescent Trespassers (current and future land use)	Soil incidental ingestion Soil dermal contact Inhalation of fugitive dust

Note:

Risks were quantitatively estimated as summarized in Section 2.9.1.4 for residential and industrial receptors.

2.9.4 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 primary risk drivers (i.e., COCs) are included in Appendix C. Toxicity data for other COPCs evaluated in the HHRSE are in the DGA Report.

2.9.5 Risk Characterization

During the risk characterization, cancer risks and hazard indices were estimated for those chemicals identified as COPCs in order to present some perspective on the magnitude of exceedances of the screening criteria. Non-carcinogenic risk estimates are presented in the form of Hazard Quotients (HQs). The HQ was derived by dividing the non-carcinogenic risk-based concentration (RBC) for a particular medium (e.g., soil) into the EPC. The USEPA RSLs were used as the RBCs in this evaluation. Compounds potentially resulting in non-carcinogenic (systemic) effects were evaluated using the following equations:

$$HQ_i = \frac{C_i}{RBC}$$

$$HI = \sum_{i=1}^{n} HQ_i$$

where: HQ_i = Hazard quotient for compound i.

C_i = Exposure point concentration (mg/kg) for compound i.

RBC = Risk-based concentration (mg/kg) for compound i.

HI = Hazard index.

The HQs for all COPCs were summed to account for potential non-carcinogenic effects associated with multiple chemical exposures (i.e., the HI was calculated). The total HI was then compared to the USEPA's target level of 1. "Acceptable" exposure levels are generally concentration levels that represent a HI less than or equal to 1. However, because all chemicals do not exhibit the same mechanism of action or impact the same target organ, the exceedance of this value does not necessarily constitute an "unacceptable" non-carcinogenic risk. If the estimated HI was greater than 1, non-carcinogenic effects were segregated according to the affected target organs and target organ HIs were calculated, which represent the sum of those chemicals that impact similar target organs or exhibit similar mechanisms of action. Generally, estimated HIs greater than 1 for the same target organs are considered to be "unacceptable."

Carcinogenic risks are expressed in the form of dimensionless probabilities, referred to as Incremental Lifetime Cancer Risks (ILCRs). The ILCR was derived by dividing the carcinogenic RBC for a particular medium (e.g., soil) into the exposure point concentration. COPCs potentially resulting in carcinogenic effects were evaluated using the following equation:

$$ILCR = \sum_{i=1}^{n}\left(\frac{C_i}{RBC_i} \times 10^{-6}\right)$$

where: ILCR = Incremental lifetime cancer risk.

C_i = Exposure point concentration (mg/kg) for compound i.

RBC = Risk-based concentration (mg/kg) for compound i.

10^{-6} = Risk assessment point of departure risk level.

Multiplying the C_i/RBC ratio by USEPA's point of departure risk level, $1x10^{-6}$, produces a cancer risk estimate for the detected COPC. The ratios are multiplied by $1x10^{-6}$ because the RBCs correspond to a $1x10^{-6}$ risk level. The ILCR values for all COPCs were summed to account for potential cumulative carcinogenic effects of multiple carcinogens detected in an environmental medium. The total ILCR was then compared to USEPA's target cancer risk range of 10^{-4} to 10^{-6}, which is used to determine whether a potential for human health risk exists at a site. According to the USEPA, for known or suspected carcinogens, "acceptable" exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk between 10^{-4} to 10^{-6} or less than $1x10^{-6}$. A $1x10^{-4}$ ILCR estimate corresponds to the potential for the occurrence of one additional incidence of cancer in an exposed population of 10,000 individuals. Generally (but not always), an estimated ILCR greater than $1x10^{-4}$ is regarded as "unacceptable."

Some chemicals exhibit both carcinogenic and noncarcinogenic effects. The more restrictive USEPA RSL was used for selecting COPCs but both carcinogenic and noncarcinogenic risks were estimated. Cancer risks and hazard indices were estimated assuming industrial and hypothetical residential land use.

The estimated risks for DUs 1-1, 1-2, and 1-3 are discussed below.

DU 1-1

HIs and ILCRs for residential and industrial exposures to surface soil and subsurface soil are summarized below. Groundwater did not exceed the target level of 1.

TABLE 2-4 RECEPTORS AND CALCULATED RISK EXCEEDANCES IN THE HHRSE AT DU 1-1

MEDIA	RESIDENTIAL		INDUSTRIAL	
	HI	ILCR	HI	ILCR
Surface Soil	1	$2x10^{-4}$	0.1	$2x10^{-5}$
Subsurface Soil	1	$7x10^{-5}$	0.08	$7x10^{-6}$

HIs for residential exposures to surface soil and subsurface soil were less than or equal to 1. The ILCR for residential exposure to surface soil exceeded USEPA's target risk range of 10^{-4} to 10^{-6}. Carcinogenic PAHs, arsenic, and chromium were the major contributors to the ILCR for residential exposures to surface soil, and the data contributing to the ILCR is a statistically derived concentration from all the DU 1-1 surface soil data. The ILCR for residential exposure to subsurface soil was within USEPA's target risk range.

DU 1-2

No noncarcinogenic toxicity criteria are available for the identified COPCs in surface soil, therefore HIs could not be estimated for exposures to surface soil. The ILCR for residential exposures ($1x10^{-4}$) to surface soil was at the upper bound of USEPA's target risk range. The ILCR for industrial exposures ($3x10^{-5}$) to surface soil at DU 1-2 was within USEPA's target risk range. No COPCs were identified for exposures to subsurface soil, consequently risks were not calculated.

DU 1-3

HIs for residential (HI = 0.3) and industrial (HI = 0.03) exposures to surface soil were less than the target level of 1. ILCRs for residential ($1x10^{-5}$) and industrial ($3x10^{-6}$) exposures to surface soil at DU 1-3 were within USEPA's target risk range. No COPCs were identified for exposures to subsurface soil, consequently risks were not calculated.

2.9.6 Summary of Human Health Risks

A HHRSE was conducted for the DU 1-1, 1-2, and 1-3 at Tank Farm 1 at NAVSTA Newport. The main purpose of the HHRSE was to identify chemicals detected at concentrations exceeding human health screening criteria based on USEPA RSLs, and background levels. In order to present some perspective on the magnitude of exceedances of the screening criteria, cancer and non-cancer risk estimates were calculated based on development of ratios of EPCs of COPCs in surface soil and subsurface soil to the RSLs for residential and industrial soil exposures.

DU 1-1

At DU 1-1, noncancer risk estimates (HIs) developed on a target organ basis for residential exposures to surface soil and subsurface soil did not exceed the target level of 1. Cancer risks for residents exposed to surface soil exceeded USEPA's target risk range. Carcinogenic PAHs, arsenic, and chromium were the major contributors to the ILCR for residential exposures to surface soil. Cancer risks for residential exposures to subsurface soil and industrial exposures to surface soil and subsurface soil were less than or within USEPA's target risk range.

DU 1-2 and DU 1-3

No noncarcinogenic toxicity criteria are available for the identified COPCs in surface soil at DU 1-2; therefore HIs could not be estimated for exposures to surface soil. HIs for residential and industrial exposures to surface soil at DU 1-3 were less than the target level of 1. Cancer risks for residential exposures to surface soil at DU 1-2 were at the upper bound of USEPA's target risk range. Cancer risks for residential exposures to surface soil at DU 1-3 and industrial exposures to surface soil at DU 1-2 and DU 1-3 were within USEPA's target risk range. No COPCs were identified for exposures to subsurface soil, consequently risks were not calculated.

2.9.7 Ecological Risk

An ERA was conducted to determine whether adverse ecological impacts are potentially occurring from exposure to chemicals released to the environment through historical activities at DUs 1-1, 1-2, and 1-3 at Tank Farm 1, Site 7 at NAVSTA Newport. The evaluation was based on data collected during the DGA and previous Site Investigation (Shaw, 2010). The Ecological Risk Assessment consisted of Steps 1, 2, and 3a of the eight-steps process, consistent with EPA and Navy guidance. The first two steps (Steps 1 and 2) consisted of the baseline ecological risk assessment (BERA). The third step (Step 3a) was the first step of the baseline ecological risk assessment (BERA), and consisted of refining general parameters used in the SLERA to be more site-specific with the goal of reaching a Scientific Management Decision Point (SMDP).

DU 1-1

Based on the initial screening of the chemical data, several chemicals (5 VOCs, 20 SVOCs, 10 metals, and 2 petroleum hydrocarbons) were initially selected as COPCs in surface soil because they were detected at concentrations that exceeded conservative screening levels, they had Ecological Effects Quotients (EEQs) greater than 1.0 in the conservative food chain model, or because they did not have screening levels. These chemicals were then further evaluated to refine the list of COPCs, and to better characterize risks to ecological receptors. At DU 1-1, no chemicals were retained as COPCs for further evaluation in a BERA for the receptor groups anticipated to be present, which include terrestrial plants, soil invertebrates, mammals, or birds.

DU 1-2 and 1-3

Based on the initial screening of the chemical data, Aroclor 1260 and two petroleum hydrocarbons were initially selected as COPCs. At DU 1-2 and DU 1-3, no chemicals were retained as COPCs for further evaluation for the following receptor groups: terrestrial plants, soil invertebrates, and herbivorous wildlife. However, considering the (1) disparity between the maximum Aroclor-1260 concentrations and the rest of the data; and (2) the uncertainty associated with determining population level risks in an area that comprises a small percent of the home range, the localized areas associated with the maximum Aroclor-1260 concentrations should be addressed to protect insectivorous receptors in the future if the soil is spread over a larger area because of site activities. Therefore the recommended SMDP was to further evaluate these localized areas associated with TV2 and TV3 for the insectivorous wildlife endpoints in a FS.

2.9.8 Basis for Action

At DU 1-1, unacceptable risks to human health were identified for exposure to certain PAHs and metals in surface soil under a potential residential or other unrestricted use of the site. At DU 1-2 and 1-3, PCBs in surface soil require remediation to protect insectivorous receptors in the future if soil is spread over a larger area because of site activities. At DU 1-2 and DU 1-3, although concentrations of PCBs in surface soil did not contribute to calculated risk levels greater than the EPA target risk range, PCB levels do exceed EPA guidance risk-based PCB standards for unrestricted use.

Because unacceptable risks were identified under current and/or future use, 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. In addition, state criteria exceedances and guidance classified as "to be considered" (TBC) will be addressed by the response action.

2.10 REMEDIAL ACTION OBJECTIVES (RAOS)

RAOs consist of 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., Remediation Goals [RGs]) for a site and provide a general description of what the cleanup will accomplish. RAOs are developed to ensure compliance with ARARs and typically serve as the design basis for the remedial alternatives (see Section 2.11.)

Based on the potential pathways, receptors of concern, and current and potential future land use scenarios, the RAOs for soil at DUs 1-1, 1-2, and 1-3 are provided below.

The soil RAOs for the protection of human health at DU 1-1 are:

- Prevent exposure by industrial and restricted recreational users to soil containing site contaminants that exceed industrial use scenario RGs.
- Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario RGs.
- Prevent future migration of soil contaminants to groundwater (soil COCs above RIDEM GA Leachability Criteria).

The soil RAOs for the protection of human health and the environment at DU 1-2 and DU 1-3 are:

- Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario RGs.
- Prevent exposure by industrial and restricted recreational users to soil containing site contaminants that exceed industrial use scenario RGs.
- Prevent future migration of soil contaminants to groundwater (soil COCs above RIDEM GA Leachability Criteria).

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

For DU 1-1, chemicals associated with unacceptable human health risk (ILCR greater than 1 x 10^{-4} or HIs greater than 1) were identified as **COCs** that require remediation. No unacceptable ecological risks were identified at DU 1-1, so no ecological COCs were identified. Additional COCs were identified for DU 1-1 soil based on constituents detected above RIDEM Residential and Industrial/Commercial Direct Exposure Criteria (DEC) and/or Leachability Criteria. For DU 1-2 and DU 1-3, PCBs were identified as COCs that require remediation based on risk to ecological receptors.

PRGs were developed during the FS as target cleanup goals for remedial actions that, if met, would result in acceptable COC concentrations in soil at each DU and thereby mitigate risks to human health and the environment and/or result in concentrations below state criteria and federal guidance classified as "to be considered (TBC)" (see Appendices C and D).

For DU 1-1, cancer risks greater than 10^{-4} and/or non-cancer HIs greater than 1 were used as thresholds for each exposure pathway and land use scenario. Chemicals were not considered to be significant contributors to risk if their individual carcinogenic risk contribution was less than 1 x 10^{-6} or their non-carcinogenic HQ was less than 1. Acceptable concentrations based on risk were calculated to meet an ILCR of 1 x 10^{-6} and an HQ of 1 for carcinogens and non-carcinogens, respectively. These calculated concentrations were identified as candidate risk-based PRGs in the FS (see Appendix C). In addition, COCs were identified by comparison to RIDEM DECs and Leachability Criteria and these criteria were identified as candidate ARAR-based PRGs for these COCs. The candidate PRGs were then compared to applicable facility-specific background concentrations, if available (Tetra Tech, 2008). If the candidate PRG for a metal was less than the applicable background concentration, the PRG was revised to be equal to the background concentration.

For DU 1-2 and DU 1-3, ecological risk-based PRGs were developed to correspond to a HQ of 1. PRGs were developed for two insectivorous receptors using the geometric mean of the TRVs based on both no observed adverse effects levels (NOAELs) and lowest observed adverse effects levels (LOAELs) and the lower of the PRGs was recommended as the ecological PRG for total PCBs in soil. In addition, COCs were identified by comparison to RIDEM DECs and Leachability Criteria and an EPA residential risk-based guidance value (EPA, 1990) and these criteria were identified as candidate ARAR- and TBC-based PRGs for PCBs.

The recommended PRGs developed and presented in the FS have been retained as **Remediation Goals (RGs)** in this ROD. RGs for soil at DU 1-1 were selected for industrial and residential use scenarios and RGs for soil at DU 1-2 and DU 1-3 were selected to be protective of ecological, industrial, and residential receptors. Tables 2-5 and 2-6 (and Appendix C) summarize the COCs and respective RGs selected for remediation of soil at DU 1-1 and DUs 1-2 and 1-3, respectively. Exceedances of RGs are indicated on Figures 3, 4, and 5 for DUs 1-1, 1-2, and 1-3, respectively.

Table 2-5. Remediation Goals for Surface Soil at DU 1-1

Analyte	Selected RG (mg/kg)	Basis
Residential Use Scenario		
Benzo(a)anthracene	0.9	RDEC
Benzo(a)pyrene	0.4	RDEC
Benzo(b)fluoranthene	0.9	RDEC
Benzo(g,h,i)perylene	0.8	RDEC
Benzo(k)fluoranthene	0.9	RDEC
Chrysene	0.4	RDEC
Dibenz(a,h)anthracene	0.4	RDEC
Fluoranthene	20	RDEC
Indeno(1,2,3-cd)pyrene	0.9	RDEC
Naphthalene	0.8	Leachability
Pyrene	13	RDEC
Arsenic	14	Background
Chromium VI	18	Background
Manganese	390	RDEC
Industrial Use Scenario		
Benzo(a)anthracene	7.8	I/C DEC
Benzo(a)pyrene	0.8	I/C DEC
Benzo(b)fluoranthene	7.8	I/C DEC
Dibenz(a,h)anthracene	0.8	I/C DEC
Naphthalene	0.8	Leachability
Arsenic	14	Background

Notes:

RDEC and I/C DEC – RIDEM Remediation Regulations, DEM-DSR-01-093, November 2011, Table 1 (Residential and Industrial/Commercial Direct Exposure Criteria [DEC])

Leachability – RIDEM Remediation Regulations, DEM-DSR-01-93, November 2011, Table 2 (GA Leachability Criteria)

Background – If RIDEM criteria or risk-based PRGs were below background concentrations for the site, the background concentration was selected.

Table 2-6. Remediation Goals for Surface Soil at DU 1-2 and DU 1-3		
Analyte	Selected RG (mg/kg)	Basis
Residential Use Scenario		
PCBs	1	TSCA
Industrial Use Scenario		
PCBs	10	I/C DEC and Leachability
Ecological		
PCBs	3.4	Ecological

Notes:
TSCA – Toxic Substances Control Act; Section 761.1(c) of TSCA allows for risk-based cleanup of PCB remediation waste. EPA guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive #9355.4-01FS; EPA/540/G-90/007; August 1990) was utilized to develop the risk-based value presented.

2.11 Description of Alternatives

To address potentially unacceptable risks to human health and the environment and state criteria exceedances at DUs 1-1, 1-2, and 1-3, a **preliminary technology screening** evaluation was conducted in the FS (Resolution, 2015). General response actions were developed to satisfy the RAOs and a number of remedial technologies and process options were initially screened based on their potential effectiveness, implementability, and cost. The technologies and process options retained after the initial screening were assembled into five potential remedial alternatives for soil at DUs 1-1, 1-2, and 1-3. Consistent with the NCP, the No Action alternative was evaluated as a baseline for comparison with other alternatives during the comparative analysis (see Section 2.12). The remedial alternatives underwent an initial screening process which resulted in the elimination of Alternative S-5, which consisted of excavation and consolidation of all contaminated material from DU 1-1, 1-2, and 1-3 to one location at the site for installation of a soil cover. It did not appear advantageous to carry this Alternative through to the detailed analysis due to the costs associated with containing the consolidated soils as well as the relatively small area that would be made available for unlimited use/unrestricted exposure as a result. Table 2-7 summarizes the major components and provides estimated costs for each of the remaining four remedial alternatives developed and evaluated in detail for soil at DUs 1-1, 1-2, and 1-3. Note that subsequent to completion of the FS (Resolution, 2015), the Navy made a modification to Alternative S-2, which was documented in a **Memorandum to Site File** (Resolution, 2016). The modification has been incorporated in the alternative description and associated costs in Table 2-7.

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED			
ALTERNATIVE	**COMPONENTS**	**DETAILS**	**COST**
S-1 No Action	None	No further actions would be taken.	Capital: $0 Five Year Review: $0 O&M: $0 Total Cost: $0
S-2 – Limited Soil Excavation with Land Use Controls	Limited Soil Excavation	Pre-design sampling will be needed (and has already been planned) to delineate the extent of surface soils that exceed RGs at DUs 1-1, 1-2, and 1-3. Further sampling would also include analysis for hexavalent chromium at a few locations in DU 1-1 to potentially eliminate that contaminant as a COC. For DU 1-1, limited soil excavation and off-site disposal would remove surface soils (0 to 2 foot depth) exceeding industrial RGs (including RIDEM GA Leachability Criteria). For DU 1-2 and DU 1-3, all surface soil around the TV2 and TV3 structures with PCB concentrations exceeding the Ecological and Industrial RGs would be removed for off-site disposal. Approximately 130 cubic yards of soil would be removed from DU 1-1 and approximately 17 cubic yards of soil would be removed from DUs 1-2 and 1-3. Stormwater runoff controls will be required during excavation. Once the excavation is complete, stormwater runoff controls (such as an impermeable cover material) will not need to be implemented because the remaining contaminant concentrations would not exceed the RIDEM GA Leachability Criteria. Once all contaminated soil is removed, the areas would be re-graded and seeded. Due to the shallow depths of the excavation, it is assumed that no backfill would be needed, unless needed for drainage.	Capital: $162,521 Five Year Review: $23,307 O&M: $51,514 Total 30-Year Present Worth: $237,000
	Land Use Controls	At DU 1-1, 1-2, and 1-3, soil would remain on-site at concentrations greater than residential RGs; therefore, LUCs would be established to prevent residential and other unrestricted use and thus prevent the exposure of such receptors to COCs in surface soil at DU 1-1, 1-2, and 1-3 that remain above Residential RGs. Because there is only a thin layer of soil overlying bedrock at DU 1-1, it is likely that little to no soil is present below the EBP foundation. However, as a conservative measure, LUCs would also be required for the EBP foundation in order to prevent exposure to soil, if it exists, below the building. If the EBP structure is demolished in the future, the presence or absence of soil beneath the building can be assessed and if soil is present, it can be remediated, if necessary, to meet industrial RGs, consistent with the rest of DU 1-1. Similarly, LUCs would be required for the TV2 and TV3 structure foundations to prevent exposure to soil beneath the buildings, which has not been assessed. If TV2 and/or TV3 is demolished in the future, the soil would be assessed and remediated, if necessary, to meet the Industrial and Ecological PRGs for PCBs. LUCs would prevent disturbance of the EBP, TV2, and TV3 building foundations without approval of the Navy and regulatory agencies. LUCs would also include maintenance of the building foundations. If TV2 and/or TV3 are demolished, the demolition/disposal will meet TSCA protectiveness standards so as not to create a threat of release to the environment. Demolition of these buildings is not considered part of this alternative.	

Table 2-7. Summary Of Remedial Alternatives Evaluated			
Alternative	**Components**	**Details**	**Cost**
		In accordance with the ROD, LUCs would be monitored and enforced as long as contaminants are present above levels that allow for unrestricted use and unlimited exposure, as determined by the five-year review process. In cases where LUCs are placed to address contamination at a site, the Navy must submit an annual report to the regulatory agencies documenting that all of the restrictions are being met. The Navy is also required to take immediate action to correct any violations identified. This report must be submitted every year until such time as LUCs are no longer needed. As long as Navy retains ownership of the property, NAVSTA Newport enforces the LUCs and assures that each LUC is maintained appropriately by tracking it through a centralized tracking system. If the property is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the site's FFA, 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 that 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 and land use restrictions. 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 concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure.	
	Five Year Reviews	Five-year reviews would be conducted because contamination would remain in excess of levels that allow for UU/UE. Five-year reviews of Tank Farm 1 would be conducted as part of the facility-wide five-year review process. The next five-year review is scheduled for 2019.	
S-3 – Soil Excavation with Short-Term Land Use Controls	Soil Excavation	Pre-design sampling will be needed (and has already been planned) to delineate the extent of surface soils (0 to 2 foot depth) that exceed RGs at DUs 1-1, 1-2, and 1-3. Further sampling would also include analysis for hexavalent chromium at a few locations in DU 1-1 to potentially eliminate that contaminant as a COC. At DU 1-1, all surface soil around the EBP structure with COCs above residential and industrial RGs would be removed and disposed off-site. Approximately 400 cubic yards of soil would be excavated from DU 1-1. At DU 1-2 and DU 1-3, all surface soil around the TV2 and TV3 structures with PCBs exceeding the cleanup level would be removed for off-site disposal. Approximately 20 cubic yards of soil would be removed from DUs 1-2 and 1-3. Stormwater runoff controls will be required during excavation. Once the excavation is complete, stormwater runoff controls (such as an impermeable cover material) will not need to be implemented because the contaminant concentrations would not exceed the RIDEM GA Leachability Criteria. Once all contaminated soil is removed, the area would be re-graded and seeded. Due to the shallow depth of the excavation, it is assumed that no backfill would be needed, unless needed for drainage.	Capital: $253,646 Five Year Review: $9,284 O&M: $20,316 Total 10-Year Present Worth: $283,000

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED			
ALTERNATIVE	COMPONENTS	DETAILS	COST
	Short-term LUCs	Because there is only a thin layer of soil overlying bedrock at DU 1-1, it is likely that little to no soil is present below the EBP foundation. However, as a conservative measure, since no sampling has been performed underneath the EBP structure, short-term LUCs would likely be required until the EBP structure is demolished and the presence or absence of soil beneath the building can be assessed. Similarly, for DU 1-2 and DU 1-3, the soil beneath TV2 and TV3 has not been assessed and short-term LUCs would be required to maintain the foundations of TV2 and TV3 to prevent exposure to soil below the buildings until the building are demolished. The demolition of the buildings is not considered part of this alternative. However, when the EBP, TV2 and/or TV3 structures are demolished and the foundations removed in the future, the presence or absence of soil beneath the buildings would be assessed and, if soil is present, it would be remediated, if necessary, to meet all RGs, allowing for UU/UE at that time. Short-term LUCs would also include maintenance of the EBP, TV2, and TV3 structure foundations. Short-term LUCs would prevent disturbance of the building foundations without approval of the Navy and regulatory agencies. When TV2 and/or TV3 are demolished, the demolition/disposal will meet TSCA protectiveness standards so as not to create a threat of release to the environment. In accordance with the ROD, LUCs would be monitored and enforced as long as contaminants are present above levels that allow for unrestricted use and unlimited exposure, as determined by the five-year review process. In cases where LUCs are placed to address contamination at a site, the Navy must submit an annual report to the regulatory agencies documenting that all of the restrictions are being met. The Navy is also required to take immediate action to correct any violations identified. This report must be submitted every year until such time as LUCs are no longer needed. As long as Navy retains ownership of the property, NAVSTA Newport enforces the LUCs and assures that each LUC is maintained appropriately by tracking it through a centralized tracking system. If the property is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the site's FFA, 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 that 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 and land use restrictions. 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 concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure.	

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED			
ALTERNATIVE	COMPONENTS	DETAILS	COST
	Five Year Reviews	Five-year reviews would be conducted because contamination would remain in excess of levels that allow for UU/UE. Five-year reviews of Tank Farm 1 would be conducted as part of the facility-wide five-year review process. The next five-year review is scheduled for 2019.	
S-4 – Limited Soil Excavation with Soil Cover and Land Use Controls	Limited Soil Excavation	Pre-design sampling will be needed (and has already been planned) to delineate the extent of surface soils (0 to 2 foot depth) that exceed RGs at DUs 1-1, 1-2, and 1-3. Further sampling would also include analysis for hexavalent chromium at a few locations in DU 1-1 to potentially eliminate that contaminant as a COC. At DU 1-1, limited soil excavation would be conducted to remove soils exceeding the RIDEM GA Leachability Criteria for naphthalene for off-site disposal. At DU 1-2 and DU 1-3, all surface soil around the TV2 and TV3 structures with PCBs exceeding the cleanup level would be removed for off-site disposal. Approximately 60 cubic yards of soil would be removed from DU 1-1 and approximately 20 cubic yards of soil would be removed from DUs 1-2 and 1-3. Once all contaminated soil is removed, the DU 1-2 and DU 1-3 excavation areas would be re-graded and seeded. The DU 1-1 excavation area would be re-graded in preparation for the soil cover described below. Due to the shallow depth of the excavation, it is assumed that no backfill would be needed.	Capital: $242,127 Five Year Review: $23,307 O&M: $83,215 Total 30-Year Present Worth: $349,000
	Soil Cover	This alternative would use a clean soil cover to isolate the contaminated surface soils at DU 1-1 that exceed residential and industrial RGs based on direct exposure. A soil cover will reduce exposure risks at DU 1-1 by preventing direct contact with the contaminated soil. Since the excavations at DU 1-2 and DU 1-3 will remove all contaminated soil around the TV2 and TV3 structures exceeding the PRG, a cover is not warranted in these two areas. For purposes of the FS, the cover would consist of a two-foot layer of clean fill. Other cover options could include the use of geotextile material with less soil, or the use of pavement over gravel, for instance. Stormwater runoff controls would be required during installation of the soil cover and until the site is stabilized. Once the site is stabilized, stormwater runoff controls (such as an impermeable cover material) will not need to be implemented because the contaminant concentrations in the covered soil would not exceed the RIDEM GA Leachability Criteria. Maintenance of the cover would be required over time including mowing, shrub removal, and integrity inspections.	
	LUCs and Inspections	LUCs would be required at DU 1-1 to prevent disturbance of the soil cover. Because there is only a thin layer of soil overlying bedrock at DU 1-1, it is likely that little to no soil is present below the EBP foundation. However, as a conservative measure, LUCs would also be required for the EBP foundation to prevent access to soil below the building, if it exists. Similarly, for DU 1-2 and DU 1-3, LUCs would be required to maintain the foundations of TV2 and TV3 to prevent access to soil below the buildings. LUCs would prevent disturbance of the EBP, TV2, and TV3	

TABLE 2-7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED			
ALTERNATIVE	COMPONENTS	DETAILS	COST
		structure foundations without approval of the Navy and regulatory agencies. LUCs would also include maintenance of the EBP, TV2, and TV3 structure foundations. The demolition of the buildings is not considered part of this alternative. However, if any of the buildings are demolished in the future and the foundation is removed, if underlying soil is present, it would be assessed and remediated, if needed, to meet industrial RGs at DU 1-1 and the cleanup level for PCBs at DUs 1-2 and 1-3. If TV2 and/or TV3 are demolished, the demolition/disposal will meet TSCA protectiveness standards so as not to create a threat of release to the environment. In accordance with the ROD, LUCs would be monitored and enforced as long as contaminants are present above levels that allow for unrestricted use and unlimited exposure, as determined by the five-year review process. In cases where LUCs are placed to address contamination at a site, the Navy must submit an annual report to the regulatory agencies documenting that all of the restrictions are being met. The Navy is also required to take immediate action to correct any violations identified. This report must be submitted every year until such time as LUCs are no longer needed. As long as Navy retains ownership of the property, NAVSTA Newport enforces the LUCs and assures that each LUC is maintained appropriately by tracking it through a centralized tracking system. If the property is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the site's FFA, 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 that 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 and land use restrictions. 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 concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure.	
	Five Year Reviews	Five-year reviews would be conducted because contamination would remain in excess of levels that allow for UU/UE. Five-year reviews of Tank Farm 1 would be conducted as part of the facility-wide five-year review process. The next five-year review is scheduled for 2019.	

2.12 COMPARATIVE ANALYSIS OF ALTERNATIVES

Table 2-8 and subsequent text in this section summarize the comparison of the remedial alternatives for DUs 1-1, 1-2, and 1-3 soil against 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. Additional information on the detailed comparison of remedial alternatives is presented in the FS (Resolution, 2015). Alternative S-1 (No Action) does not meet the threshold criteria and therefore cannot be selected for a remedy.

2.12.1 Threshold Criteria

2.12.1.1 Overall Protection of Human Health and the Environment

Alternative S-3 is considered the most effective at protecting human health and the environment. Under Alternative S-3, contaminated soil is removed from DUs 1-1, 1-2, and 1-3. Under Alternative S-3, once the presence or absence of soil underneath the EBP, TV2 and TV3 structures is assessed and, if needed, remediated, all contaminants will be removed from DUs 1-1, 1-2, and 1-3; thereby, allowing unrestricted use at the site and eliminating the possibility of future exposures that exist under other alternatives. In the interim, short-term LUCs and five-year reviews, under Alternative S-3, will maintain the protectiveness of the remedy in the area under the structures, until such time that they are removed and the soil underneath assessed. Both Alternatives S-2 and S-4 require the implementation of LUCs at DU 1-1, which add protection for human health. Alternative S-4 removes soil that exceeds the RIDEM GA Leachability Criteria and includes a physical barrier that would isolate the contaminated soil remaining at DU 1-1. Alternative S-2 removes soil that exceeds the Industrial RGs (including the RIDEM GA Leachability Criteria). As such, Alternative S-2 provides a slightly greater level of protection. Alternative S-1 would not be protective of human health and the environment because contact with contaminated soil would not be prevented.

TABLE 2-8. COMPARISON OF CLEANUP ALTERNATIVES EVALUATED

	ALTERNATIVE S-1	ALTERNATIVE S-2 *	ALTERNATIVE S-3	ALTERNATIVE S-4
Alternative Description/Components				
Evaluation Criteria	No Action	Limited Soil Excavation with LUCs	Soil Excavation with Short-Term LUCs	Limited Soil Excavation with Soil Cover and LUCs
Estimated Timeframes For Cleanup				
Time to achieve cleanup goals	NA	Approx. 1 year	Approx. 1 year	Approx. 1 year
CRITERIA ANALYSIS: Threshold Criteria – Selected alternative must meet these criteria				
Protects Human Health and the Environment – Will it protect people and animal life? Is it permanent?	⃠	●	●	●
Compliance with ARARs – Does this alternative meet federal and state environmental laws, regulations, and requirements?	⃠	●	●	●
Primary Balancing Criteria – Used to differentiate between alternatives meeting the threshold criteria above				
Provides Long-Term Effectiveness and Permanence – Do risks remain onsite? If so, are the controls adequate and reliable?	⃠	●	●	●

TABLE 2-8. COMPARISON OF CLEANUP ALTERNATIVES EVALUATED

	ALTERNATIVE S-1	ALTERNATIVE S-2 *	ALTERNATIVE S-3	ALTERNATIVE S-4
Alternative Description/Components				
Evaluation Criteria	No Action	Limited Soil Excavation with LUCs	Soil Excavation with Short-Term LUCs	Limited Soil Excavation with Soil Cover and LUCs
Reduces Mobility, Toxicity, and Volume Through Treatment – Does the alternative reduce the harmful effects of the contaminants, their ability to spread, and the amount of contaminated material present?	⃠	⃠	⃠	⃠
Provides Short-Term Protection – How soon will risks be reduced? Are there short-term hazards to workers, residents, or the environment that could occur during cleanup?	⃠	●	●	●
Implementability – Is the alternative technically feasible? Are necessary goods and services (treatment equipment, space, etc.) available?	●	●	●	●
Cost (1) (2)				
Capital Cost	$0	$162,521	$253,646	$242,127
Future O&M and Periodic Costs (PV)	$0	$51,514	$20,316	$83,215
Five Year Reviews	$0	$23,307	$9,284	$23,307
Total Present Worth Cost	$0	$237,000	$283,000	$349,000
Modifying Criteria – May be used to modify recommended cleanup				
State Agency Acceptance – Do state environmental agencies agree with Navy's recommended alternative?	⃠	●	⃠	⃠
Community Acceptance – What objections, modifications, or suggestions do the public offer during the public comment period?	Not Applicable	●	Not Applicable	Not Applicable

Notes:

● Meets
⃠ Does Not Meet

ARARs: Applicable or Relevant and Appropriate Requirements
LUCs: Land Use Controls
O&M: Operation and Maintenance

* Alternative S-2 – Limited Soil Excavation with LUCs is the Selected Remedy

1. For purposes of cost estimation, all future cost (periodic and O&M) represent 30-year time frames for Alternatives S-2 and S-4 and a 10-year timeframe forAlternative S-3. Present Value (PV) of all future costs are provided. Actual total costs may be higher.
2. The five-year reviews for DUs 1-1, 1-2, and 1-3 are a component of the NAVSTA Newport facility five-year reviews.

2.12.1.2 Compliance with ARARs

Alternatives S-2, S-3, and S-4 meet the chemical-specific, location-specific, and action-specific ARARs. Implementation of either of these alternatives would be compliant and conducted in accordance with regulations. Alternative S-1 does not comply with ARARs since it does not prevent exposure to contaminated soil exceeding the RGs. Also refer to Appendix B of the FS.

2.12.2 Primary Balancing Criteria

2.12.2.1 Long-Term Effectiveness and Permanence

In terms of mitigating risks remaining at the site after RAOs have been met, and for risks from management of residuals, Alternative S-3 has the highest long-term effectiveness since it removes all contaminated soil from

DUs 1-1, 1-2, and 1-3 that exceed RGs. Alternatives S-2 and S-4 are less effective since contaminated soil remains at DU 1-1 under those alternatives. However, these alternatives utilize controls to prevent exposure to contaminated soil over the long-term to provide the desired long-term effectiveness. A future residential land use scenario would be prevented under Alternatives S-2 and S-4; however, controls and inspections would be relied upon to provide permanent protection from contaminants and are therefore less effective. Alternative S-1 is not effective and doesn't provide permanent protection from contaminants.

2.12.2.2 Reduction in Toxicity, Mobility, or Volume through Treatment

The alternatives evaluated do not utilize treatment processes. Therefore, the criteria for treatment have not been evaluated.

2.12.2.3 Short-Term Effectiveness

The effectiveness of the remedial alternatives during construction and implementation are compared to one another in the following paragraphs.

Protection of Community and Workers During Remedial Action: Short-term risks include any additional risks to the community or workers at the site from exposures to COCs as a result of construction measures and implementation of remedial activities. Since no construction activities or remedial actions are proposed under Alternative S-1, there are no additional short-term risks to the community or workers. Under Alternative S-2, limited excavation is proposed and short-term risks to the workers and surrounding community will be minimal. Alternative S-4 includes the same short-term risks as Alternative S-2 as well as risks to workers during the installation of the cover. Alternative S-3 has the greatest short-term risk since it involves exposure of contaminated soil to construction workers during the excavation and exposure of the surrounding community during off-site disposal. The short-term risks associated with Alternatives S-2, S-3, and S-4 can be mitigated with the use of appropriate PPE during construction activities and proper handling and management (i.e., engineering controls and contingency measures) of contaminated soil.

Environmental Impacts: The remedial alternatives evaluated differ in the magnitude of potential impacts to natural habitats. Since no construction activities or remedial actions are proposed under Alternative S-1, there are no additional short-term impacts to natural habitats. Under Alternative S-2, limited excavation and environmental sampling are proposed and short-term impacts to the natural habitat will be minimal. Alternatives S-3 and S-4 have the greatest short-term impact to natural habitats since they have the longest construction period and impact the same construction footprint, which is larger than Alternative S-2.

Based on the discussions above, Alternative S-1 is considered the most effective in the short-term, followed by Alternatives S-2, S-4, and S-3. Given the small size of DUs 1-1, 1-2, and 1-3, short-term risks are not considered significant under any of the remedial alternatives.

2.12.2.4 Implementability

The alternatives with the highest degree of implementability would have the following characteristics from USEPA's FS guidance (USEPA, 1988):

- Require the lowest effort to construct, operate and maintain the technologies
- Include or consist only of the highest or most reliable technologies

- Require the lowest effort to undertake additional remedial actions, if necessary
- Include the fewest administrative hurdles for obtaining necessary permits, approvals and agreements
- Rely only minimally on off-site treatment, storage, and disposal facility (TSDF) services
- Require the least amount or quantity of necessary specialized equipment and/or personnel specialists
- Utilize commonly available technologies to the largest degree

Conversely, alternatives with lesser degrees of implementability will have lesser degrees of the characteristics discussed above. The first three bullets define the "technical feasibility" with regard to implementability of the alternative, the fourth bullet defines "administrative feasibility," and the remaining three bullets define the "availability of services and materials" with respect to the alternative. These three factors combine to provide the overall degree of implementability of the alternative.

In general, more complex remedial technologies are more difficult to implement and will have lesser degrees of overall implementability compared to other, less complex, alternatives. As a result, the No Action alternative (S-1) is typically considered the most implementable, and any additional alternatives are less implementable. However, it should be noted that none of the alternatives presented, when applied to these areas, are considered highly complex and are commonly implemented at similar environmental restoration sites.

The following paragraphs present more detailed evaluations of the comparison on implementability characteristics of the remedial alternatives discussed in this FS.

Technical Feasibility: Implementability with regard to the technical feasibility of an alternative includes an evaluation of three factors: 1) ability to construct, operate and maintain the technologies, 2) the reliability of the technologies, and 3) the ease of undertaking additional remedial actions, if warranted by site conditions determined after implementation of the remedy.

Alternative S-3 is relatively easy to implement because excavation is a common technology and there are limited complications such as ease of access and very shallow soil contamination. Initial implementation of Alternatives S-2 and S-4 is not complicated given the site conditions and low concentrations of contaminants.

The ease of undertaking additional remedial actions, if warranted by future site conditions or requirements, is proportional to the degree or intensity of each remedy. Since Alternative S-3 would remove all contamination exceeding Industrial and Residential RGs, additional remedial actions can be performed with relative ease. Additional remedial actions would be more difficult to implement for Alternatives S-2 and S-4 since contamination remains in place. Additional actions associated with Alternative S-4 would be more difficult to implement than Alternative S-3 since the soil cover may need to be removed to conduct additional remedial actions.

Administrative Feasibility: Alternative S-3 would address all surface soils exceeding RGs and therefore, would ultimately allow for unrestricted use. Since only short-term LUCs would be required under Alternative S-3, while Alternatives S-2 and S-4 would require permanent LUCs, the administrative issues associated with five-year reviews and LUCs, which are easily administered, would exist over a longer duration under Alternatives

S-2 and S-4. Therefore, this alternative has the highest degree of administrative feasibility. Based on this analysis, Alternative S-3 is considered the most implementable, followed by Alternatives S-2, and S-4.

Availability of Services and Materials: Implementability with regard to the availability of services and materials includes an evaluation of three factors: 1) availability or usage of off-site TSDFs, 2) availability of necessary or specialized equipment or specialist personnel needed to implement the alternative, and 3) availability of prospective technologies required by the alternative. Each of these three factors is described for the alternatives.

Alternative S-1 would not require specialized equipment or personnel. Alternatives S-2 through S-4 would require off-site disposal of soil, with Alternative S-3 requiring disposing the largest amount of soil. All services and materials required for the remaining alternatives would be relatively easy to obtain. Finally, special technologies (i.e., proprietary technologies or technologies with more variables affecting ultimate effectiveness) are not proposed for any of the alternatives discussed in this FS.

Based on the evaluations above, Alternative S-1 is considered the most implementable, followed by Alternatives S-2, S-3, and S-4. Given the small size of DUs 1-1, 1-2, and 1-3, all remedial alternatives discussed in this FS can be implemented with relative ease.

2.12.2.5 Cost

Alternative S-1 has no cost as nothing is being implemented. Alternative S-4 is the most expensive, followed by Alternative S-3, and Alternative S-2. The costs associated with the four alternatives are summarized as follows:

Cost Component	Alternative S-1	Alternative S-2	Alternative S-3	Alternative S-4
Capital Costs	$0	$162,521	$253,646	$242,127
O&M	$0	$51,514	$20,316	$83,215
Five-Year Reviews	$0	$23,307	$9,284	$23,307
Total Cost[1]	$0	$237,000	$283,000	$349,000

[1] Rounded to the nearest $1,000

Note: Costs associated with potential assessment and remediation of soil beneath the EBP, TV2 and TV3 structures are not included. If remediation is required, it is assumed the cost will be within the acceptable NCP cost range.

2.12.3 Modifying Criteria

2.12.3.1 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.

2.12.3.2 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. No written comments were received during the formal public comment period (May 5 to June 4, 2016) for the Proposed Plan. The questions posed at the public meeting (informal session) on May 18, 2016, were mainly general clarifications 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, occurred immediately after the public meeting on May 18, 2016. These formal comments/questions and the Navy's responses are summarized in Section 3.0. The transcript of the public hearing is provided for reference as Appendix E.

2.13 PRINCIPAL THREAT WASTE

The NCP at 40 CFR Section 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 DUs 1-1, 1-2, and 1-3 at Site 7 – Tank Farm 1 (OU13), the contaminant concentrations are not highly toxic or highly mobile; therefore, principal threat wastes are not present at the site.

2.14 SELECTED REMEDY

2.14.1 Rationale for Selected Remedy

The Selected Remedy for DUs 1-1, 1-2, and 1-3 is Soil Alternative S-2 – Limited Soil Excavation with Land Use Controls, with the post-FS modification (Resolution, 2016) that for DU 1-2 and DU 1-3, soil removal will be conducted to address soil exceeding Ecological and Industrial RGs and LUCs will address remaining soil that exceeds the Residential RG. This modification was made to be consistent with the current and planned future use of the Tank Farm 1 site, which does not include residential or other unrestricted uses. This alternative, with the modification stated above, was selected because it provides the best balance with respect to the nine evaluation criteria and will allow for continued industrial and restricted recreational use of the property.

When completed, Soil Alternative S-2, as modified, will be: (1) protective of human health and the environment (e.g., achieve the site-specific remedial action objectives); (2) comply with all state and federal regulations; (3) provide long-term effectiveness; and (4) provide a cost-effective action that can be easily implemented using proven technology. Although the Selected Remedy requires land use controls that would prevent residential or other unrestricted use of the property, residential development is not included in the Navy's current development plans at Site 7 – Tank Farm 1. As such, this alternative would achieve RAOs. While Alternatives S-3 and S-4 would also achieve the RAOs if successfully implemented, these alternatives are more difficult to implement and cost more than Alternative S-2, as modified here.

2.14.2 Description of Selected Remedy

The Selected Remedy, Soil Alternative S-2, includes limited soil excavation and off-site disposal and implementation of LUCs. Five-year reviews are required since COCs will remain above RGs after the remedy is complete.

<u>Soil Removal and Disposal</u> – The goal of the soil removal is to remove soils exceeding Industrial RGs (including RIDEM GA Leachability Criteria) at DU 1-1 and to remove soil exceeding the Ecological and

Industrial RGs (including RIDEM GA Leachability Criteria) for DU 1-2 and DU 1-3. Soil will remain onsite at concentrations greater than the Residential RGs at DU 1-1, DU 1-2, and DU 1-3. No remedial actions are required for subsurface soil and subsurface soil concentrations do not exceed surface soil RGs. The estimated areas currently targeted for excavation are presented on Figures 3, 4, and 5. Further sampling will be needed as part of a pre-design investigation to delineate the extent of surface soils that exceed RGs at DUs 1-1, 1-2, and 1-3. Further sampling will also include analysis for hexavalent chromium at a few locations in DU 1-1. Chromium is currently identified as a potential COC based on an assumption that the detections in surface soil around DU 1-1 are hexavalent chromium; however, if hexavalent chromium is determined not to be present, then chromium would no longer be a COC.

Prior to the excavation, erosion control measures (i.e., silt fences) will be installed around the excavation area. During the excavation, dust control and air monitoring will be performed, as necessary. Once all contaminated soil is removed, the areas will be re-graded and seeded. Due to the shallow depth of the excavation, it is assumed that no backfill will be needed.

The excavated soil will be transported and disposed of at an off-site, licensed landfill or treatment facility.

<u>LUCs and Inspections</u> – Following the soil excavation, soil will remain at DU 1-1, DU 1-2, and DU 1-3 at concentrations greater than Residential RGs; therefore, LUCs would be established to prevent residential and other unrestricted use. Because there is only a thin layer of soil overlying bedrock at DU 1-1, it is likely that little to no soil is present below the EBP foundation. However, as a conservative measure, LUCs would also be required for the EBP foundation to prevent access to soil, if it exists, below the building. For DU 1-2 and DU 1-3, LUCs would be required for the TV2 and TV3 structure footprints to prevent access to soil below the buildings, since it has not been assessed. The intent of LUCs at DU 1-1, DU 1-2, and DU 1-3 is to prevent residential and unrestricted recreational use of the property so that contact with COCs at concentrations that would cause an unacceptable risk to human receptors is prevented for the life of the remedy. Requirements for management of excavated soil as part of any future construction activities (including sampling and disposal of contaminated soils) at DU 1-1, DU 1-2, and DU 1-3 would also be included as part of the LUCs. LUCs would prevent disturbance of the EBP, TV2, and TV3 building foundations without approval of the Navy and regulatory agencies. LUCs would also include maintenance of the EBP, TV2 and TV3 structure foundations. The demolition of the buildings is not considered part of this alternative. However, if any of the buildings are demolished and the foundations removed, the presence or absence of underlying soil would be assessed and remediated, if needed, to meet Industrial RGs for DU 1-1 and Ecological and Industrial RGs for DU 1-2 and DU 1-3. If TV2 and/or TV3 are demolished, the demolition/disposal will meet TSCA protectiveness standards so as not to create a threat of release to the environment.

The LUC implementation actions including monitoring and enforcement requirements will be provided in a 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 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. 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 FFA. As long as Navy retains ownership of the property, NAVSTA Newport enforces the LUCs and assures that each LUC is maintained appropriately by tracking it through a centralized tracking system. If the property is transferred from the Navy to another federal owner, upon meeting the requirements for transfers under the site's FFA, 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 that 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 land use restrictions. 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 concentrations of hazardous substances in the soil are at levels that allow for unrestricted use and exposure.

Five-Year Reviews – 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, 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 5 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 will review site conditions and monitoring data to determine whether the Selected Remedy is appropriate. Five-year reviews will be conducted until DU 1-1, 1-2, and 1-3 conditions are restored such that the site is suitable for unrestricted use and unlimited exposure in accordance with CERCLA. The five-year reviews would be performed as part of the facility-wide five year reviews.

2.14.3 Expected Outcomes of Selected Remedy

The current industrial and restricted recreational land use, which will be supported by the Selected Remedy, is expected to continue at DUs 1-1, 1-2, and 1-3, and there are no other planned land uses in the foreseeable future. There are no socio-economic, community revitalization, or economic impacts or benefits associated with implementation of the Selected Remedy. RAOs for the site are anticipated to be achieved within approximately 1 year. Table 2-9 describes how the Selected Remedy mitigates risk and achieves RAOs for DUs 1-1, 1-2, and 1-3.

If the existing structures (EBP, TV2, and TV3) at DUs 1-1, 1-2, and 1-3 are demolished, the underlying soil would need to be assessed and remediated, if needed, consistent with the remedy. At that time, modification of the LUCs will be required. 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 modification to LUCs will be conducted in accordance with provisions in the DUs 1-1, 1-2, and 1-3 LUC RD, CERCLA, and the NCP.

TABLE 2-9. HOW SELECTED REMEDY MITIGATES RISK AND ACHIEVES RAOS

RISK	RAO	COMMENTS
DU 1-1		
Direct exposure to and ingestion of contaminated soil	Prevent exposure by industrial and restricted recreational users to soil containing site contaminants that exceed industrial use scenario RGs.	At DU 1-1, soils around the EBP structure with contaminants exceeding industrial RGs will be removed and LUCs will prohibit residential and other unrestricted uses of DU 1-1 and also require maintenance of the EBP foundation to prevent access to underlying soil.
	Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario RGs.	
Migration of contaminants to groundwater and surface water	Prevent future migration of soil contaminants to groundwater (soil COCs above Rhode Island Department of Environmental Management [RIDEM] GA Leachability Criteria).	At DU 1-1, soils with COCs exceeding RIDEM GA Leachability Criteria will be removed.
DU 1-2 and DU 1-3		
Direct exposure to and ingestion of contaminated soil	Prevent exposure by industrial and restricted recreational users to soil containing site contaminants that exceed industrial use scenario RGs.	At DU 1-2 and DU 1-3, soils around the TV2 and TV3 structures with contaminants exceeding the industrial and ecological cleanup level will be removed and LUCs will prohibit residential and other unrestricted uses of DU 1-2 and DU 1-3 and also require maintenance of the TV2 and TV3 foundations to prevent access to underlying soil.
	Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario RGs.	
	Prevent exposure by insectivorous mammals and birds to soil containing COCs that exceed ecological RGs.	
Migration of contaminants to groundwater and surface water	Prevent future migration of soil contaminants to groundwater (soil COCs above RIDEM GA Leachability Criteria).	At DU 1-2 and DU 1-3, soils with COCs exceeding RIDEM GA Leachability Criteria will be removed.

2.15 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 and the environment associated with potential exposure to COCs at DUs 1-1, 1-2, and 1-3. The Selected Remedy will be protective of human health and the environment through soil removal and prevention of unacceptable exposures to COCs remaining in soil through LUCs. LUCs and compliance monitoring will ensure the long-term effectiveness of the remedy.

Compliance with ARARs - The Selected Remedy will attain all identified federal and state ARARs, as presented in Appendix D. Incorporated into this ROD is an EPA finding that the remedy selected will address PCB-contaminated media in order to control risk of injury to human health or the environment, in compliance with 40 CFR Section 761.61(c).

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. These cost estimates 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 following this ROD.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable - The Navy, EPA, and RIDEM have concluded that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practical manner. Some contaminated soils remain above state criteria, but pose a relatively low long-term threat (i.e., not principal threat). Because there are no source materials at this site that constitute a principal threat, the Selected Remedy is not required to satisfy the statutory preference for remedies employing treatment that reduce the toxicity, mobility, or volume as a principal element. The Selected Remedy for soil includes LUCs, and provides the best balance of cost versus benefit to achieve the remedial goals. 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 UU/UE, 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.

2.16 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 May 18, 2016, 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 transcript of the public hearing is included as Appendix E.

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

QUESTION/COMMENT	RESPONSE
From Public Hearing	
Ms. Claudette Weissinger/Portsmouth Conservation Commisison commented that there are multiple explanations for open space and it needs to be clarified what the Navy means by open space and what DEM considers open space. Ms Weissinger indicated that she saw the term used in information related to the Navy's EIS that addesses Tank Farm 1.	The EPA generally defines "open space" as "any open piece of land that is undeveloped (has no buildings or other built structures) and is accessible to the public." Open space can include green space, schoolyards, playgrounds, public seating areas, public plazas, and vacant lots. (Source: https://www3.epa.gov/region1/eco/uep/openspace.html) While the term "open space" is not used in the Proposed Plan or other documents that form the Administrative Record for this site, the commenter is correct that the term is used in the Navy's Draft Environmental Impact Statement (EIS) for the Disposal and Reuse of Surplus Property at Naval Station Newport, Rhode Island (Dated March 2016). The Draft EIS evaluates reuse alternatives and analyzes the Navy's proposed action to transfer surplus properties, including Tank Farm 1. For the Tank Farm 1 property, the Draft EIS documents that the Navy's preferred alternative for redevelopment includes areas of light industrial and marina-related use with parking/access, with the majority of the property designated as open space. The Draft EIS states that "Open space on the property would be publicly accessible, unless land use controls put in place upon completion of remediation prohibit public access." This Draft EIS also states that "The tank farms will likely be cleaned to industrial standards. Upon completion of remediation, it is anticipated that land use controls, which may include restrictions on the type of development or permitted uses or activities, or site access will be developed based on state standards for former industrial sites." The Selected Remedy for DUs 1-1, 1-2, and 1-3, will support industrial and restricted recreational uses, but will include land use controls to restrict residential or other unrestricted uses. This level of cleanup is consistent with the Draft EIS and the Navy's preferred alternative for redevelopment.

TABLE 3-1. SUMMARY OF COMMENTS FROM PUBLIC COMMENT PERIOD	
QUESTION/COMMENT	**RESPONSE**
Ms. Kathy Abbas commented that there could be cultural materials there at the site and on the need to be vigilant about cultural resources during the work since there are areas of cultural significance nearby. She noted that the the area nearby was part of the Revolutionary War and there was a Civil War hospital down the hill from that. It has been her experience that even if studies or tests are done to identify the presence or absence of historical properties, you could find something that wasn't found when the testing is done.	The Navy will remain aware of the potential for culturally significant resources during soil excavations and other site activities. Findings of cultural signficance will be identified if encountered.
Ms. Margaret Kirschner commented that there is a lot to study with this site in the administrative record. Ms. Kirschner noted that the aerial photographs of the site are very interesting showing the site in use from 1940 to the '70s and it's a lot of work cleaning up these sites and it's very impressive.	The comment is noted.
From Public Comment Period	
None.	Not applicable.

3.2 TECHNICAL AND LEGAL ISSUES

No technical or legal issues associated with the Site 7 – Tank Farm 1 (OU13), DUs 1-1, 1-2, and 1-3 ROD were identified.

Figures

RESOLUTION CONSULTANTS

Drawn:	JB	01/11/2016
Approved:	MK	01/11/2016
Project #:	60266436	

Map Location

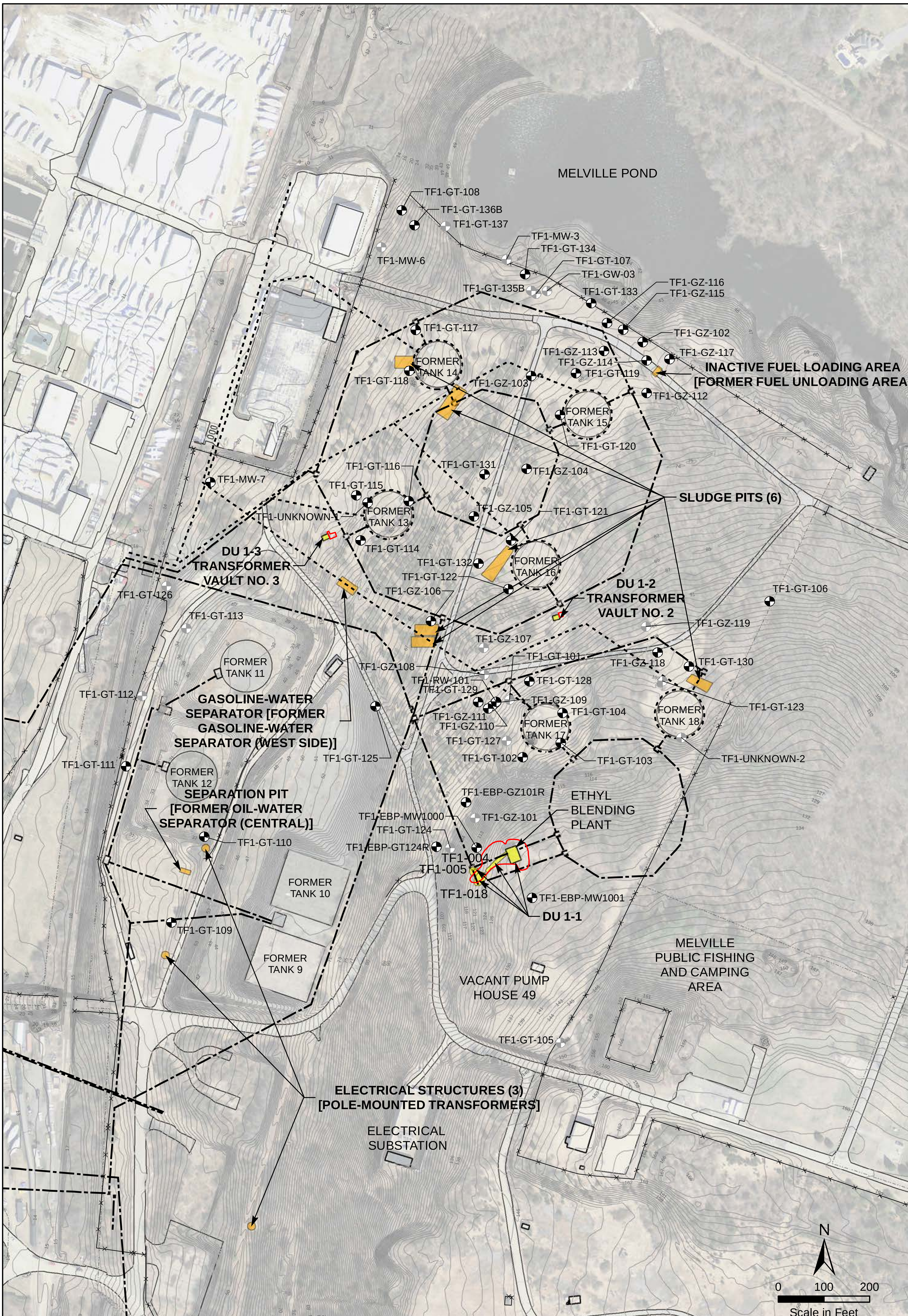
N

0 1,200 2,400

Scale in Feet

FIGURE 1
SITE LOCUS
RECORD OF DECISION
TANK FARM 1 - SITE 7
DECISION UNITS 1-1, 1-2, 1-3
NAVSTA NEWPORT, RHODE ISLAND

Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\ROD\MXD\Fig_1_Site_Locus.mxd



RESOLUTION CONSULTANTS

Drawn: JB 5/12/2016

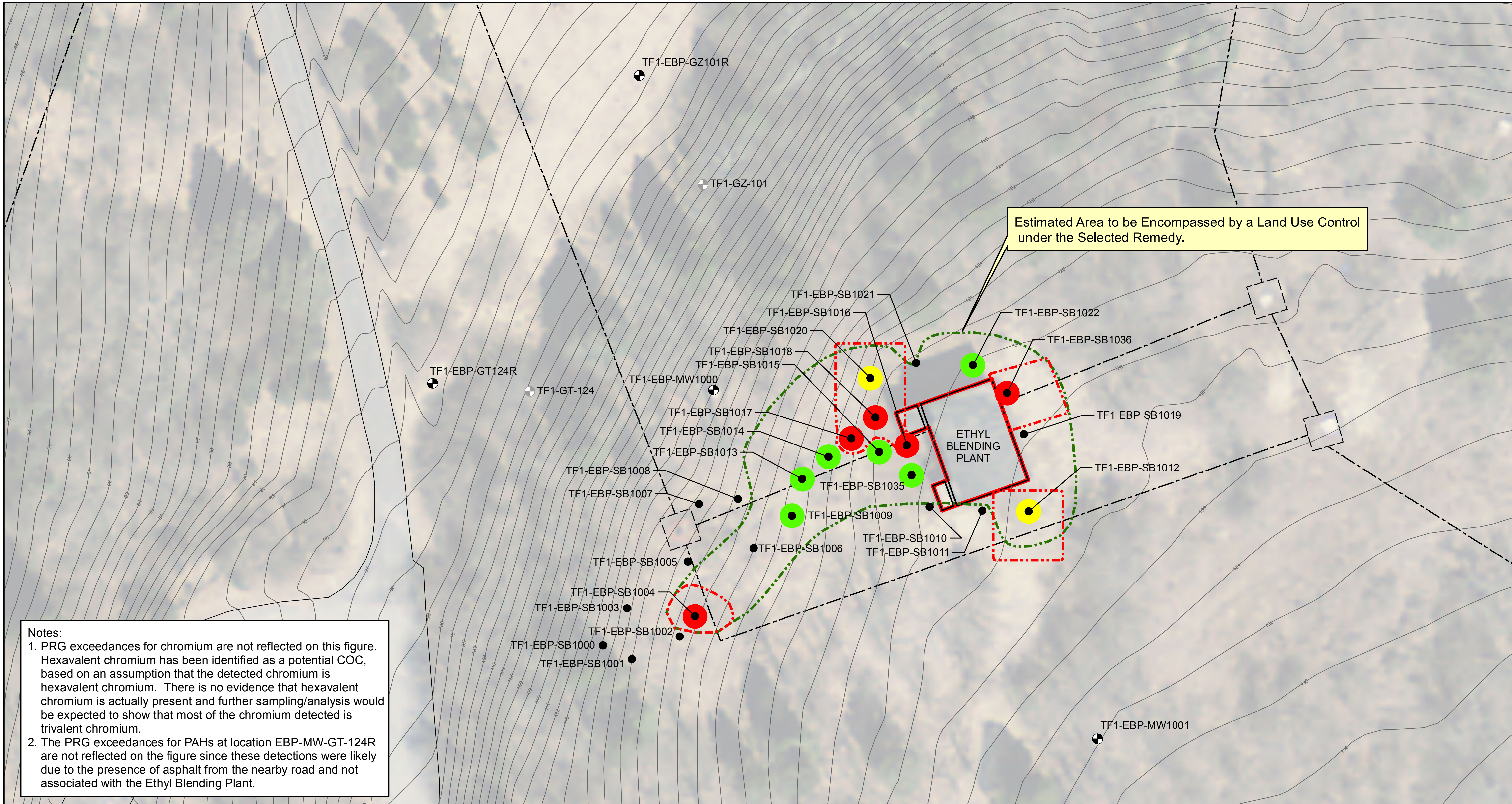
Approved: MK 5/12/2016

Project #: 60266436

Legend
- Existing Monitoring Well
- Abandoned or Destroyed Monitoring Well
- Chain Link Fence
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)
- AOCs Investigated during Data Gaps Assessment
- Decision Unit
- Site 7 Boundary
- Other AOCs Identified in April 2012 Dispute Resolution

FIGURE 2
TANK FARM 1 LAYOUT
RECORD OF DECISION
TANK FARM 1 - SITE 7
DECISION UNITS 1-1, 1-2, 1-3
NAVSTA NEWPORT, RHODE ISLAND

Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\ROD\MXD\Fig_2_TF1_Layout.mxd



Notes:
1. PRG exceedances for chromium are not reflected on this figure. Hexavalent chromium has been identified as a potential COC, based on an assumption that the detected chromium is hexavalent chromium. There is no evidence that hexavalent chromium is actually present and further sampling/analysis would be expected to show that most of the chromium detected is trivalent chromium.
2. The PRG exceedances for PAHs at location EBP-MW-GT-124R are not reflected on the figure since these detections were likely due to the presence of asphalt from the nearby road and not associated with the Ethyl Blending Plant.

RESOLUTION CONSULTANTS

Drawn: JB 05/12/2016
Approved: NO 05/12/2016
Project #: 60266436

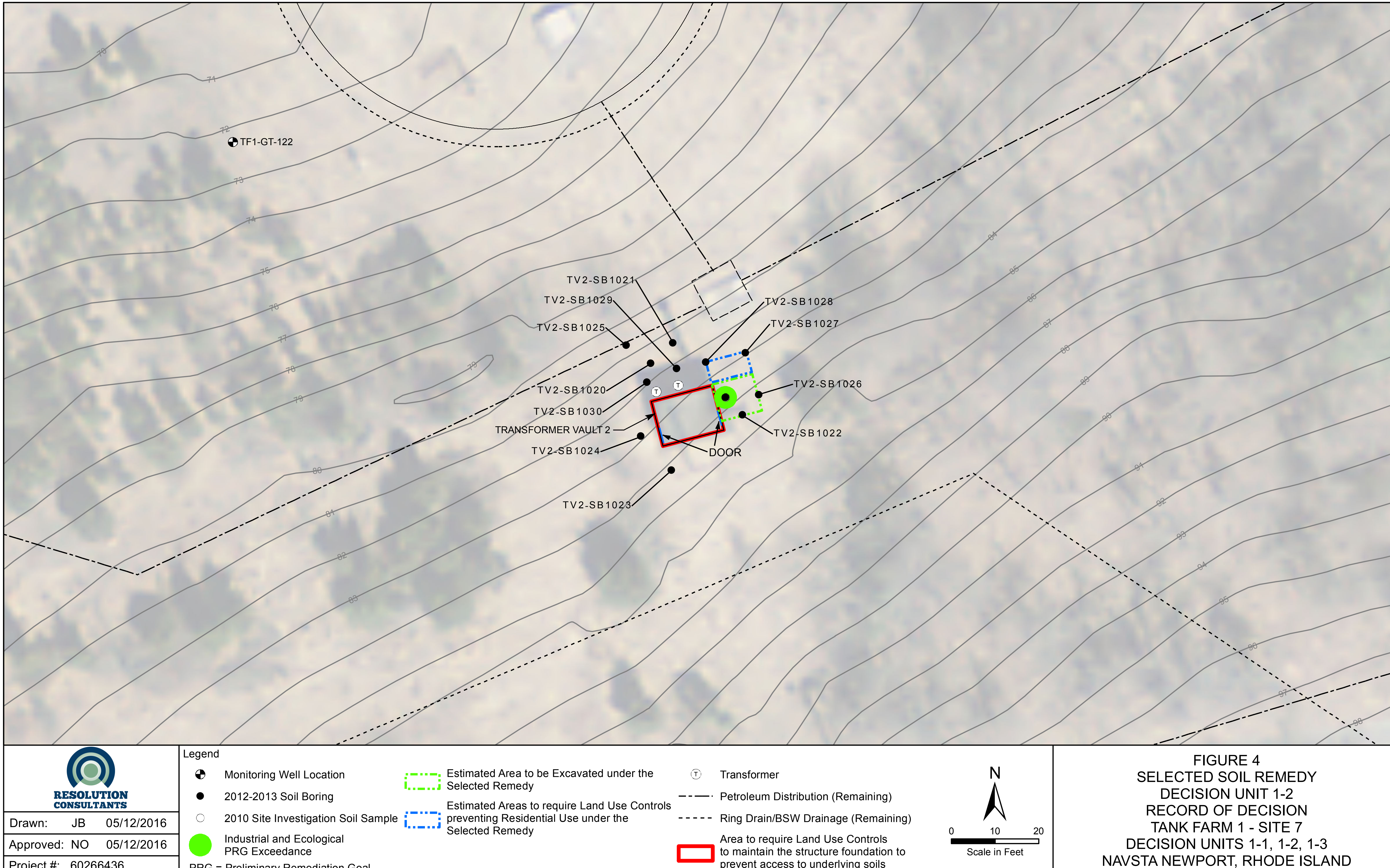
Legend
- Existing Monitoring Well
- Abandoned or Destroyed Monitoring Well
- Soil Boring
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)
- Exceeds Residential and Industrial PRGs (including GA LC)
- Exceeds Residential PRGs
- Exceeds Residential and Industrial PRGs
- Estimated Area to be Encompassed by a Land Use Control under the Selected Remedy
- Estimated Extent of Excavation under the Selected Remedy (based on Ind PRG Exceedances)
- Area to require Land Use Controls to maintain the structure foundation to prevent access to underlying soils

PRG = Preliminary Remediation Goal
GA LC = GA Leachability Criteria

N
0 15 30
Scale in Feet

FIGURE 3
SELECTED SOIL REMEDY FOR
DECISION UNIT 1-1
RECORD OF DECISION
TANK FARM 1 (SITE 7)
DECISION UNITS 1-1, 1-2, 1-3
NAVSTA NEWPORT, RHODE ISLAND

Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\ROD\MXD\Fig_3_Selected_Soil_Remedy_DU_1_1.mxd

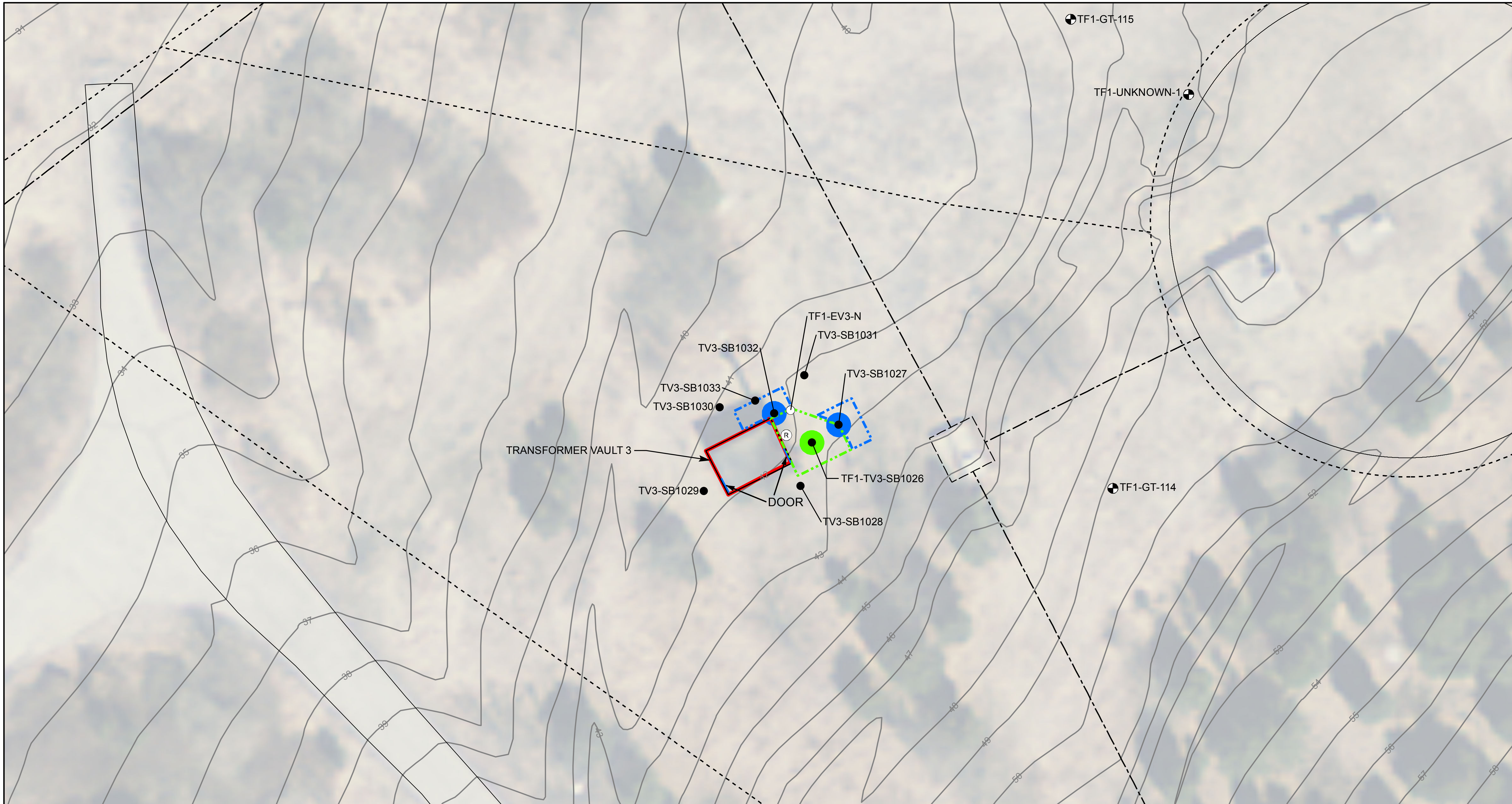


RESOLUTION CONSULTANTS

Drawn: JB	05/12/2016
Approved: NO	05/12/2016
Project #: 60266436	

FIGURE 4
SELECTED SOIL REMEDY
DECISION UNIT 1-2
RECORD OF DECISION
TANK FARM 1 - SITE 7
DECISION UNITS 1-1, 1-2, 1-3
NAVSTA NEWPORT, RHODE ISLAND

Document Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\ROD\MXD\Fig_4_Selected_Soil_Remedy_DU_1_2.mxd



Legend

- Existing Monitoring Well
- 2010 Site Investigation Soil Sample
- 2012-2013 Soil Boring
- Rectifier
- Residential
- Residential and Ecological
- Estimated Area to be Excavated under the Selected Remedy
- Estimated Areas to require Land Use Controls* preventing Residential Use under the Selected Remedy
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)
- Area to require Land Use Controls to maintain the structure foundation to prevent access to underlying soils

PRG = Preliminary Remediation Goal

N

0 10 20

Scale in Feet

RESOLUTION CONSULTANTS

Drawn: JB 05/12/2016

Approved: NO 05/12/2016

Project #: 60266436

FIGURE 5
SELECTED SOIL REMEDY FOR
DECISION UNIT 1-3
RECORD OF DECISION
SITE 7 - TANK FARM 1
DECISION UNITS 1-1, 1-2, 1-3
NAVSTA NEWPORT, RHODE ISLAND

Document Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\ROD\MXD\Fig_5_Selected_Soil_Remedy_DU_1_3.mxd

Administrative Record Reference Table

DETAILED ADMINISTRATIVE RECORD TABLE

ITEM	REFERENCE PHRASE IN ROD	LOCATION IN ROD	LOCATION OF INFORMATION IN ADMINISTRATIVE RECORD
1	**April 2012 dispute resolution agreement**	Section 1.3	Formal Dispute Resolution Agreement – April 24, 2012
2	**Background Soil Investigation**	Table 2-1	Tetra Tech, 2008. *Basewide Background Study Report for Naval Station Newport, Newport, Rhode Island.* July.
3	**Data Gaps Investigation (DGA)**	Table 2-1	Tetra Tech, 2014. *Tank Farm 1 – Category 1 AOCs Data Gaps Assessment For Site 7 – Tank Farm 1 Navsta Newport Portsmouth, Rhode Island* December.
4	**Human Health Risk Screening Evaluation (HHRSE)**	Table 2-1 and Section 2.9.1	Tetra Tech, 2014
5	**Ecological Risk Assessment (ERA)**	Table 2-1 and Section 2.9.2	Tetra Tech, 2014
6	**Feasibility Study (FS)**	Table 2-1	Resolution, 2015. *Feasibility Study Decision Units 1-1, 1-2, and 1-3 at Tank Farm 1 – Site 7 Naval Station Newport Portsmouth, Rhode Island* December.
7	**remedial alternatives**	Section 2.12	Resolution, 2015
8	**public notice**	Section 2.3	*Newport Daily News* 2016
9	**potential receptors**	Section 2.9	Tetra Tech, 2014
10	**Chemicals of Potential Concern (COPCs Identified)**	Section 2.9.1.1	Tetra Tech, 2014
11	**exposure assessment**	Section 2.9.3	Tetra Tech, 2014
12	**cancer risks and non-cancer hazards**	Section 2.9.1.3	Tetra Tech, 2014
13	**Remedial Action Objectives (RAOs)**	Section 2.10	Resolution, 2015
14	**Chemicals of Concern (COCs)**	Section 2.10	Tetra Tech, 2014
15	**Preliminary Remediation Goals (PRGs)**	Section 2.10	Resolution, 2015
16	**Remediation Goals (RGs)**	Section 2.10	Resolution, 2015
17	**preliminary technology screening**	Section 2.11	Resolution, 2015
18	**Memorandum to Site File**	Section 2.11	Resolution, 2016. Memorandum to Site File, Regarding Modification of Alternative S-2 as the Preferred Remedy. April.
19	**nine CERCLA evaluation criteria**	Section 2.12	Resolution, 2015

ADDITIONAL REFERENCES

U.S. Environmental Protection Agency (EPA). 2002. Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10. December 2002.

U.S. Environmental Protection Agency (EPA). 2013. ProUCL Version 5.0.00, updated September 9, 2013.

Appendix A

Rhode Island Department Of Environmental Management Concurrence Letter

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF THE DIRECTOR
235 Promenade Street, Room 425
Providence, Rhode Island 02908

7 September 2016

Bryan O. Olson, Director
U.S. EPA, Region I
Office of Site Remediation and Restoration
5 Post Office Square
Suite 100 (OSRR 07-5)
Boston, MA 02109-3912

RE: Record of Decision for Decision Units 1-1, 1-2 and 1-3
Site 7 - Tank Farm 1, Operable Unit (OU) 13
Naval Station Newport, RI

Dear Mr. Olson:

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) dated August 2016 for Decision Units (DU) 1-1, 1-2 and 1-3 at Site 7 – Tank Farm 1 (OU13) at Naval Station Newport, RI. This ROD addresses soil only for these three DUs. Groundwater at Tank Farm 1 will be addressed on a site-wide basis. DU 1-1 is the Ethyl Blending Plant which was used to mix fuel additives with petroleum where soil is impacted with metals and polycyclic aromatic hydrocarbons (PAHs). DUs 1-2 and 1-3 are Transformer Vault Nos. 2 and 3 where soil is impacted by releases of polychlorinated biphenyls (PCBs).

The Department of the Navy's selected alternative for soil at DUs 1-1, 1-2 and 1-3, as presented in the ROD, is the following: limited soil excavation and off-site disposal of surface soil exceeding Industrial Remedial Goals (RGs), including RIDEM GA Leachability Criteria at DU 1-1; limited soil excavation and off-site disposal of surface soil exceeding Industrial and Ecological RGs, including RIDEM Leachability Criteria at DUs 1-2 and 1-3; and, implementation of land use controls (LUCs) to prevent residential and other unrestricted use and to prevent access to soil in excess of the Residential RGs.

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 complete the ongoing pre-design investigation (PDI) which includes soil sampling and analysis to identify the extent of soils for the removal action at DUs 1-1, 1-2 and 1-3;

- The Navy will implement LUCs to prevent residential and unrestricted recreational uses of the Site;

- The Navy will also establish LUCs for under the structures at each DU in the event that currently inaccessible soil exceeds risk thresholds and becomes accessible if the buildings are demolished;

- The 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;

- Finally, we urge the Navy to make every effort to assure that this remedy is implemented in a manner that allows the local community maximum participation in this process.

RIDEM would like to thank the Navy for their diligence in investigating this site and working with the affected stakeholders by considering their concerns in the decision-making process. RIDEM concurs with this ROD and looks forward to working with the Navy and the USEPA on the remaining concerns at Naval Station Newport.

Sincerely,

Terrence D. Gray
Associate Director for Environmental Protection

cc: Leo Hellested, RIDEM
Matthew DeStefano, RIDEM
Pamela Crump, RIDEM
Anni Loughlin, USEPA
Kymberlee Keckler, USEPA
Jim Gravette, NAVFAC MIDLANT

Appendix B

Cost Estimates

Planning Cost Estimate Summary

Alternative:	Modified S-2 Limited Soil Excavation with Land Use Controls
Site:	DU 1-1, 1-2, & 1-3 at Tank Farm 1 - Site 7, NAVSTA Newport
Location:	Portsmouth, Rhode Island
Phase:	FS
Date:	February 2016

Description: This alternative consists of limited surface soil excavation at DU 1-1 to meet Industrial PRGs (including GA Leachability Criteria, limited surface soil excavation at DU 1-2 and 1-3 to meet Ecological and Industrial PRGs (including GA Leachability Criteria), land use controls and annual site inspections, and five-year reviews.

CAPITAL COSTS

Description		QTY	UNIT	UNIT COST	Total	Notes
Land Use Control Remedial Design (LUC RD)						
Prepare LUC RD (4 iterations)		1	LS	$10,000	$10,000	Estimated
					$10,000	
Delineation Soil Sampling						
HASP		1	LS	$2,500	$2,500	
Work Plan/UFP SAP		1	LS	$10,000	$10,000	
Direct push drill rig and operator		2	day	$2,000	$4,000	Assumes 24 0-2 foot depth soil borings
Labor to record and collect samples		4	person-days	$1,500	$6,000	Assume 12-hr field day
Laboratory analyses:						
PAHs		18	EA	$120	$2,160	See Backup for sampling and analysis
Arsenic		3	EA	$20	$60	assumptions. Quantities include field
Manganese		7	EA	$20	$140	duplicates.
Total Chromium		4	EA	$20	$80	
Hexavalent Chromium		4	EA	$65	$260	
pH, ORP, ferrous iron, react. Sulfide		4	EA	$90	$360	
PCBs		10	EA	$60	$600	
Travel		4	person-days	$200	$800	
Field supplies and equipment		1	EA	$1,500	$1,500	Allowance
Data Validation		20	HR	$100	$2,000	Allowance
Surveying		1	LS	$2,000	$2,000	Sample locations, contours, surface features
Tech Memo (2 iterations)		60	HR	$100	$6,000	Allowance
					$38,460	
Site Preparation and Management						
RA Contractor Work Plan		1	LS	$2,500	$2,500	
HASP		1	LS	$1,500	$1,500	
Equipment mobilization		1	LS	$1,500	$1,500	
Temporary facilities		1	LS	$500	$500	
Erosion control measures		400	LF	$4	$1,600	
Clearing and grubbing		2020	SF	$1	$2,020	
					$9,620	
Excavation						
Excavate soil		147	CY	$15	$2,205	Based on 2 foot depth and areas shown on Figures 3-5
Dust control and air monitoring		1	LS	$500	$500	
Regrade excavation footprint		2020	SF	$1	$2,020	
Seeding		2020	SF	$5	$10,100	
					$14,825	
Soil Disposal						
Waste Characterization		1	EA	$830	$830	Estimate for VOCs, SVOCs, PCBs, pesticides, TPH, metals; 1 per 500 CY
T&D non-haz soil		220.5	Ton	$75	$16,538	
					$17,368	
Post-Construction						
Contractor Completion Report		75	HR	$100	$7,500	
Remedial Action Completion Report (2 iterations)		100	HR	$100	$10,000	
					$17,500	
SUBTOTAL					$107,773	
Contingency	30%				$32,332	Scope (15%)+ Bid(15%)
SUBTOTAL					$140,104	
Project Management	6%				$8,406.26	
Remedial Design	4%				$5,604.17	
Construction Management	6%				$8,406.26	
TOTAL CAPITAL COSTS					$162,521	

Planning Cost Estimate Summary

Alternative: Modified S-2 Limited Soil Excavation with Land Use Controls

O&M COSTS

Description		QTY	UNIT	UNIT COST	Total	Notes
Annual LUC Site inspections (through year 30)		1	each	$1,950	$1,950	Estimated; See attached worksheet
SUBTOTAL					$1,950	
Contingency	0%				$0	
Project Management	10%				$195	
TOTAL O&M ANNUAL COSTS					$2,145	

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	Total	Notes
Five Year Review (through year 30)	6	each	$5,000	$30,000	Assume one component of base-wide 5-yr review
SUBTOTAL				$30,000	
TOTAL PERIODIC ANNUAL COSTS				$5,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor at 1.5%	Present Value	Notes
Capital Cost	0	$162,521	$162,521	1	$162,521	Discount rate of 1.5% is based on the
O&M Cost	1 to 30	$64,350	$2,145	24.0158	$51,514	30-Year Real Interest Rate in Appendix C
Periodic Cost	5	$5,000	$5,000	0.9283	$4,642	of the White House Office of Management
	10	$5,000	$5,000	0.8617	$4,309	and Budget (OMB) Circular A-94, Revised
	15	$5,000	$5,000	0.7999	$4,000	December 2014.
	20	$5,000	$5,000	0.7425	$3,713	
	25	$5,000	$5,000	0.6892	$3,446	
	30	$5,000	$5,000	0.6398	$3,199	
Total Present Value of Alternative					$237,342	

Planning Cost Backup Worksheet

Alternative:	S-2 Limited Soil Excavation with Land Use Controls and S-4 Limited Soil Excavation with Soil Cover and Land Use Controls

Site:	DU 1-1, 1-2, & 1-3 at Tank Farm 1 - Site 7, NAVSTA Newport	Prepared By:	CC	Checked By:	NT
Location:	Portsmouth, Rhode Island	Date:	7/9/2014	Date:	7/16/2014
Phase:	FS				
Date:	October 2015				

Assumptions:

EBP Delineation Soil Sampling (including QA/QC)
Sampling and analysis to assess whether hexavalent chromium is present above the PRG or if it should be eliminated as a COC
- Assume resampling of previous locations EBP-SB1007, EBP-SB1019, and EBP-SB1036 that had total chromium in excess of the PRG for hexavalent chromium.
- Assume analysis for total chromium, hexavalent chromium, pH, ORP, and possibly ferrous iron and reactive sulfide.

Sampling and anlysis to delineate overall extent of PAHs, manganese, and arsenic at the EBP
- Assume 3 surface soil samples east and west of EBP-SB1004 with analysis for arsenic to delineate arsenic exceedances.
- Assume 7 surface soil samples collected north of EBP-SB1020 and EBP-SB1022 with analysis for PAHs and manganese.
- Assume 11 additional surface soil samples collected to delineate horizontal extent of PAHs.

TV2 and TV3 Delineation Soil Sampling (including QA/QC)
Sampling and analysis to delineate overall extent of PCBs
- Assume 5 surface soil samples collected around TF1-EV2-E and 5 surface soil samples collected around TV3-SB1026

Work Statement:
Annual Land Use Control (LUC) Inspections and Reporting

Description	QTY	UNIT	UNIT COST	Total	Notes
Travel	1	LS	$200	$200	
Labor for Inspection	12	HR	$100	$1,200	
Report	4	HR	$100	$400	
Misc	1	LS	$100	$150	
TOTAL COST PER ANNUAL INSPECTION				$1,950	

Source of Cost Data:
Engineering Estimate

Cost Adjustment Factor:

FACTOR:		NOTES:
H&S Productivity (labor & equip)		Level D
Escalation to Base Year		
Area Cost Factor		
Subcontractor Overhead & Prof.		
Prime Contractor Overhead & Prof.		

Appendix C

Risk Assessment and Remedial Goal Development Tables

TABLE 1 - SUMMARY OF HUMAN HEALTH RISK FROM DATA GAPS ASSESSMENT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCS -
RESIDENTIAL EXPOSURES TO SURFACE SOIL - ETHYL BLENDING PLANT
TANK FARM 1 - CATEGORY 1 AOCS - DATA GAPS ASSESSMENT
NAVSTA NEWPORT, NEWPORT, RHODE ISLAND

Chemical	Incremental Lifetime Carcinogenic Risk (ILCR)			Estimated Non-Carcinogenic Hazard Quotient (HQ)		
	Exposure Point Concentration (mg/kg)[1]	Residential RSL[2] (mg/kg)	Estimated ILCR	Primary Target Organ	Residential RSL[2] (mg/kg)	Estimated HQ
Semivolatile Organic Compounds						
Benzo(a)anthracene	4.5	0.15	3E-05	Cancer	NA	NA
Benzo(a)pyrene	1.3	0.015	9E-05	Cancer	NA	NA
Benzo(b)fluoranthene	2.6	0.15	2E-05	Cancer	NA	NA
Benzo(k)fluoranthene	1.2	1.5	8E-07	Cancer	NA	NA
Dibenzo(a,h)anthracene	0.48	0.015	3E-05	Cancer	NA	NA
Indeno(1,2,3-cd)pyrene	2.55	1.5	2E-06	Cancer	NA	NA
Metals						
Arsenic	9.7	0.61	2E-05	Skin, Cardiovascular System	34	0.3
Chromium[2]	15.3	0.29	5E-05	None Specified	230	0.1
Cobalt	8.3	370	2E-08	Thyroid	23	0.4
Iron	22,210	NA	NA	Gastrointestinal System	55000	0.4
Manganese	264	NA	NA	Central Nervous System	1,800	0.1
Thallium	0.09	NA	NA	Skin	0.78	0.1
		Total ILCR	2E-04		Total HI	1

1 - Exposure point concentration is the 95% upper confidence calculated by ProUCL Version 5.0.

2 - USEPA Regional Screening Level Table (November 2013). Carcinogenic values correspond to a 1×10^{-6} cancer risk level. Noncarcinogenic values corresponds to a hazard index of 1.

3 - RSLs are for hexavalent chromium.

NA - Not applicable. There are no cancer slope factors (CSF) or reference dose (RfD) available for this chemical.

Note: The Residential Regional Screening Levels (RSLs) shown above are those that were available at the time the risk assessment was completed as part of the Data Gaps Assessment (Tetra Tech, 2014). The current RSLs were used to develop the preliminary remediation goals. Use of the most current RSLs would not have changed the outcome of the screening results shown above.

TABLE 2 - HUMAN HEALTH PRG DEVELOPMENT EQUATIONS

Resident Soil

Noncarcinogenic-child

- Ingestion

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}\,(mg/kg)=\frac{THQ\times AT_r\left(\frac{365\ days}{year}\times ED_c\,(6\ years)\right)\times BW_c\,(15\ Kg)}{EF_r\left(\frac{350\ days}{year}\right)\times ED_c\,(6\ year)\times\frac{1}{RfD_o\left(\frac{mg}{Kg\text{-}day}\right)}\times IRS_c\left(\frac{200\ mg}{day}\right)\times\frac{10^{-6}Kg}{1\,mg}}$$

- Dermal

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}\,(mg/kg)=\frac{THQ\times AT_r\left(\frac{365\ days}{year}\times ED_c\,(6\ years)\right)\times BW_c\,(15\ Kg)}{EF_r\left(\frac{350\ days}{year}\right)\times ED_c\,(6\ year)\times\frac{1}{\left(RfD_o\left(\frac{mg}{Kg\text{-}day}\right)\times GIABS\right)}\times SA_c\left(\frac{2690\ cm^2}{day}\right)\times AF_c\left(\frac{0.2\ mg}{cm^2}\right)\times ABS_d\times\frac{10^{-6}Kg}{1\,mg}}$$

- Inhalation

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}c}\,(mg/kg)=\frac{THQ\times AT_r\left(\frac{365\ days}{year}\times ED_c\,(6\ years)\right)}{EF_r\left(\frac{350\ days}{year}\right)\times ED_c\,(6\ year)\times ET_{rs}\left(\frac{24\ hours}{day}\right)\times\left(\frac{1\ day}{24\ hours}\right)\times\frac{1}{RfC\left(mg/m^3\right)}\times\left(\frac{1}{VF_s\left(\frac{m^3}{Kg}\right)}+\frac{1}{PEF_w\left(\frac{m^3}{Kg}\right)}\right)}$$

- Total

$$SL_{res\text{-}soil\text{-}nc\text{-}tot\text{-}c}\,(mg/kg)=\frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}}+\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}}+\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}c}}}$$

Noncarcinogenic-adult

- Ingestion

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}a}\,(mg/kg)=\frac{THQ\times AT_r\left(\frac{365\ days}{year}\times ED_r\,(26\ years)\right)\times BW_a\,(80\ Kg)}{EF_r\left(\frac{350\ days}{year}\right)\times ED_r\,(26\ year)\times\frac{1}{RfD_o\left(\frac{mg}{Kg\text{-}day}\right)}\times IRS_a\left(\frac{100\ mg}{day}\right)\times\frac{10^{-6}Kg}{1\,mg}}$$

- Dermal

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}a}\,(mg/kg)=\frac{THQ\times AT_r\left(\frac{365\ days}{year}\times ED_r\,(26\ years)\right)\times BW_a\,(80\ Kg)}{EF_r\left(\frac{350\ days}{year}\right)\times ED_r\,(26\ year)\times\frac{1}{\left(RfD_o\left(\frac{mg}{Kg\text{-}day}\right)\times GIABS\right)}\times SA_a\left(\frac{6032\ cm^2}{day}\right)\times AF_a\left(\frac{0.07\ mg}{cm^2}\right)\times ABS_d\times\frac{10^{-6}Kg}{1mg}}$$

- Inhalation

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}\,(mg/kg)=\frac{THQ\times AT_r\left(\frac{365\ days}{year}\times ED_r\,(26\ years)\right)}{EF_r\left(\frac{350\ days}{year}\right)\times ED_r\,(26\ year)\times ET_{rs}\left(\frac{24\ hours}{day}\right)\times\left(\frac{1\ day}{24\ hours}\right)\times\frac{1}{RfC\left(mg/m^3\right)}\times\left(\frac{1}{VF_s\left(\frac{m^3}{Kg}\right)}+\frac{1}{PEF_w\left(\frac{m^3}{Kg}\right)}\right)}$$

- Total

$$SL_{res\text{-}soil\text{-}nc\text{-}tot\text{-}a}\,(mg/kg)=\frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}a}}+\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}a}}+\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}}}$$

Carcinogenic

- Ingestion

$$SL_{res\text{-}soil\text{-}ca\text{-}ing}\,(mg/kg)=\frac{TR\times AT_r\left(\frac{365\ days}{year}\times LT\,(70\ years)\right)}{CSF_o\left(\frac{mg}{Kg\text{-}day}\right)^{-1}\times IFS_{adj}\left(\frac{36750\ mg}{Kg}\right)\times\left(\frac{10^{-6}Kg}{mg}\right)}$$

where:

$$IFS_{adj}\left(\frac{36750\ mg}{Kg}\right)=\frac{EF_{ressc}\left(\frac{350\ days}{year}\right)\times ED_c\,(6\ years)\times IRS_c\left(\frac{200\ mg}{day}\right)}{BW_c\,(15\ Kg)}+\frac{EF_{ressa}\left(\frac{350\ days}{year}\right)\times ED_r\text{-}ED_c\,(20\ years)\times IRS_a\left(\frac{100\ mg}{day}\right)}{BW_a\,(80\ Kg)}$$

- Dermal

$$SL_{res\text{-}soil\text{-}ca\text{-}der}\,(mg/kg)=\frac{TR\times AT_r\left(\frac{365\ days}{year}\times LT\,(70\ years)\right)}{\left(\frac{CSF_o\left(\frac{mg}{Kg\text{-}day}\right)^{-1}}{GIABS}\right)\times DFS_{adj}\left(\frac{112266\ mg}{Kg}\right)\times ABS_d\times\left(\frac{10^{-6}Kg}{mg}\right)}$$

where:

$$DFS_{adj}\left(\frac{112266\ mg}{Kg}\right)=\frac{EF_{ressc}\left(\frac{350\ days}{year}\right)\times ED_c\ (6\ years)\times SA_c\left(\frac{2690\ cm^2}{day}\right)\times AF_c\left(\frac{0.2\ mg}{cm^2}\right)}{BW_c\ (15\ Kg)}+\frac{EF_{ressa}\left(\frac{350\ days}{year}\right)\times ED_r\text{-}ED_c\ (20\ years)\times SA_a\left(\frac{6032\ cm^2}{day}\right)\times AF_a\left(\frac{0.07\ mg}{cm^2}\right)}{BW_a\ (80\ Kg)}$$

- **Inhalation**

$$SL_{res\text{-}soil\text{-}ca\text{-}inh}\ (mg/kg)=\frac{TR\times AT_r\left(\frac{365\ days}{year}\times LT\ (70\ years)\right)}{IUR\left(\mu g/m^3\right)^{-1}\times\left(\frac{1000\ \mu g}{mg}\right)\times EF_r\left(\frac{350\ days}{year}\right)\times\left(\frac{1}{VF_s\left(\frac{m^3}{Kg}\right)}+\frac{1}{PEF_w\left(\frac{m^3}{Kg}\right)}\right)\times ED_r\ (26\ years)\times ET_{rs}\left(\frac{24\ hours}{day}\right)\times\left(\frac{1\ day}{24\ hours}\right)}$$

- **Total**

$$SL_{res\text{-}soil\text{-}ca\text{-}tot}\ (mg/kg)=\frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}ing}}+\frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}der}}+\frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}inh}}}$$

Mutagenic

- Ingestion

$$SL_{res\text{-}soil\text{-}mu\text{-}ing}\ (mg/kg)=\frac{TR\times AT_r\left(\frac{365\ days}{year}\times LT\ (70\ years)\right)}{CSF_o\left(\frac{mg}{Kg\text{-}day}\right)^{-1}\times IFSM_{adj}\left(\frac{166833.33\ mg}{Kg}\right)\times\left(\frac{10^{-6}Kg}{mg}\right)}$$

where:

$$IFSM_{adj\text{-}}\left(\frac{166833.33\ mg}{Kg}\right)=\frac{EF_{ressc\ 0\text{-}2}\left(\frac{350\ days}{year}\right)\times ED_{0\text{-}2}\ (yr)\times IRS_c\left(\frac{200\ mg}{day}\right)\times 10}{BW_c\ (15\ Kg)}+\frac{EF_{ressc\ 2\text{-}6}\left(\frac{350\ days}{year}\right)\times ED_{2\text{-}6}\ (yr)\times IRS_c\left(\frac{200\ mg}{day}\right)\times 3}{BW_c\ (15\ Kg)}+$$
$$\frac{EF_{ressa\ 6\text{-}16}\left(\frac{350\ days}{year}\right)\times ED_{6\text{-}16}\ (yr)\times IRS_a\left(\frac{100\ mg}{day}\right)\times 3}{BW_a\ (80\ Kg)}+\frac{EF_{ressa\ 16\text{-}26}\left(\frac{350\ days}{year}\right)\times ED_{16\text{-}26}\ (yr)\times IRS_a\left(\frac{100\ mg}{day}\right)\times 1}{BW_a\ (80\ Kg)}$$

- Dermal

$$SL_{res\text{-}soil\text{-}mu\text{-}der}\ (mg/kg)=\frac{TR\times AT_r\left(\frac{365\ days}{year}\times LT\ (70\ years)\right)}{\left(\frac{CSF_o\left(\frac{mg}{Kg\text{-}day}\right)^{-1}}{GIABS}\right)\times DFSM_{adj}\left(\frac{475598.67\ mg}{Kg}\right)\times ABS_d\times\left(\frac{10^{-6}Kg}{mg}\right)}$$

where:

where:

$$DFSM_{adj}\left(\frac{475598.67\ mg}{Kg}\right)=\frac{EF_{ressc\ 0\text{-}2}\left(\frac{350\ days}{year}\right)\times ED_{0\text{-}2}\ (yr)\times AF_c\left(\frac{0.2\ mg}{cm^2}\right)\times SA_c\left(\frac{2690\ cm^2}{day}\right)\times 10}{BW_c\ (15\ Kg)}+\frac{EF_{ressc\ 2\text{-}6}\left(\frac{350\ days}{year}\right)\times ED_{2\text{-}6}\ (yr)\times AF_c\left(\frac{0.2\ mg}{cm^2}\right)\times SA_c\left(\frac{2690\ cm^2}{day}\right)\times 3}{BW_c\ (15\ Kg)}+$$

$$\frac{EF_{ressa\ 6\text{-}16}\left(\frac{350\ days}{year}\right)\times ED_{6\text{-}16}\ (yr)\times AF_a\left(\frac{0.07\ mg}{cm^2}\right)\times SA_a\left(\frac{6032\ cm^2}{day}\right)\times 3}{BW_a\ (80\ Kg)}+\frac{EF_{ressa\ 16\text{-}26}\left(\frac{350\ days}{year}\right)\times ED_{16\text{-}26}\ (yr)\times AF_a\left(\frac{0.07\ mg}{cm^2}\right)\times SA_a\left(\frac{6032\ cm^2}{day}\right)\times 1}{BW_a\ (80\ Kg)}$$

- **Inhalation**

$$SL_{res\text{-}soil\text{-}mu\text{-}inh}\ (mg/kg)=\frac{TR\times AT_r\left(\frac{365\ days}{year}\times LT\ (70\ years)\right)}{ET_{rs}\left(\frac{24\ hours}{day}\right)\times\left(\frac{1\ day}{24\ hours}\right)\times\left(\frac{1000\ \mu g}{mg}\right)\times\left(\begin{array}{l}\left(EF_{0\text{-}2}\left(\frac{350\ days}{year}\right)\times ED_{0\text{-}2}\ (yrs)\times IUR\left(\frac{\mu g}{m^3}\right)^{-1}\times 10\right)+\\\left(EF_{2\text{-}6}\left(\frac{350\ days}{year}\right)\times ED_{2\text{-}6}\ (yrs)\times IUR\left(\frac{\mu g}{m^3}\right)^{-1}\times 3\right)+\\\left(EF_{6\text{-}16}\left(\frac{350\ days}{year}\right)\times ED_{6\text{-}16}\ (yrs)\times IUR\left(\frac{\mu g}{m^3}\right)^{-1}\times 3\right)+\\\left(EF_{16\text{-}26}\left(\frac{350\ days}{year}\right)\times ED_{16\text{-}26}\ (yrs)\times IUR\left(\frac{\mu g}{m^3}\right)^{-1}\times 1\right)\end{array}\right)\times\left(\frac{1}{VF_s\left(\frac{m^3}{Kg}\right)}+\frac{1}{PEF_w\left(\frac{m^3}{Kg}\right)}\right)}$$

- **Total**

$$SL_{res\text{-}soil\text{-}mu\text{-}tot}\ (mg/kg)=\frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}mu\text{-}ing}}+\frac{1}{SL_{res\text{-}soil\text{-}mu\text{-}der}}+\frac{1}{SL_{res\text{-}soil\text{-}mu\text{-}inh}}}$$

Supporting Equations

- Child

$$ED_c\ (6\ years)=ED_{0\text{-}2}\ (2\ years)+ED_{2\text{-}6}\ (4\ years)$$

$$BW_c\ (15\ kg)=\frac{BW_{0\text{-}2}\ (15\ kg)\times ED_{0\text{-}2}\ (2\ years)+BW_{2\text{-}6}\ (15\ kg)\times ED_{2\text{-}6}\ (4\ years)}{ED_{0\text{-}2}\ (2\ years)+ED_{2\text{-}6}\ (4\ years)}$$

$$EF_c\left(\frac{350\ days}{year}\right)=\frac{EF_{0\text{-}2}\left(\frac{350\ days}{year}\right)\times ED_{0\text{-}2}\ (2\ years)+EF_{2\text{-}6}\left(\frac{350\ days}{year}\right)\times ED_{2\text{-}6}\ (4\ years)}{ED_{0\text{-}2}\ (2\ years)+ED_{2\text{-}6}\ (4\ years)}$$

$$AF_c\left(\frac{0.2\ mg}{cm^2}\right)=\frac{AF_{0\text{-}2}\left(\frac{0.2\ mg}{cm^2}\right)\times ED_{0\text{-}2}\,(2\ years)+AF_{2\text{-}6}\left(\frac{0.2\ mg}{cm^2}\right)\times ED_{2\text{-}6}\,(4\ years)}{ED_{0\text{-}2}\,(2\ years)+ED_{2\text{-}6}\,(4\ years)}$$

$$SA_c\left(\frac{2690\ cm^2}{day}\right)=\frac{SA_{0\text{-}2}\left(\frac{2690\ cm^2}{day}\right)\times ED_{0\text{-}2}\,(2\ years)+SA_{2\text{-}6}\left(\frac{2690\ cm^2}{day}\right)\times ED_{2\text{-}6}\,(4\ years)}{ED_{0\text{-}2}\,(2\ years)+ED_{2\text{-}6}\,(4\ years)}$$

$$IRS_c\left(\frac{200\ mg}{day}\right)=\frac{IRS_{0\text{-}2}\left(\frac{200\ mg}{day}\right)\times ED_{0\text{-}2}\,(2\ years)+IRS_{2\text{-}6}\left(\frac{200\ mg}{day}\right)\times ED_{2\text{-}6}\,(4\ years)}{ED_{0\text{-}2}\,(2\ years)+ED_{2\text{-}6}\,(4\ years)}$$

- Adult

$$ED_a\,(20\ years)=ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)$$

$$BW_a\,(80\ kg)=\frac{BW_{6\text{-}16}\,(80\ kg)\times ED_{6\text{-}16}\,(10\ years)+BW_{16\text{-}26}\,(80\ kg)\times ED_{16\text{-}26}\,(10\ years)}{ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)}$$

$$EF_a\left(\frac{350\ days}{year}\right)=\frac{EF_{6\text{-}16}\left(\frac{350\ days}{year}\right)\times ED_{6\text{-}16}\,(10\ years)+EF_{16\text{-}26}\left(\frac{350\ days}{year}\right)\times ED_{16\text{-}26}\,(10\ years)}{ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)}$$

$$AF_a\left(\frac{0.07\ mg}{cm^2}\right)=\frac{AF_{6\text{-}16}\left(\frac{0.07\ mg}{cm^2}\right)\times ED_{6\text{-}16}\,(10\ years)+AF_{16\text{-}26}\left(\frac{0.07\ mg}{cm^2}\right)\times ED_{16\text{-}26}\,(10\ years)}{ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)}$$

$$SA_a\left(\frac{6032\ cm^2}{day}\right)=\frac{SA_{6\text{-}16}\left(\frac{6032\ cm^2}{day}\right)\times ED_{6\text{-}16}\,(10\ years)+SA_{16\text{-}26}\left(\frac{6032\ cm^2}{day}\right)\times ED_{16\text{-}26}\,(10\ years)}{ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)}$$

$$IRS_a\left(\frac{100\ mg}{day}\right)=\frac{IRS_{6\text{-}16}\left(\frac{100\ mg}{day}\right)\times ED_{6\text{-}16}\,(10\ years)+IRS_{16\text{-}26}\left(\frac{100\ mg}{day}\right)\times ED_{16\text{-}26}\,(10\ years)}{ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)}$$

- Age-adjusted

$$ED_r\,(26\ years)=ED_{0\text{-}2}\,(2\ years)+ED_{2\text{-}6}\,(4\ years)+ED_{6\text{-}16}\,(10\ years)+ED_{16\text{-}26}\,(10\ years)$$

$$EF_r\left(\frac{350\ \text{days}}{\text{year}}\right)=\frac{\begin{array}{c}EF_{0\text{-}2}\left(\frac{350\ \text{days}}{\text{year}}\right)\times ED_{0\text{-}2}\,(2\ \text{years})+EF_{2\text{-}6}\left(\frac{350\ \text{days}}{\text{year}}\right)\times ED_{2\text{-}6}\,(4\ \text{years})\\+EF_{6\text{-}16}\left(\frac{350\ \text{days}}{\text{year}}\right)\times ED_{6\text{-}16}\,(10\ \text{years})+EF_{16\text{-}26}\left(\frac{350\ \text{days}}{\text{year}}\right)\times ED_{16\text{-}26}\,(10\ \text{years})\end{array}}{\begin{array}{c}ED_{0\text{-}2}\,(2\ \text{years})+ED_{2\text{-}6}\,(4\ \text{years})+ED_{6\text{-}16}\,(10\ \text{years})+ED_{16\text{-}26}\,(10\ \text{years})\\ ET_{ress}\left(\frac{24\ \text{hour}}{\text{day}}\right)\end{array}}$$

TABLE 3 - HUMAN HEALTH EXPOSURE ASSUMPTIONS

Attached

Note that the attachment table is taken directly from an EPA directive (USEPA, 2014) and includes some exposure parameters which are not relevant to the PRG development for Tank Farm 1.

USEPA, 2014. Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors. February 6, 2014 (revised February 2015).

Attachment 1. Recommended Default Exposure Factors (2014)

Symbol	Definition (units)	Previous Default Value	Currently Recommended Value	Source of current recommendation	Source of previous recommendation
Ingestion and Dermal Contact Rates					
IRW_c	Resident Drinking Water Ingestion Rate - Child (L/day)	1	0.78	U.S. EPA 2011a, Tables 3-15 and 3-33; weighted average of 90th percentile consumer-only ingestion of drinking water (birth to <6 years)	U.S. EPA 1989 (Exhibit 6-11)
IRW_a	Resident Drinking Water Ingestion Rate - Adult (L/day)	2	2.5	U.S. EPA 2011a, Table 3-33; 90th percentile of consumer-only ingestion of drinking water (≥ 21 years)	U.S. EPA 1989 (Exhibit 6-11)
IRS_c	Resident Soil Ingestion Rate - Child (mg/day)	200	200	U.S. EPA 2011a (Table 5-1); "upper-bound values" accounting for both soil and dust ingestion	U.S. EPA 1991a (pg. 15)
IRS_a	Resident Soil Ingestion Rate - Adult (mg/day)	100	100	U.S. EPA 1991a (pp. 6 and 15); EFH 2011 only provides a central tendency value	U.S. EPA 1991a (pg. 15)
IR_{iw}	Indoor Worker Soil Ingestion Rate (mg/day)	50	50	U.S. EPA 1991a (pp. 9-10, 15); EFH 2011 values not provided	U.S. EPA 1991a (pg. 15)
IR_{ow}	Outdoor Worker Soil Ingestion Rate (mg/day)	100	100	U.S. EPA 1991a (pg. 15), same as adult resident; EFH 2011 value not provided	U.S. EPA 1991a (pg. 15)
SA_c	Resident skin surface area - child (cm^2)	2,800	2,373	U.S. EPA 2011a, Tables 7-2 and 7-8; weighted average of mean values for head, hands, forearms, lower legs, and feet (male and female, birth to < 6 years)(forearm and lower leg-specific data used when available, ratios for nearest available age group used elsewhere (per EPA 2011b))	U.S. EPA 2002 (Exhibit 1-2)
SA_a	Resident skin surface area - adult (cm^2)	5,700	6,032	U.S. EPA 2011a, Tables 7-2 and 7-12; weighted average of mean values for head, hands, forearms, and lower legs (male and female, 21+ years)(forearm and lower leg-specific data used for males and female lower leg; ratio of male forearm to arm applied to female arm data)	U.S. EPA 2002 (Exhibit 1-2)
SA_{ow}	Worker skin surface area - adult (cm^2)	3,300	3,527	US EPA 2011a, Table 7-2; weighted average of mean values for head, hands, and forearms (male and female, 21+years) (similar assumptions for forearms as used in EPA 2011b)	U.S. EPA 2002 (Exhibit 1-2)
SA_c	Resident Water Surface area - child (cm^2)	6,600	6,378	U.S. EPA 2011a, Table 7.10; weighted average of mean values for children <6 years.	U.S. EPA 2004 (Exhibit 3-2)
SA_a	Resident Water Surface area - adult (cm^2)	18,000	20,900	U.S. EPA 2011a, Table 7.10; weighted average of mean values for adults, male and female 21+.	U.S. EPA 2004 (Exhibit 3-2)
AF_c	Resident soil adherence factor - child (mg/cm^2)	0.2	0.2	U.S. EPA 2004 (Exhibit 3-5), RAGS Part E	U.S. EPA 2002 (Exhibit 1-2)
AF_a	Resident soil adherence factor - adult (mg/cm^2)	0.07	0.07	U.S. EPA 2004 (Exhibit 3-5), RAGS Part E	U.S. EPA 2002 (Exhibit 1-2)
AF_{ow}	Worker soil adherence factor - adult (mg/cm^2)	0.2	0.12	U.S. EPA 2011a, Table 7-20 and Section 7.2.2; arithmetic mean of weighted average of body part-specific (hands, forearms, and face) mean adherence factors for adult commercial/industrial activities	U.S. EPA 2002 (Exhibit 1-2)
BW_c	Resident Body Weight - child (kg)	15	15	U.S. EPA 2011a, Table 8-1; weighted average of mean body weights (birth to <6 years)	U.S. EPA 1991a (pg. 15)

Attachment 1. Recommended Default Exposure Factors (2014)

Symbol	Definition (units)	Previous Default Value	Currently Recommended Value	Source of current recommendation	Source of previous recommendation
BW_a	Resident Body Weight - adult (kg)	70	80	U.S. EPA 2011a, Table 8-3; weighted mean values for adults 21 – 78	U.S. EPA 1991a (pg. 15)
Bw_w	Worker Body Weight (kg)	70	80	U.S. EPA 2011a, Table 8-3; weighted mean values for adults 21 – 78	U.S. EPA 1991a (pg. 15)
Exposure Frequency, Exposure Duration, and Exposure Time Variables					
EF_r	Resident Exposure Frequency (days/yr)	350	350	U.S. EPA 1991a (pg. 15); value not provided in EFH 2011	U.S. EPA 1991a (pg. 15)
EF_w	Worker Exposure Frequency (days/yr)	250	250	U.S. EPA 1991a (pg. 15); value not provided in EFH 2011	U.S. EPA 1991a (pg. 15)
EF_{iw}	Indoor Worker Exposure Frequency (days/yr)	250	250	U.S. EPA 1991a (pg. 15); value not provided in EFH 2011	U.S. EPA 1991a (pg. 15)
EF_{ow}	Outdoor Worker Exposure Frequency (days/yr)	225	225	U.S. EPA 2002; value not provided in EFH 2011	U.S. EPA 1991a (pg. 15)
ED_r	Resident Exposure Duration (yr)	30	26	EPA 2011a, Table 16-108; 90th percentile for current residence time.	U.S. EPA 1991a (pg. 15)
ED_c	Resident Exposure Duration - child (yr)	6	6	U.S. EPA 1991a, Pages 6 and 15	U.S. EPA 1991a (pg. 15)
ED_a	Resident Exposure Duration - adult (yr)	24	20	EDr (26 years) - EDc (6 years)	U.S. EPA 1991a (pg. 15)
ED_w	Worker Exposure Duration - (yr)	25	25	U.S. EPA 1991a (pg. 15); EFH 2011 only provides a central tendency value	U.S. EPA 1991a (pg. 15)
ED_{iw}	Indoor Worker Exposure Duration - (yr)	25	25	U.S. EPA 1991a (pg. 15); EFH 2011 only provides a central tendency value	U.S. EPA 1991a (pg. 15)
ED_{ow}	Outdoor Worker Exposure Duration (yr)	25	25	U.S. EPA 1991a (pg. 15); EFH 2011 only provides a central tendency value	U.S. EPA 1991a (pg. 15)
ET_{ra}	Resident Air Exposure Time (hours/day)	24	24	The whole day	The whole day
ET_{rs}	Resident Soil Exposure Time (hours/day)	24	24	The whole day	The whole day
ET_w	Worker Air Exposure Time (hr/hr)	8	8	The work day	The work day
ET_{ws}	Worker Soil Exposure Time (hours/day)	8	8	The work day	The work day
ET_{rw}	Resident Water Exposure Time (hours/day)	24	24	The whole day	The whole day
ET_{rwc}	Resident Water Exposure Time - child (hours/event)	1	0.54	U.S. EPA 2011a, Table 16-28; weighted average of 90th percentile time spent bathing (birth to <6 years)	U.S. EPA 2004
ET_{rwa}	Resident Water Exposure Time - adult (hours/event)	0.58	0.71	U.S. EPA 2011a, Tables 16-30 and 16-31; weighted average of adult (21 to 78) 90th percentile of time spent bathing/ showering in a day, divided by mean number of baths/showers taken in a day.	U.S. EPA 2004
Miscellaneous Variables; values not provided in EFH 2011					

Attachment 1. Recommended Default Exposure Factors (2014)

Symbol	Definition (units)	Previous Default Value	Currently Recommended Value	Source of current recommendation	Source of previous recommendation
AT_r	Averaging time - resident (days/year)	365	365	U.S. EPA 1989 (pg. 6-23)	U.S. EPA 1989 (pg. 6-23)
AT_w	Averaging time - composite worker (days/year)	365	365	U.S. EPA 1989 (pg. 6-23)	U.S. EPA 1989 (pg. 6-23)
AT_{iw}	Averaging time - indoor worker (days/year)	365	365	U.S. EPA 1989 (pg. 6-23)	U.S. EPA 1989 (pg. 6-23)
AT_{ow}	Averaging time - outdoor worker (days/year)	365	365	U.S. EPA 1989 (pg. 6-23)	U.S. EPA 1989 (pg. 6-23)
LT	Lifetime (years)	70	70	U.S. EPA 1989 (pg. 6-22), pending additional input from NCEA	U.S. EPA 1989 (pg. 6-22)
IR_{fish}	Fish Ingestion Rate (mg/day)	5.4×10^4	**	Recommend using site-specific values	U.S. EPA 1991a (pg. 15)
$IR_{produce}$	Consumption of homegrown produce (g/day)	42 (fruit); 80 (veg)	**	Recommend using site-specific values	U.S. EPA 1990

References for Cited Sources:

U.S. EPA 1989. Risk assessment guidance for Superfund. Volume I: Human health evaluation manual (Part A). Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002.

U.S. EPA 1990. Exposure Factors Handbook. Office of Health and Environmental Assessment. EPA / 8-89 / 043, March 1990.

U.S. EPA 1991a. Human health evaluation manual, supplemental guidance: "Standard default exposure factors". OSWER Directive 9285.6-03.

U.S. EPA 1991b. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Office of Emergency and Remedial

U.S. EPA. 1996a. Soil Screening Guidance: User's Guide. Office of Emergency and Remedial Response. Washington, DC. OSWER No. 9355.4-

U.S. EPA. 1996b. Soil Screening Guidance: Technical Background Document. Office of Emergency and Remedial Response. Washington, DC. OSWER No. 9355.4-

U.S. EPA. 1997a. Exposure Factors Handbook. Office of Research and Development, Washington, DC. EPA/600/P-95/002Fa.

U.S. EPA 2000. Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds. Part I: Estimating Exposure to Dioxin-Like Compounds. Volume 3--

U.S. EPA, 2001. WATER9. Version 1.0.0. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

U.S. EPA 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December 2002.http://www.epa.gov/superfund/health/conmedia/soil/index.htm

U.S. EPA 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. OSWER 9285.7-02EP.July

U.S. EPA, 2005. Guidance on Selecting Age Groupsfor Monitoring and Assessing Childhood Exposures to Environmental Contaminants. EPA/630/P-03/003F, November, 2005.

U.S. EPA 2009. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) Final. OSWER 9285.7-82.2009.

U.S. EPA 2011a. Exposure Factors Handbook: 2011 Edition. EPA/ 600/ R-090/052F, September 2011.

EPA. 2011b. "Regional Screening Levels (Formerly PRGs), User's Guide." November. On-Line Address: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

Footnote: Users are directed to the *Exposure Factors Handbook* (2011) as a source for specific age-group exposure factors as described in EPA, 2005.

TABLE 4 - HUMAN HEALTH TOXICITY VALUES FOR RISK DRIVERS

Key: I = IRIS; P = PPRTV; A = ATSDR; C = Cal EPA; X = APPENDIX PPRTV SCREEN (See FAQ #27); H = HEAST; J = New Jersey; O = EPA Office of Water; F = See FAQ; E = Environmental Criteria and Assessment Office; S = see user guide Section 5; L = see user guide on lead; M = mutagen; V = volatile; R = RBA applied (See User Guide for Arsenic notice) ; c = cancer; * = where: n SL < 100X c SL; ** = where n SL < 10X c SL; n = noncancer; m = Concentration may exceed ceiling limit (See User Guide); s = Concentration may exceed Csat (See User Guide); SSL values are based on DAF=1

Toxicity and Chemical-specific Information															Contaminant		Carcinogenic Target Risk (TR) = 1E-06				Noncancer Child Hazard Index (HI) = 1			
SFO $(mg/kg\text{-}day)^{-1}$	key	IUR $(ug/m^3)^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	voc	mutagen	GIABS	ABS	C_{sat} (mg/kg)	PEF (m^3/kg)	VF (m^3/kg)	Analyte	CAS No.	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL Child HQ=1 (mg/kg)	Dermal SL Child HQ=1 (mg/kg)	Inhalation SL Child HQ=1 (mg/kg)	Noncarcinogenic SL Child HI=1 (mg/kg)
1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C			1.0E+00	3.0E-02		1.4E+09		Arsenic, Inorganic	7440-38-2	7.7E-01	5.5E+00	8.9E+02	6.8E-01	3.9E+01	3.3E+02	2.1E+04	3.5E+01
				1.5E+00	I					1.3E-02			1.4E+09		Chromium(III), Insoluble Salts	16065-83-1					1.2E+05			1.2E+05
5.0E-01	J	8.4E-02	S	3.0E-03	I	1.0E-04	I		M	2.5E-02			1.4E+09		Chromium(VI)	18540-29-9	3.1E-01		1.6E+01	3.0E-01	2.3E+02		1.4E+05	2.3E+02
										1.3E-02			1.4E+09		Chromium, Total	7440-47-3								
															Polynuclear Aromatic Hydrocarbons (PAHs)									
7.3E-01	E	1.1E-04	C					V	M	1.0E+00	1.3E-01		1.4E+09	4.4E+06	~Benz[a]anthracene	56-55-3	2.1E-01	6.3E-01	4.1E+01	1.6E-01				
7.3E+00	I	1.1E-03	C						M	1.0E+00	1.3E-01		1.4E+09		~Benzo[a]pyrene	50-32-8	2.1E-02	6.3E-02	1.3E+03	1.6E-02				
7.3E-01	E	1.1E-04	C						M	1.0E+00	1.3E-01		1.4E+09		~Benzo[b]fluoranthene	205-99-2	2.1E-01	6.3E-01	1.3E+04	1.6E-01				
7.3E+00	E	1.2E-03	C						M	1.0E+00	1.3E-01		1.4E+09		~Dibenz[a,h]anthracene	53-70-3	2.1E-02	6.3E-02	1.1E+03	1.6E-02				
7.3E-01	E	1.1E-04	C						M	1.0E+00	1.3E-01		1.4E+09		~Indeno[1,2,3-cd]pyrene	193-39-5	2.1E-01	6.3E-01	1.3E+04	1.6E-01				

TABLE 5. DEVELOPMENT OF HUMAN HEALTH RESIDENTIAL PRELIMINARY REMEDIATION GOALS (PRGs) FOR SOIL (RESIDENTIAL SCENARIO) AT DECISION UNIT 1-1

Analyte[1]	Maximum Detected Surface Soil Concentration	Maximum Detected Subsurface Soil Concentration	Units	Regulatory Criteria RIDEM Rem. Regs[2] RDEC	Leachability - GA	Leachability - GB	Residential Risk-Based Goals[3] ILCR 10^{-6}	10^{-5}	10^{-4}	HQ = 1	Additional Information Site-specific Background[4]	RI Background[5]	Selected Residential PRG for Surface Soil	Basis	Selected Residential PRG for Subsurface Soil	Basis
Volatile Organic Compounds																
2-Butanone	0.058	0.018	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Acetone	0.77	0.4	mg/kg	7800	NA	NA	NA	NA	NA	NA			NA		NA	
Semivolatile Organic Compounds																
1,1-Biphenyl	0.18	NA	mg/kg	0.8	NA	NA	NA	NA	NA	NA			NA		NA	
2-Methylnaphthalene	0.71	NA	mg/kg	123	NA	NA	NA	NA	NA	NA			NA		NA	
Acenaphthene	2.2	0.022	mg/kg	43	NA	NA	NA	NA	NA	NA			NA		NA	
Acenaphthylene	0.2	0.0015	mg/kg	23	NA	NA	NA	NA	NA	NA			NA		NA	
Anthracene	3.3	0.038	mg/kg	35	NA	NA	NA	NA	NA	NA			NA		NA	
Benzo(a)anthracene	8.1	0.13	mg/kg	0.9	NA	NA	1.6E-01	1.6E+00	1.6E+01	NA			0.9	RDEC	NA	(7)
Benzo(a)pyrene	6	0.084	mg/kg	0.4	240	NA	1.6E-02	1.6E-01	1.6E+00	NA			0.4	RDEC	NA	(7)
Benzo(b)fluoranthene	8.8	0.16	mg/kg	0.9	NA	NA	1.6E-01	1.6E+00	1.6E+01	NA			0.9	RDEC	NA	(7)
Benzo(g,h,i)perylene	2.8	0.043	mg/kg	0.8	NA	NA	NA	NA	NA	NA			0.8	RDEC	NA	
Benzo(k)fluoranthene	3.9	0.055	mg/kg	0.9	NA	NA	NA	NA	NA	NA			0.9	RDEC	NA	
Bis(2-ethylhexyl)phthalate	1.9	0.5	mg/kg	46	NA	NA	NA	NA	NA	NA			NA		NA	
Chrysene	9.1	0.13	mg/kg	0.4	NA	NA	NA	NA	NA	NA			0.4	RDEC	NA	
Dibenzo(a,h)anthracene	0.96	0.016	mg/kg	0.4	NA	NA	1.6E-02	1.6E-01	1.6E+00	NA			0.4	RDEC	NA	(7)
Fluoranthene	23	0.28	mg/kg	20	NA	NA	NA	NA	NA	NA			20	RDEC	NA	
Fluorene	2.3	0.019	mg/kg	28	NA	NA	NA	NA	NA	NA			NA		NA	
Indeno(1,2,3-cd)pyrene	4.8	0.091	mg/kg	0.9	NA	NA	1.6E-01	1.6E+00	1.6E+01	NA			0.9	RDEC	NA	(7)
Naphthalene	2	0.006	mg/kg	54	0.8	NA	NA	NA	NA	NA			0.8	Leachability	NA	
Phenanthrene	21	0.19	mg/kg	40	NA	NA	NA	NA	NA	NA			NA		NA	
Pyrene	14	0.2	mg/kg	13	NA	NA	NA	NA	NA	NA			13	RDEC	NA	
Metals																
Antimony	0.32	0.044	mg/kg	10	NA	NA	NA	NA	NA	NA			NA		NA	
Arsenic	20.7	11.9	mg/kg	7	NA	NA	6.8E-01	6.8E+00	6.8E+01	3.5E+01	14	1.7	14	Background	NA	(8)
Barium	40.8	36	mg/kg	5500	NA	NA	NA	NA	NA	NA			NA		NA	
Beryllium	0.65	0.61	mg/kg	1.5	NA	NA	NA	NA	NA	NA			NA		NA	
Cadmium	0.42	0.23	mg/kg	39	NA	NA	NA	NA	NA	NA			NA		NA	
Chromium[6]	24.3	24.2	mg/kg	390	NA	NA	3.0E-01	3.0E+00	3.0E+01	2.3E+02	18		18	Background	NA	(7)
Copper	22.4	43.3	mg/kg	3100	NA	NA	NA	NA	NA	NA			NA		NA	
Lead	127	22.6	mg/kg	150	NA	NA	NA	NA	NA	NA			NA		NA	
Manganese	575	345	mg/kg	390	NA	NA	NA	NA	NA	NA	261		390	RDEC	NA	
Mercury	0.48	0.23	mg/kg	23	NA	NA	NA	NA	NA	NA			NA		NA	
Nickel	25.3	27	mg/kg	1000	NA	NA	NA	NA	NA	NA			NA		NA	
Selenium	0.73	0.72	mg/kg	390	NA	NA	NA	NA	NA	NA			NA		NA	
Silver	0.11	0.08	mg/kg	200	NA	NA	NA	NA	NA	NA			NA		NA	
Thallium	0.15	0.13	mg/kg	5.5	NA	NA	NA	NA	NA	NA			NA		NA	
Vanadium	27.7	22.5	mg/kg	550	NA	NA	NA	NA	NA	NA			NA		NA	
Zinc	82.2	61.6	mg/kg	6000	NA	NA	NA	NA	NA	NA			NA		NA	
Petroleum Hydrocarbons																
TPH (C09-C36)	300	47	mg/kg	500	500	2500	NA	NA	NA	NA			NA		NA	

Notes
ILCR - Incremental Lifetime Cancer Risk
HQ - Hazard Quotient
NA - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable
1. Only detected analytes which were considered risk drivers or have regulatory criteria have been presented.
2. RIDEM Rem. Regs. - RIDEM Remediation Regulations, DEM-DSR-01-93, November 2011, Table 1 (Residential Direct Exposure Criteria [DEC]) and Table 2 (Leachability Criteria); NA = no criterion available
3. Residential risk-based goals are developed based on risk results from the human health risk screening evaluation and consider the ingestion, dermal and inhalation routes of exposure, as applicable.
Calculations are subject to change based on future changes to toxicity values and exposure parameters; NA = Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable if not a risk driver
4. 95% UPL of background data set - ProUCL input and output can be found in this appendix; calculations only performed on metals which were either risk drivers or exceeded regulatory criteria.
5. Arsenic background based on Office Of Waste Management Policy Memo 00-01, Guidance for Arsenic in Soil, September 22, 2000
6. Chromium speciation has not been performed for this site. At this time, chromium has been assumed to be hexavalent chromium even though there is no current evidence that it would be this species. Future sampling/analysis is anticipated to show that most of the chromium detected is trivalent chromium. Upon confirmation of this assumption, chromium would no longer be a chemical of concern (COC) at this site.
7. No PRG selected for this COC because risk-based criteria do not apply to subsurface soil and regulatory criteria were not exceeded.
8. No PRG was selected because although regulatory criteria are exceeded for this COC, the maximum concentration is below the background value.

TABLE 6. RESIDUAL HUMAN HEALTH RISK ASSOCIATED WITH SELECTED RESIDENTIAL PRGs FOR DECISION UNIT 1-1

Analyte[1]	Maximum Detected Surface Soil Concentration	Units	Regulatory Criteria RIDEM Rem. Regs[2]			Residential Risk-Based Goals[3]				Additional Information		Selected PRG	Basis	Residual Risk at PRG[6]	
			Res. DEC	Leachability - GA	Leachability - GB	ILCR 10^{-6}	ILCR 10^{-5}	ILCR 10^{-4}	HQ = 1	Site-specific Background[4]	RI Background[5]			Estimated ILCR	Estimated HQ
Volatile Organic Compounds															
2-Butanone	0.058	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA			
Acetone	0.77	mg/kg	7800	NA	NA	NA	NA	NA	NA			NA			
Semivolatile Organic Compounds															
1,1-Biphenyl	0.18	mg/kg	0.8	NA	NA	NA	NA	NA	NA			NA			
2-Methylnaphthalene	0.71	mg/kg	123	NA	NA	NA	NA	NA	NA			NA			
Acenaphthene	2.2	mg/kg	43	NA	NA	NA	NA	NA	NA			NA			
Acenaphthylene	0.2	mg/kg	23	NA	NA	NA	NA	NA	NA			NA			
Anthracene	3.3	mg/kg	35	NA	NA	NA	NA	NA	NA			NA			
Benzo(a)anthracene	8.1	mg/kg	0.9	NA	NA	1.6E-01	1.6E+00	1.6E+01	NA			0.9	RDEC	5.6E-06	NA
Benzo(a)pyrene	6	mg/kg	0.4	240	NA	1.6E-02	1.6E-01	1.6E+00	NA			0.4	RDEC	2.5E-05	NA
Benzo(b)fluoranthene	8.8	mg/kg	0.9	NA	NA	1.6E-01	1.6E+00	1.6E+01	NA			0.9	RDEC	5.6E-06	NA
Benzo(g,h,i)perylene	2.8	mg/kg	0.8	NA	NA	NA	NA	NA	NA			0.8	RDEC	NA	4.4E-04
Benzo(k)fluoranthene	3.9	mg/kg	0.9	NA	NA	NA	NA	NA	NA			0.9	RDEC	5.6E-07	NA
Bis(2-ethylhexyl)phthalate	1.9	mg/kg	46	NA	NA	NA	NA	NA	NA			NA			
Chrysene	9.1	mg/kg	0.4	NA	NA	NA	NA	NA	NA			0.4	RDEC	2.5E-08	NA
Dibenzo(a,h)anthracene	0.96	mg/kg	0.4	NA	NA	1.6E-02	1.6E-01	1.6E+00	NA			0.4	RDEC	2.5E-05	NA
Fluoranthene	23	mg/kg	20	NA	NA	NA	NA	NA	NA			20	RDEC	NA	8.3E-03
Fluorene	2.3	mg/kg	28	NA	NA	NA	NA	NA	NA			NA			
Indeno(1,2,3-cd)pyrene	4.8	mg/kg	0.9	NA	NA	1.6E-01	1.6E+00	1.6E+01	NA			0.9	RDEC	5.6E-06	NA
Naphthalene	2	mg/kg	54	0.8	NA	NA	NA	NA	NA			0.8	Leachability	2.1E-07	6.2E-03
Phenanthrene	21	mg/kg	40	NA	NA	NA	NA	NA	NA			NA			
Pyrene	14	mg/kg	13	NA	NA	NA	NA	NA	NA			13	Res. DEC	NA	7.2E-03
Metals															
Antimony	0.32	mg/kg	10	NA	NA	NA	NA	NA	NA			NA			
Arsenic	20.7	mg/kg	7	NA	NA	6.8E-01	6.8E+00	6.8E+01	3.5E+01	14	1.7	14	Background	2.1E-05	4.0E-01
Barium	40.8	mg/kg	5500	NA	NA	NA	NA	NA	NA			NA			
Beryllium	0.65	mg/kg	1.5	NA	NA	NA	NA	NA	NA			NA			
Cadmium	0.42	mg/kg	39	NA	NA	NA	NA	NA	NA			NA			
Chromium[6]	24.3	mg/kg	390	NA	NA	3.0E-01	3.0E+00	3.0E+01	2.3E+02	18		18	Background	6.0E-05	7.8E-02
Copper	22.4	mg/kg	3100	NA	NA	NA	NA	NA	NA			NA			
Lead	127	mg/kg	150	NA	NA	NA	NA	NA	NA			NA			
Manganese	575	mg/kg	390	NA	NA	NA	NA	NA	NA	190		390	Res. DEC	NA	2.2E-01
Mercury	0.48	mg/kg	23	NA	NA	NA	NA	NA	NA			NA			
Nickel	25.3	mg/kg	1000	NA	NA	NA	NA	NA	NA			NA			
Selenium	0.73	mg/kg	390	NA	NA	NA	NA	NA	NA			NA			
Silver	0.11	mg/kg	200	NA	NA	NA	NA	NA	NA			NA			
Thallium	0.15	mg/kg	5.5	NA	NA	NA	NA	NA	NA			NA			
Vanadium	27.7	mg/kg	550	NA	NA	NA	NA	NA	NA			NA			
Zinc	82.2	mg/kg	6000	NA	NA	NA	NA	NA	NA			NA			
Petroleum Hydrocarbons															
TPH (C09-C36)	300	mg/kg	500	500	2500	NA	NA	NA	NA			NA			
													Sum =	1E-04	7E-01
													Sum (without Chromium[7]) =	9E-05	

Notes

ILCR - Incremental Lifetime Cancer Risk

HQ - Hazard Quotient

NA - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable

1. Only detected analytes which were considered risk drivers or have regulatory criteria have been presented.
2. RIDEM Rem. Regs. - RIDEM Remediation Regulations, DEM-DSR-01-93, February 2004, Table 1 (Residential Direct Exposure Criteria [DEC]) and Table 2 (Leachability Criteria); NA = no criterion available
3. Risk-based goals are developed based on risk results from the human health risk screening evaluation and consider the ingestion, dermal and inhalation routes of exposure, as applicable.

Calculations are subject to change based on future changes to toxicity values and exposure parameters; NA = Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable if not a risk driver

4. 95% UPL of background data set - ProUCL input and output can be found in this appendix; calculations only performed on metals which were either risk drivers or exceeded regulatory criteria.
5. Arsenic background based on Office Of Waste Management Policy Memo 00-01, Guidance for Arsenic in Soil, September 22, 2000
6. Residual Risk at PRG - determined by utilizing proportion of the Regional Screening Level (either at ILCR of $1x10^{-6}$ or HQ of 1) to the selected PRG.

   Regional Screening Levels (RSLs) - June 2015
7. Chromium speciation has not been performed for this site. At this time, chromium has been assumed to be hexavalent chromium even though there is no current evidence that it would be this species. Pre-design sampling/analysis is anticipated to show that most of the chromium detected is trivalent chromium. Upon confirmation of this assumption, chromium would no longer be a chemical of concern (COC) at this site.

TABLE 7. DEVELOPMENT OF HUMAN HEALTH INDUSTRIAL PRELIMINARY REMEDIATION GOALS (PRGs) FOR SOIL (INDUSTRIAL USE SCENARIO) AT DECISION UNIT 1-1

Analyte[1]	Maximum Detected Surface Soil Concentration	Maximum Detected Subsurface Soil Concentration	Units	Regulatory Criteria RIDEM Rem. Regs[2] I/C DEC	Leachability - GA	Leachability - GB	Risk-Based Goals[3] ILCR 10^{-6}	10^{-5}	10^{-4}	HQ = 1	Additional Information Site-specific Background[4]	RI Background[5]	Selected Industrial PRG for Surface Soil	Basis	Selected Industrial PRG for Subsurface Soil	Basis
Volatile Organic Compounds																
2-Butanone	0.058	0.018	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Acetone	0.77	0.4	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Semivolatile Organic Compounds																
1,1-Biphenyl	0.18	NA	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
2-Methylnaphthalene	0.71	NA	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Acenaphthene	2.2	0.022	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Acenaphthylene	0.2	0.0015	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Anthracene	3.3	0.038	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Benzo(a)anthracene	8.1	0.13	mg/kg	7.8	NA	NA	NA	NA	NA	NA			7.8	I/C DEC	NA	
Benzo(a)pyrene	6	0.084	mg/kg	0.8	240	NA	NA	NA	NA	NA			0.8	I/C DEC	NA	
Benzo(b)fluoranthene	8.8	0.16	mg/kg	7.8	NA	NA	NA	NA	NA	NA			7.8	I/C DEC	NA	
Benzo(g,h,i)perylene	2.8	0.043	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Benzo(k)fluoranthene	3.9	0.055	mg/kg	78	NA	NA	NA	NA	NA	NA			NA		NA	
Bis(2-ethylhexyl)phthalate	1.9	0.5	mg/kg	410	NA	NA	NA	NA	NA	NA			NA		NA	
Chrysene	9.1	0.13	mg/kg	780	NA	NA	NA	NA	NA	NA			NA		NA	
Dibenzo(a,h)anthracene	0.96	0.016	mg/kg	0.8	NA	NA	NA	NA	NA	NA			0.8	I/C DEC	NA	
Fluoranthene	23	0.28	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Fluorene	2.3	0.019	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Indeno(1,2,3-cd)pyrene	4.8	0.091	mg/kg	7.8	NA	NA	NA	NA	NA	NA			NA		NA	
Naphthalene	2	0.006	mg/kg	10000	0.8	NA	NA	NA	NA	NA			0.8	Leachability	NA	
Phenanthrene	21	0.19	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Pyrene	14	0.2	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Metals																
Antimony	0.32	0.044	mg/kg	820	NA	NA	NA	NA	NA	NA			NA		NA	
Arsenic	20.7	11.9	mg/kg	7	NA	NA	NA	NA	NA	NA	14	1.7	14	Background	NA	(7)
Barium	40.8	36	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Beryllium	0.65	0.61	mg/kg	1.5	NA	NA	NA	NA	NA	NA			NA		NA	
Cadmium	0.42	0.23	mg/kg	1000	NA	NA	NA	NA	NA	NA			NA		NA	
Chromium	24.3	24.2	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Copper	22.4	43.3	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Lead	127	22.6	mg/kg	500	NA	NA	NA	NA	NA	NA			NA		NA	
Manganese	575	345	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Mercury	0.48	0.23	mg/kg	610	NA	NA	NA	NA	NA	NA			NA		NA	
Nickel	25.3	27	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Selenium	0.73	0.72	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Silver	0.11	0.08	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Thallium	0.15	0.13	mg/kg	140	NA	NA	NA	NA	NA	NA			NA		NA	
Vanadium	27.7	22.5	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Zinc	82.2	61.6	mg/kg	10000	NA	NA	NA	NA	NA	NA			NA		NA	
Petroleum Hydrocarbons																
TPH (C09-C36)	300	47	mg/kg	2500	500	2500	NA	NA	NA	NA			NA		NA	

Notes

ILCR - Incremental Lifetime Cancer Risk

HQ - Hazard Quotient

NA - Not carcinogenic, or a carcinogen was not evaluated for potential non-carcinogenic effects; not applicable

1. Only detected analytes which were considered risk drivers or have regulatory criteria have been presented.
2. RIDEM Rem. Regs. - RIDEM Remediation Regulations, DEM-DSR-01-93, November 2011, Table 1 (Industrial/Commercial Direct Exposure Criteria [DEC]) and Table 2 (Leachability Criteria); NA = no criterion available
3. Risk-based goals are not included because risks to a commercial/industrial works from exposure to soils at the Ethyl Blending Plant did not exceed USEPA's target risk range as presented in the human health risk screening evaluation.
   NA = Not applicable
4. 95% UPL of background data set - ProUCL input and output can be found in this appendix; calculations only performed on metals which were either risk drivers or exceeded regulatory criteria.
5. Arsenic background based on Office Of Waste Management Policy Memo 00-01, Guidance for Arsenic in Soil, September 22, 2000
6. Analyte exceeded the I/C DEC but did not exceed the higher background value.
7. No PRG was selected because although regulatory criteria are exceeded for this COC, the maximum concentration is below the background value.

TABLE 8. DERIVATION OF PRGs FOR THE SHORT-TAILED SHREW AT DECISION UNITS 1-2 and 1-3

Total Daily Dose (TDD) = $\frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] \times ED \times AUF}{\text{Body Weight}}$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of soil (kg/day)
C_f = Concentration of COC in food (mg/kg)
C_s= Concentration of COC in soil (mg/kg)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range, etc,... relative to the size of exposure area)

ASSUMPTIONS FOR THE SHORT-TAILED SHREW	
Average Body Weight (kg)	0.0161
Exposure Duration (ED)	1.0
Area Use Factor (AUF)	0.10
Average Soil Consumption Rate (kg_{dw}/day)	0.0000129
Average Soil Invt.Consumption Rate (kg_{dw}/day)	0.001430

SUPPORTING CALCULATIONS

COC	Media Concentrations			Potential Total Daily Dose (mg/kg_{bw}/day)			Geometric Mean of LOAEL- and NOAEL-based TRVs (mg/kg_{bw}/day)	HQ
	Soil PRG (mg/kg_{dw})	Soil BAF	Soil Invertebrate (mg/kg_{dw})	Soil	Soil Invertebrate	Total		
POLYCHLORINATED BIPHENYLS - CALCULATION OF PRELIMINARY REMEDIAL GOALS								
Total PCBs	3.4	6.67	22.7	0.000272	0.201	0.201	0.215	1

Notes:
BAF - Bioaccumulation Factor.
dw - Dry Weight.
HQ - Hazard Quotient (TDD/TRV).
LOAEL - Lowest Observed Adverse Effects Level.
NOAEL - No Observed Adverse Effects Level.
PRG - Preliminary Remediation Goal. Soil concentration that results in a TDD equal to the TRV (i.e., HQ = 1).
TRV - Toxicity Reference Value.

Exposure assumptions reflect the average inputs used in the Step 3a evaulation in the Data Gaps Assessment (Tetra Tech, 2014; see Table I.1).
BAF represents the average soil-to-earthworm BAF used in the Step 3a evaulation in the Data Gaps Assessment (Tetra Tech, 2014; see Table I.3).
TRVs represent the values used in the Step 3a evaulation in the Data Gaps Assessment (Tetra Tech, 2014; see Table I.5).
NOAEL TRV = 0.068 mg/kg_{bw}/day
LOAEL TRV = 0.68 mg/kg_{bw}/day
Shrew AUF assumed to be 0.1 (10% of the home range of 0.97 acres).
BAF and TRVs are the same for Aroclor 1254 and 1260. Therefore, PRG applies to the Total PCB concentration.

TABLE 9. DERIVATION OF PRGs FOR THE AMERICAN ROBIN AT DECISION UNITS 1-2 and 1-3

ASSUMPTIONS FOR THE AMERICAN ROBIN	
Average Body Weight (kg)	0.0804
Exposure Duration	1.0
Area Use Factor	0.10
Average Soil Consumption Rate (kg_{dw}/day)	0.00076
Average Soil Invt.Consumption Rate (kg_{dw}/day)	0.0119

$$\text{Total Daily Dose (TDD)} = \frac{\Sigma([IR_f \times C_f] + [IR_s \times C_s] \times ED \times AUF}{\text{Average Body Weight}}$$

Where:
IR_f = Ingestion rate of food (kg/day)
IR_s = Incidental ingestion rate of soil (kg/day)
C_f = Concentration of COC in food (mg/kg)
C_s= Concentration of COC in soil (mg/kg)
ED = Exposure duration (fraction of time receptor spends within exposure area)
AUF = Area use factor (ratio of the receptor's home range, etc,... relative to the size of exposure area)

SUPPORTING CALCULATIONS

COC	Media Concentrations			Potential Total Daily Dose (mg/kg_{bw}/day)			Geometric Mean of LOAEL- and NOAEL-based TRVs	HQ
	Soil PRG (mg/kg_{dw})	Soil BAF	Soil Invertebrate (mg/kg_{dw})	Soil	Soil Invertebrate	Total	(mg/kg_{bw}/day)	
POLYCHLORINATED BIPHENYLS - CALCULATION OF PRELIMINARY REMEDIAL GOALS								
Total PCBs	5.7	6.67	38.1	0.0054	0.56	0.57	0.57	1

Notes:
BAF - Bioaccumulation Factor.
dw - Dry Weight.
HQ - Hazard Quotient (TDD/TRV).
LOAEL - Lowest Observed Adverse Effects Level.
NOAEL - No Observed Adverse Effects Level.
PRG - Preliminary Remediation Goal. Soil concentration that results in a TDD equal to the TRV (i.e., HQ = 1).
TRV - Toxicity Reference Value.

Exposure assumptions reflect the average inputs used in the Step 3a evaulation in the Data Gaps Assessment (Tetra Tech, 2014; see Table I.1).
BAF represents the average soil-to-earthworm BAF used in the Step 3a evaulation in the Data Gaps Assessment (Tetra Tech, 2014; see Table I.3).
TRVs represent the values used in the Step 3a evaulation in the Data Gaps Assessment (Tetra Tech, 2014; see Table I.5).
NOAEL TRV = 0.18 mg/kg_{bw}/day
LOAEL TRV = 1.8 mg/kg_{bw}/day
Robin AUF assumed to be 0.1 (10% of the home range of 0.97 acres).
BAF and TRVs are the same for Aroclor 1254 and 1260. Therefore, PRG applies to the Total PCB concentration.

TABLE 10. SUMMARY OF ECOLOGICAL PRGs FOR DECISION UNITS 1-2 and 1-3

Analyte	Ecological PRG (mg/kg)	Basis	Recommended Ecological PRG (mg/kg)	Basis
Total PCBs	3.4	Short-tailed shrew PRG	3.4	Shrew PRG (lower of the shrew and robin PRGs)
	5.7	American robin PRG		

Notes:
LOAEL - Lowest Observed Adverse Effects Level.
NOAEL - No Observed Adverse Effects Level.
PRG - Preliminary Remediation Goal.

Ecological PRGs were derived using food web assumptions from Data Gaps Assessment (Tetra Tech, 2014).
PRGs assume shrew and robin obtain 10% of their diet from the transformer vault.

TABLE 11. DEVELOPMENT OF PRELIMINARY REMEDIATION GOALS (PRGs) FOR SOIL AT DECISION UNITS 1-2 and 1-3

Analyte[1]	Maximum Detected Concentration	Units	Regulatory Criteria RIDEM Rem. Regs[2]				Insectivorous Ecological Receptor Exposure Scenario[3]	Selected PRG	Basis
			RDEC	I/C DEC	Leachability - GA	Leachability - GB			
Polychlorinated biphenyls (PCBs)									
PCBs	24	mg/kg	10	10	10	10	3.4	1	EPA Residential Guidance Value [4]

Notes
1. Only detected analytes which were considered risk drivers or have regulatory criteria have been presented.
2. RIDEM Rem. Regs. - RIDEM Remediation Regulations, DEM-DSR-01-93, November 2011, Table 1 (Residential and Industrial/Commercial Direct Exposure Criteria [DEC]) and Table 2 (Leachability Criteria); NA = no criterion available

3. The geometric mean of the no observed adverse effects level- (NOAEL) and lowest observed adverse effects level- (LOAEL) based TRVs and an area use factor (AUF) of 10% were used to derive PRGs for the American robin and the short-tailed shrew. The lower of the two values is recommended as the ecological PRG for insectivores.

4. USEPA, 1990.

Analytical Results
NS Newport
As BACKGROUND

	Site	SITE 00002	SITE 00002	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BKG-SS03-NEB	BKG-SS09-NEB	BWBK-NE01	BWBK-NE02	BWBK-NE03	BWBK-NE04	BWBK-NE05
	Depth	0 - 1.6 ft	0 - 1.8 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft
	Date	1/1/1900 00:00	1/1/1900 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BKG-SS03-NEB-0016	BKG-SS09-NEB-0018	BWBK-SS-NE01-0001	BWBK-SS-NE02-0001	BWBK-SS-NE03-0001	BWBK-SS-NE04-0001	BWBK-SS-NE05-0001
Analyte	**Units**							
Metals								
ARSENIC	mg/kg	**6.2 J**	**10.8 J**	**14.5**	**17.1**	**8.6**	**6.7**	**9.4**

Analytical Results
NS Newport
As BACKGROUND

	Site	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE06	BWBK-NE07	BWBK-NE08	BWBK-NE09	BWBK-NE10	BWBK-NE101	BWBK-NE102
	Depth	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft
	Date	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	3/27/2007 00:00	3/27/2007 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SS-NE06-0001	BWBK-SS-NE07-0001	BWBK-SS-NE08-0001	BWBK-SS-NE09-0001	BWBK-SS-NE10-0001	BWBK-SS-NE101-0001	BWBK-SS-NE102-0001
Analyte	**Units**							
Metals								
ARSENIC	mg/kg	**5.6**	**11.7**	**6.4**	**8.3**	**8.2**	**3.1**	**2.4**

Analytical Results
NS Newport
As BACKGROUND

	Site	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE103	BWBK-NE104	BWBK-NE105	BWBK-NE106	BWBK-NE107	BWBK-NE108	BWBK-NE109
	Depth	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft
	Date	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SS-NE103-0001	BWBK-SS-NE104-0001	BWBK-SS-NE105-0001	BWBK-SS-NE106-0001	BWBK-SS-NE107-0001	BWBK-SS-NE108-0001	BWBK-SS-NE109-0001
Analyte	**Units**							
Metals								
ARSENIC	mg/kg	**2.8**	**2.4**	**2.2**	**2.3**	**2.3**	**2.4**	**1.7**

Analytical Results
NS Newport
As BACKGROUND

	Site	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE110	BWBK-NE01	BWBK-NE02	BWBK-NE03	BWBK-NE04	BWBK-NE05	BWBK-NE06
	Depth	0 - 1 ft	1 - 8 ft	1 - 9 ft	1 - 5 ft	1 - 10 ft	1 - 8 ft	1 - 9 ft
	Date	3/27/2007 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SS-NE110-0001	BWBK-SB-NE01-0108	BWBK-SB-NE02-0109	BWBK-SB-NE03-0105	BWBK-SB-NE04-0110	BWBK-SB-NE05-0108	BWBK-SB-NE06-0109
Analyte	**Units**							
Metals								
ARSENIC	mg/kg	**3**	**5.2**	**5.8**	**5.5**	**4.6**	**5**	**4.9**

Analytical Results
NS Newport
As BACKGROUND

Analyte	Site / Location / Depth / Date / Matrix / Type / Sample / Units	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE07	BWBK-NE08	BWBK-NE09	BWBK-NE10	BWBK-NE101	BWBK-NE102	BWBK-NE103
	Depth	1 - 7 ft	1 - 4 ft	1 - 10 ft	1 - 7 ft	1 - 10 ft	1 - 10 ft	1 - 10 ft
	Date	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SB-NE07-0107	BWBK-SB-NE08-0104	BWBK-SB-NE09-0110	BWBK-SB-NE10-0107	BWBK-SB-NE101-0110	BWBK-SB-NE102-0110	BWBK-SB-NE103-0110
Analyte	**Units**							
Metals								
ARSENIC	mg/kg	**5.2**	**4.4**	**4.3**	**3.8**	**3.2**	**2.6**	**2.4**

Analytical Results
NS Newport
As BACKGROUND

Analyte	Units	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE104	BWBK-NE105	BWBK-NE106	BWBK-NE107	BWBK-NE108	BWBK-NE109	BWBK-NE110
	Depth	1 - 10 ft	1 - 10 ft	1 - 10 ft	5 - 10 ft	1 - 10 ft	1 - 10 ft	1 - 10 ft
	Date	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SB-NE104-0110	BWBK-SB-NE105-0110	BWBK-SB-NE106-0110	BWBK-SB-NE107-0510	BWBK-SB-NE108-0110	BWBK-SB-NE109-0110	BWBK-SB-NE110-0110
Metals								
ARSENIC	mg/kg	**2.1**	**3.7**	**2.6**	**1.9**	**2.2**	**2.2**	**2.6**

Analytical Results
NS Newport
Cr Mn BACKGROUND

Analyte	Site / Location / Depth / Date / Matrix / Type / Sample / Units							
	Site	SITE 00002	SITE 00002	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BKG-SS03-NEB	BKG-SS09-NEB	BWBK-NE01	BWBK-NE02	BWBK-NE03	BWBK-NE04	BWBK-NE05
	Depth	0 - 1.6 ft	0 - 1.8 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft
	Date	1/1/1900 00:00	1/1/1900 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BKG-SS03-NEB-0016	BKG-SS09-NEB-0018	BWBK-SS-NE01-0001	BWBK-SS-NE02-0001	BWBK-SS-NE03-0001	BWBK-SS-NE04-0001	BWBK-SS-NE05-0001
Analyte	**Units**							
Metals								
CHROMIUM, TOTAL	mg/kg	**12**	**11.4**	**17.1**	**17**	**14.5**	**15.7**	**16.7**
MANGANESE	mg/kg	**204**	**179**	**290**	**222**	**192**	**253**	**208**

Analytical Results
NS Newport
Cr Mn BACKGROUND

	Site	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE06	BWBK-NE07	BWBK-NE08	BWBK-NE09	BWBK-NE10	BWBK-NE101	BWBK-NE102
	Depth	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft
	Date	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	9/13/2006 00:00	3/27/2007 00:00	3/27/2007 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SS-NE06-0001	BWBK-SS-NE07-0001	BWBK-SS-NE08-0001	BWBK-SS-NE09-0001	BWBK-SS-NE10-0001	BWBK-SS-NE101-0001	BWBK-SS-NE102-0001
Analyte	**Units**							
Metals								
CHROMIUM, TOTAL	mg/kg	**15.2**	**14.4**	**14.2**	**13.9**	**12.8**	**10.3**	**7.9**
MANGANESE	mg/kg	**184**	**177**	**185**	**219**	**193**	**146**	**128**

Analytical Results
NS Newport
Cr Mn BACKGROUND

Analyte	Units							
	Site	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND
	Location	BWBK-NE103	BWBK-NE104	BWBK-NE105	BWBK-NE106	BWBK-NE107	BWBK-NE108	BWBK-NE109
	Depth	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft	0 - 1 ft
	Date	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00	3/27/2007 00:00
	Matrix	SO	SO	SO	SO	SO	SO	SO
	Type	N	N	N	N	N	N	N
	Sample	BWBK-SS-NE103-0001	BWBK-SS-NE104-0001	BWBK-SS-NE105-0001	BWBK-SS-NE106-0001	BWBK-SS-NE107-0001	BWBK-SS-NE108-0001	BWBK-SS-NE109-0001
Metals								
CHROMIUM, TOTAL	mg/kg	**8.3**	**7.9**	**6.6**	**7.1**	**6.6**	**7.1**	**6.3**
MANGANESE	mg/kg	**104**	**133**	**119**	**130**	**164**	**129**	**119**

Analytical Results
NS Newport
Cr Mn BACKGROUND

	Site	BACKGROUND
	Location	BWBK-NE110
	Depth	0 - 1 ft
	Date	3/27/2007 00:00
	Matrix	SO
	Type	N
	Sample	BWBK-SS-NE110-0001
Analyte	**Units**	
Metals		
CHROMIUM, TOTAL	mg/kg	**6.6**
MANGANESE	mg/kg	**85.5**

	A–E	F	G–K	L
1		Background Statistics for Data Sets with Non-Detects		
2	**User Selected Options**			
3	Date/Time of Computation	12/1/2014 9:05:36 AM		
4	From File	As Cr Mn background data set-ProUCL Input.xls		
5	Full Precision	OFF		
6	Confidence Coefficient	95%		
7	Coverage	95%		
8	rent or Future K Observations	1		
9	mber of Bootstrap Operations	2000		
10				
11	ARSENIC			
12				
13	General Statistics			
14	Total Number of Observations	42	Number of Distinct Observations	33
15	Minimum	1.7	First Quartile	2.4
16	Second Largest	14.5	Median	4.05
17	Maximum	17.1	Third Quartile	6.1
18	Mean	5.055	SD	3.518
19	Coefficient of Variation	0.696	Skewness	1.712
20	Mean of logged Data	1.43	SD of logged Data	0.601
21				
22	**Critical Values for Background Threshold Values (BTVs)**			
23	Tolerance Factor K (For UTL)	2.104	d2max (for USL)	2.887
24				
25	**Normal GOF Test**			
26	Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk GOF Test**	
27	5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level	
28	Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
29	5% Lilliefors Critical Value	0.137	Data Not Normal at 5% Significance Level	
30	**Data Not Normal at 5% Significance Level**			
31				
32	**Background Statistics Assuming Normal Distribution**			
33	95% UTL with 95% Coverage	12.45	90% Percentile (z)	9.563
34	95% UPL (t)	11.04	95% Percentile (z)	10.84
35	95% USL	15.21	99% Percentile (z)	13.24
36				
37	**Gamma GOF Test**			
38	A-D Test Statistic	1.204	**Anderson-Darling Gamma GOF Test**	
39	5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level	
40	K-S Test Statistic	0.144	**Kolmogrov-Smirnoff Gamma GOF Test**	
41	5% K-S Critical Value	0.138	Data Not Gamma Distributed at 5% Significance Level	
42	**Data Not Gamma Distributed at 5% Significance Level**			
43				
44	**Gamma Statistics**			
45	k hat (MLE)	2.788	k star (bias corrected MLE)	2.604
46	Theta hat (MLE)	1.813	Theta star (bias corrected MLE)	1.941
47	nu hat (MLE)	234.2	nu star (bias corrected)	218.8
48	MLE Mean (bias corrected)	5.055	MLE Sd (bias corrected)	3.132
49				
50	**Background Statistics Assuming Gamma Distribution**			
51	95% Wilson Hilferty (WH) Approx. Gamma UPL	11.15	90% Percentile	9.252
52	95% Hawkins Wixley (HW) Approx. Gamma UPL	11.23	95% Percentile	11.06
53	95% WH Approx. Gamma UTL with 95% Coverage	13.36	99% Percentile	15
54	95% HW Approx. Gamma UTL with 95% Coverage	13.62		
55	95% WH USL	18.5	95% HW USL	19.38
56				
57	**Lognormal GOF Test**			
58	Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk Lognormal GOF Test**	
59	5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level	
60	Lilliefors Test Statistic	0.142	**Lilliefors Lognormal GOF Test**	
61	5% Lilliefors Critical Value	0.137	Data Not Lognormal at 5% Significance Level	
62	**Data Not Lognormal at 5% Significance Level**			
63				
64	**Background Statistics assuming Lognormal Distribution**			

95% UTL with 95% Coverage	14.8	90% Percentile (z)	9.029
95% UPL (t)	11.63	95% Percentile (z)	11.23
95% USL	23.7	99% Percentile (z)	16.92

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for Background Threshold Values

Order of Statistic, r	42	95% UTL with 95% Coverage	17.1
Approximate f	2.211	Confidence Coefficient (CC) achieved by UTL	0.884
95% Percentile Bootstrap UTL with 95% Coverage	16.97	95% BCA Bootstrap UTL with 95% Coverage	16.83
95% UPL	14.08	90% Percentile	9.32
90% Chebyshev UPL	15.73	95% Percentile	11.66
95% Chebyshev UPL	20.57	99% Percentile	16.03
95% USL	17.1		

Note: The use of USL to estimate a BTV is recommended only when the data set represents a background data set free of outliers and consists of observations collected from clean unimpacted locations. The use of USL tends to provide a balance between false positives and false negatives provided the data represents a background data set and when many onsite observations need to be compared with the BTV.

CHROMIUM

General Statistics

Total Number of Observations	22	Number of Distinct Observations	18
Minimum	6.3	First Quartile	7.3
Second Largest	17	Median	11.7
Maximum	17.1	Third Quartile	14.48
Mean	11.35	SD	3.948
Coefficient of Variation	0.348	Skewness	0.0465
Mean of logged Data	2.366	SD of logged Data	0.368

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.349	d2max (for USL)	2.603

Normal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.189	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.189	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	20.62	90% Percentile (z)	16.4
95% UPL (t)	18.29	95% Percentile (z)	17.84
95% USL	21.62	99% Percentile (z)	20.53

Gamma GOF Test

A-D Test Statistic	1.04	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.176	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.186	etected data appear Gamma Distributed at 5% Significance Lev

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.176	k star (bias corrected MLE)	7.091
Theta hat (MLE)	1.388	Theta star (bias corrected MLE)	1.6
nu hat (MLE)	359.7	nu star (bias corrected)	312
MLE Mean (bias corrected)	11.35	MLE Sd (bias corrected)	4.26

Background Statistics Assuming Gamma Distribution

95% Wilson Hilferty (WH) Approx. Gamma UPL	19.44	90% Percentile	17.03
95% Hawkins Wixley (HW) Approx. Gamma UPL	19.65	95% Percentile	19.14
95% WH Approx. Gamma UTL with 95% Coverage	23.08	99% Percentile	23.52

129	95% HW Approx. Gamma UTL with 95% Coverage	23.55		
130	95% WH USL	24.78	95% HW USL	25.4
131				
132	**Lognormal GOF Test**			
133	Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk Lognormal GOF Test**	
134	5% Shapiro Wilk Critical Value	0.911	Data Not Lognormal at 5% Significance Level	
135	Lilliefors Test Statistic	0.174	**Lilliefors Lognormal GOF Test**	
136	5% Lilliefors Critical Value	0.189	Data appear Lognormal at 5% Significance Level	
137	**Data appear Approximate Lognormal at 5% Significance Level**			
138				
139	**Background Statistics assuming Lognormal Distribution**			
140	95% UTL with 95% Coverage	25.32	90% Percentile (z)	17.09
141	95% UPL (t)	20.38	95% Percentile (z)	19.53
142	95% USL	27.8	99% Percentile (z)	25.11
143				
144	**Nonparametric Distribution Free Background Statistics**			
145	**Data appear Approximate Normal at 5% Significance Level**			
146				
147	**Nonparametric Upper Limits for Background Threshold Values**			
148	Order of Statistic, r	22	95% UTL with 95% Coverage	17.1
149	Approximate f	1.158	Confidence Coefficient (CC) achieved by UTL	0.676
150	95% Percentile Bootstrap UTL with 95% Coverage	17.1	95% BCA Bootstrap UTL with 95% Coverage	17.1
151	95% UPL	17.09	90% Percentile	16.6
152	90% Chebyshev UPL	23.45	95% Percentile	16.99
153	95% Chebyshev UPL	28.94	99% Percentile	17.08
154	95% USL	17.1		
155				
156	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background			
157	data set free of outliers and consists of observations collected from clean unimpacted locations.			
158	The use of USL tends to provide a balance between false positives and false negatives provided the data			
159	represents a background data set and when many onsite observations need to be compared with the BTV.			
160				
161	MANGANESE			
162				
163	General Statistics			
164	Total Number of Observations	22	Number of Distinct Observations	21
165	Minimum	85.5	First Quartile	129.3
166	Second Largest	253	Median	178
167	Maximum	290	Third Quartile	201.3
168	Mean	171.1	SD	50.83
169	Coefficient of Variation	0.297	Skewness	0.431
170	Mean of logged Data	5.099	SD of logged Data	0.305
171				
172	**Critical Values for Background Threshold Values (BTVs)**			
173	Tolerance Factor K (For UTL)	2.349	d2max (for USL)	2.603
174				
175	**Normal GOF Test**			
176	Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**	
177	5% Shapiro Wilk Critical Value	0.911	Data appear Normal at 5% Significance Level	
178	Lilliefors Test Statistic	0.137	**Lilliefors GOF Test**	
179	5% Lilliefors Critical Value	0.189	Data appear Normal at 5% Significance Level	
180	**Data appear Normal at 5% Significance Level**			
181				
182	**Background Statistics Assuming Normal Distribution**			
183	95% UTL with 95% Coverage	290.5	90% Percentile (z)	236.2
184	95% UPL (t)	260.5	95% Percentile (z)	254.7
185	95% USL	303.4	99% Percentile (z)	289.3
186				
187	**Gamma GOF Test**			
188	A-D Test Statistic	0.298	**Anderson-Darling Gamma GOF Test**	
189	5% A-D Critical Value	0.743	etected data appear Gamma Distributed at 5% Significance Lev	
190	K-S Test Statistic	0.13	**Kolmogrov-Smirnoff Gamma GOF Test**	
191	5% K-S Critical Value	0.185	etected data appear Gamma Distributed at 5% Significance Lev	
192	**Detected data appear Gamma Distributed at 5% Significance Level**			

193				
194	**Gamma Statistics**			
195	k hat (MLE)	11.73	k star (bias corrected MLE)	10.16
196	Theta hat (MLE)	14.59	Theta star (bias corrected MLE)	16.84
197	nu hat (MLE)	516	nu star (bias corrected)	447
198	MLE Mean (bias corrected)	171.1	MLE Sd (bias corrected)	53.67
199				
200	**Background Statistics Assuming Gamma Distribution**			
201	95% Wilson Hilferty (WH) Approx. Gamma UPL	271.1	90% Percentile	242.4
202	95% Hawkins Wixley (HW) Approx. Gamma UPL	273	95% Percentile	267.8
203	95% WH Approx. Gamma UTL with 95% Coverage	314.2	99% Percentile	320
204	95% HW Approx. Gamma UTL with 95% Coverage	318.6		
205	95% WH USL	334.1	95% HW USL	339.9
206				
207	**Lognormal GOF Test**			
208	Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**	
209	5% Shapiro Wilk Critical Value	0.911	Data appear Lognormal at 5% Significance Level	
210	Lilliefors Test Statistic	0.146	**Lilliefors Lognormal GOF Test**	
211	5% Lilliefors Critical Value	0.189	Data appear Lognormal at 5% Significance Level	
212	**Data appear Lognormal at 5% Significance Level**			
213				
214	**Background Statistics assuming Lognormal Distribution**			
215	95% UTL with 95% Coverage	335.3	90% Percentile (z)	242.2
216	95% UPL (t)	280.2	95% Percentile (z)	270.5
217	95% USL	362.3	99% Percentile (z)	333
218				
219	**Nonparametric Distribution Free Background Statistics**			
220	**Data appear Normal at 5% Significance Level**			
221				
222	**Nonparametric Upper Limits for Background Threshold Values**			
223	Order of Statistic, r	22	95% UTL with 95% Coverage	290
224	Approximate f	1.158	Confidence Coefficient (CC) achieved by UTL	0.676
225	95% Percentile Bootstrap UTL with 95% Coverage	290	95% BCA Bootstrap UTL with 95% Coverage	290
226	95% UPL	284.5	90% Percentile	221.7
227	90% Chebyshev UPL	327	95% Percentile	251.5
228	95% Chebyshev UPL	397.6	99% Percentile	282.2
229	95% USL	290		
230				
231	Note: The use of USL to estimate a BTV is recommended only when the data set represents a background			
232	data set free of outliers and consists of observations collected from clean unimpacted locations.			
233	The use of USL tends to provide a balance between false positives and false negatives provided the data			
234	represents a background data set and when many onsite observations need to be compared with the BTV.			
235				

Appendix D

ARARs And To Be Considered Guidance

CHEMICAL-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-2: LIMITED SOIL EXCAVATION WITH LAND USE CONTROLS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Human Health Assessment Cancer Slope Factors (CSFs)	None	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	Used to compute the potential carcinogenic risks caused by exposure to contaminants in site media.
EPA Risk Reference Doses (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 in side media.
Guidelines for Carcinogenic Risk Assessment	EPA/630/P-03/001F (March 2005)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	Used to calculate potential carcinogenic risks caused by exposure to contaminants in site media.
Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens	EPA/630/R-03/003F(March 2005)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	Used to calculate potential carcinogenic risks to children caused by exposure to contaminants in site media.
EPA Guidance on Remedial Actions for Superfund Sites with PCB Contamination	EPA/540/G-90/007 (August 1990)	To Be Considered	This guidance provided preliminary remediation goals (PRGs) for PCBs for various media.	Used in the development of the Residential PRG for surface soil at DU 1-2 and 1-3 to be protective of unrestricted use by humans. LUCs will ensure that accessible soil exceeding human health and ecological risk levels will be removed and the inaccessible soil under structures be assessed if the structures are removed. Future demolition of the TV structures will be conducted so as not to cause any release of PCBs.”
Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments	EPA/540/R-97/006	To Be Considered	EPA guidance for conducting ecological risk assessments	Used to calculate potential wildlife risks and PRGs. The action to be taken under this alternative will mitigate risk to receptors through excavation of soil that exceeds the ecological PRG at DU 1-2 and 1-3.
Final Guidelines for Ecological Risk Assessment	EPA/630/R095/002F	To Be Considered	EPA guidance for conducting ecological risk assessments	Used to calculate potential wildlife risks and PRGs. The action to be taken under this alternative will mitigate risk to receptors through excavation of soil that exceeds the ecological PRG at DU 1-2 and 1-3.

CHEMICAL-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-2: LIMITED SOIL EXCAVATION WITH LAND USE CONTROLS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Guidance for Developing Ecological Soil Screening Levels	OSWER Directive 9285.7-55	To Be Considered	EPA guidance for generating ecological soil screening levels	Used to calculate potential wildlife risks and PRGs. The action to be taken under this alternative will mitigate risk to receptors through excavation of soil that exceeds the ecological PRG at DU 1-2 and 1-3.
Toxicological Benchmarks for Wildlife: 1996 Revision	ES/ER/TM-86/R3	To Be Considered	Oak Ridge National Laboratory guidance on toxicity values for wildlife	Used to calculate potential wildlife risks and PRGs. The action to be taken under this alternative will mitigate risk to receptors through excavation of soil that exceeds the ecological PRG at DU 1-2 and 1-3.
Wildlife Exposure Factors Handbook. Vols. I and II	EPA/600-R/R-93/187a	To Be Considered	EPA guidance on identifying exposure parameters for wildlife	Used to calculate potential wildlife risks and PRGs. The action to be taken under this alternative will mitigate risk to receptors through excavation of soil that exceeds the ecological PRG at DU 1-2 and 1-3.
Development and Validation of Bioaccumulation Models for Earthworms	ES/ER/TM-220	To Be Considered	Oak Ridge National Laboratory guidance on uptake of contaminants from soil to earthworms	Used to calculate potential wildlife risks and PRGs. The action to be taken under this alternative will mitigate risk to receptors through excavation of soil that exceeds the ecological PRG at DU 1-2 and 1-3.
State				
State of Rhode Island 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, Section 8.02 (with the exception of 8.02A(iv)-TPH)	Applicable	These regulations set direct contact and leachability remediation standards for soil. These standards are applicable to a CERCLA remedy when they are more stringent than federal standards.	Soil Direct Exposure Criteria (DEC) and Leachability Criteria were used in the development of RGs for surface soil at DU 1-1, 1-2, and 1-3. The action to be taken under this alternative for surface soil at DU 1-1, 1-2, and 1-3 will meet the remediation regulations through excavation of soil that exceeds the RGs for industrial use (including GA Leachability Criteria) and land use controls to restrict residential use.

LOCATION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-2: LIMITED SOIL EXCAVATION WITH LAND USE CONTROLS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Federal Endangered Species Act of 1973 (ESA); Endangered and Threatened Wildlife and Plants, Special Rules: Northern Long-Eared Bat	16 U.S.C. 1531 et seq.; 50 C.F.R § 17.40(o)	Applicable	The purpose of the ESA is to "conserve the ecosystems upon with threatened and endangered species depend" and to conserve and recover listed species. Federal agencies must consult with the U.S. Fish and Wildlife Service to ensure that the actions they authorize, fund, or carry out will not jeopardize listed species. The Northern Long-Eared Bat (NLEB) is listed as federally threatened. The NLEB range includes Coastal New England towns, such as Portsmouth, RI.	This requirement may be applicable if clearing of trees of 3 inch dbh or larger is needed during the remedial action and the work is to be conducted within the April 15th -September 30th time-of-year restriction, under the assumed presence of the NLEB in the area of the site. The U.S. Fish and Wildlife Service will be consulted with, if required, during the planning process so that investigations and remedial actions do not adversely impact bat populations or habitat. Unused structures will be evaluated for overwintering bat habitat and, if present, appropriate mitigation measures for the remediation will be instituted in consultation with the USFWS.

ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-2: LIMITED SOIL EXCAVATION WITH LAND USE CONTROLS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Federal				
Clean Air Act (CAA), Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants (NESHAPS)	42 U.S.C. § 112(b)(1); 40 C.F.R. Part 61	Applicable	The regulations establish emissions standards for 189 hazardous air pollutants. Standards set for dust and other release sources.	If the excavation of contaminated soil at DU 1-1, 1-2, and 1-3 generates regulated air pollutants, then measures will be implemented to meet these standards.
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 Ecological and Industrial PCB cleanup levels at DU 1-2 and 1-3 will be excavated and disposed of off-site. LUCs will restrict residential and other unrestricted use for surface soil that will remain above the Residential RG. LUCs will also prevent exposure to soil beneath existing transformer vault foundations through maintenance of the transformer vault foundations, since that soil has not been assessed. If the transformer vaults are demolished in the future, the underlying soils will be assessed and remediated, if needed, to meet the Ecological and Industrial RGs. If and when TV2 and/or TV3 are demolished in the future, the demolition will meet TSCA protectiveness standards so as not to create a threat of release to the environment. The excavation, transportation, and management of PCB contaminated media will be performed in a manner to comply with TSCA, including air 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 and management of the contaminated media and the establishment of LUCs to prevent residential exposure and any release of PCBs during any future transformer vault demolition will not pose an unreasonable risk to human health or the environment.
State				
RI Air Pollution Control Regulation No. 5: Fugitive Dust	RIGL 23-23 *et seq.*; CRIR 12-31-05	Applicable	Requires that reasonable measures be taken to prevent particulate matter from becoming airborne.	Remediation activities could potentially result in fugitive dust. Appropriate measures would need to be taken to prevent particulate matter from becoming airborne.
RI Air Pollution Control Regulation No. 7: Emissions of	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	Remediation activities may result in emissions. Appropriate measure would need to be taken to comply with these regulations.

ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-2: LIMITED SOIL EXCAVATION WITH LAND USE CONTROLS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Air Detrimental to Persons or Property			unreasonably interfere with the enjoyment of life and property.	
Soil Erosion and Sediment Control Handbook, 1989	-	To Be Considered	Identifies soil erosion and sediment control (E & SC) requirements for construction activities involving land-disturbance activities.	E & SCs will be used during soil disturbance activities, such as excavation.
Standards for Identification and Listing of Hazardous Waste; RI Rules and Regulations for Hazardous Waste Management, Hazardous Waste Determination	RIGL 23-9.1 *et seq.*; Code of Rhode Island Rules (CRIR) 12-030-003 Rule 5.3	Applicable	Requires a determination be made as to whether waste meets the definition of hazardous waste.	These regulations apply to all waste generated during actions at the site, such as excavated soil, and will be used when determining whether or not a solid waste is hazardous. The soil at DU 1-1, 1-2, and 1-3 is not expected to be hazardous.
Standards for Generators of Hazardous Waste; Rules and Regulations for Hazardous Waste Management, Generator Standards	RIGL 23-9.1 *et seq.*; Code of Rhode Island Rules (CRIR) 12-030-003, Rule 5.3, 5.9, 5.12, and 5.13	Applicable	Establishes accumulation, manifesting, and pre-transport of requirements for hazardous waste.	These regulations would apply to any waste generated at the site that is determined to be hazardous, such as excavated soil. The soil at DU 1-1, 1-2, and 1-3 is not expected to be hazardous.

Appendix E

Public Hearing Transcript

NAVSTA Newport

Formal Public Hearing

Site 7 - Tank Farm 1 (Operable Unit 13)

Decision Units 1-1, 1-2, 1-3

Soil Proposed Plan

May 18, 2016

7:30 p.m.

Courtyard Marriott

9 Commerce Drive

Middletown, RI

P R O C E E D I N G S

MS. CASTLEBERRY-LEE: So Carol is our stenographer. She is going to start recording.

So again this is the public hearing for the proposed plan for three decision units at Site 7 Tank Farm 1 at Naval Station, Newport. And if you have a comment please state your name, whom you represent, and then provide your comment. We'll make sure that it is recorded and published in the responsiveness summary along with the Navy's response and that will be part of the record of decision for the site.

So I'll open it to the floor. I'll let a little silence go by and then I'll call it. And again, if you think of something later on, the information is in the proposed plan and you can provide a comment in writing that way, through June 4th,

MS. WEISSINGER: I'd like to say

something about Portsmouth and what we were talking about.

MS. CASTLEBERRY-LEE: State your name.

MS. WEISSINGER: Claudette Weissinger, Portsmouth Conservation Commission. It's very disturbing to me that there are multiple explanations for open space. You need to determine, and I don't think it's in any of these documents specifically, what you mean by open space and what DEM considers open space.

MS. CASTLEBERRY-LEE: Thank you.

MS. WEISSINGER: That definitely needs to be clarified, because I don't think anyone that I know of feels that they are both the same.

MS. CASTLEBERRY-LEE: Thank you.

MS. KIRSCHNER: Is open space in this proposal? I know we were talking about it, but --

MS. WEISSINGER: In the proposed plan for Portsmouth Tank Farm 1.

MS. KIRSCHNER: In here or in the EIS?

MS. WEISSINGER: In some of the information that I saw at the Gaudet School.

MR. DOROCZ: In the EIS.

MS. ABBASS: My name is Kathy Abbass, and I always remind you about cultural resource management. So I guess I'll do that at this time again. And I know that there have been studies to make sure that historical properties there, present or absence that sort of thing, but it has been my experience that sometimes the tests that's been done to say they are historic siting or archeological site there and then all of a sudden when the development starts going you actually find something that wasn't found when the testing is done. It's like you're testing for the materials that you're doing, you say there was nothing there, but that doesn't mean there wasn't something just a bit farther on. So testing only does so much which is what you were talking about before.

A good example of that happened at Block Island, when they were putting the cross island line for the wind farm. The archeologist did the test, came up clean. Let's do it. And they started building the thing and all of a sudden it had to stop because they had archeological materials.

So just to remind you we know that area nearby has been used. It was part of the Revolutionary War, the Orchid is off shore there. Still in the water nearby. She burned and she blew up, so that there could be materials there. We know there was a Civil War hospital just down the hill from that. So there could be cultural materials there, and I'm just reminding you that when you do start doing whatever you do, that you should be vigilant about that.

MS. CASTLEBERRY-LEE: Thank you.

MS. KIRSCHNER: I'll just say for the record this is a very -- there is a lot to study with this site. There is a lot of wonderful materials in the administrative record. The aerial photographs of the site are very interesting, and I think they're in the feasibility study. They show the site in use from 1940 up to I think the late '70s or mid '70s. And it's a lot of work cleaning up these sites, and it's a lot of, it's a large span of time and it's very impressive.

And I just want to thank you for the administrative record, and I hope to continue to look during the open comment period.

MS. CASTLEBERRY-LEE: Thank you. Are there any further comments?

I'll wait a few more seconds and I'll call it for the night.

I think the hearing is closed.

Thank you all for coming.

(The proceedings adjourned at 7:45 p.m.)

C E R T I F I C A T E

I hereby certify that the foregoing 7pages contain a full, true and correct transcription of all my stenographic notes to the best of my ability taken in the above-captioned matter at said time and place.

____
Carol DiFazio
Registered Professional Reporter

FORMAL PUBLIC HEARING
MAY 18, 2016
ATTENDANCE SHEET

Naval Station Newport, Rhode Island

Name (Printed)		Organization/Affiliation	E-Mail Address	Cell Phone Number
1.	Jim Gravelle	NavFac MidLant RPM	james.gravelle@navy.mil	757-341-2014
2.	Nicole Cowand	NAVFAC ML/Navy RPM	nicole.cowand@navy.mil	757-341-2009
3.	Mark Kauffman	Resolution	mark.kauffman@aecom.com	978-846-5201
4.	Andrew Borden	Resolution	andrew.borden@aecom.com	508.341.9919
5.	Pamela Crump	RIDEM	pamela.crump@dem.ri.gov	401-222-2797
6.	Deb Moore	NAVAL STATION	deborah.j.moore@navy.mil	401-841-1780
7.	David W. Brown	NAVSTA NPT RAB	djbrown2d@yahoo.com	401-848-9427
8.	David Dorocz	NAVY	david.dorocz@NAVY.MIL	401-841-7671
9.	JOE FORAN	TMLE	jforan1@maine.rr.com	207-232-3080
10.	CLAUDETTE WEISSINGER	Portsmouth Conservation Comm.		401-683-8085
11.	D K Abbass	RIMAP	rhodeislandmap@yahoo.com	401 253-2094
12.	Manuel Marques	RAB Civ	mmarques271@yahoo.com	401-486-8651
13.	Margaret Kirschner	Newport	makirschnercpa@gmail.com	857.472-9191
14.	Jane Dolan	U.S. EPA	dolan.jane@epa.gov	508 274 8810
15.	Michael Asciola	Town of Portsmouth	masciola@portsmouthri.com	401 683.0333
16.	Dave McLaughlin	Clean Ocean Access	dave.mclaughlin@cleanoceanaccess.org	401 465 0628
17.	Cindy Castleberry-Lee	Resolution	cindy.castleberry@aecom.com	781-223-4264
18.				