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FINAL FEASIBILITY STUDY FOR DECISION UNIT 1-1, DECISION UNIT 1-2, AND DECISION UNIT 1-3 AT TANK FARM 1 SITE 7 OPERABLE UNIT 13 (OU 13) NS NEWPORT RI
12/10/2015
RESOLUTION CONSULTANTS

FINAL
FEASIBILITY STUDY
DECISION UNITS 1-1, 1-2, & 1-3 AT TANK FARM 1 – SITE 7

Version: 1

NAVAL STATION NEWPORT
PORTSMOUTH, RHODE ISLAND

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Mid-Atlantic
9742 Maryland Ave.
Norfolk, VA 23511-3095

December 10, 2015

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
AST	Aboveground storage tanks
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	Chemical of concern
DBCP	1,2-dibromo-3-chloropropane
DEC	Direct Exposure Criteria
DGA	Data Gaps Assessment
DLA	Defense Logistics Agency
DoD	Department of Defense
DU	Decision Unit
EBP	Ethyl Blending Plant
EDB	1,2-dibromomethane
EDC	ethylene dichloride
EEQ	Ecological Effects Quotient
ELUR	Environmental Land Use Restriction
ERA	ecological risk assessment
FFA	Federal Facilities Agreement
FS	Feasibility Study
GRO	gasoline-range organics
HHRSE	Human Health Risk Screening Evaluation
HI	Hazard Index
I/C	Industrial/Commercial
LUCs	land use controls
MCL	Maximum Contaminant Levels
msl	mean sea level
NAVFAC MIDLANT	Naval Facilities Engineering Command Mid-Atlantic
NAVSTA	Naval Station
Navy	Department of the Navy
NCP	National Contingency Plan

NETC	Naval Education and Training Center
NFA	no further action
NPL	National Priorities List
NUWC	Naval Undersea Warfare Center
O&M	operation and maintenance
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PPE	Personal Protective Equipment
PQLs	practical quantitation limits
PRGs	Preliminary Remediation Goals
RAOs	Remedial Action Objectives
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RD	Remedial Design
RDEC	Residential Direct Exposure Criteria
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SVOCs	Semivolatile Organic Compounds
TBCs	To Be Considered
TEL	Tetraethyl lead
TPH	Total petroleum hydrocarbons
TSDF	Treatment, Storage, and Disposal Facility
TV2	Transformer Vault 2
TV3	Transformer Vault 3
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

This Feasibility Study (FS) report was prepared to address Decision Units (DU) 1-1, 1-2, and 1-3 at Tank Farm 1 (Site 7, Operable Unit [OU] 13) at the Naval Station (NAVSTA) Newport, in Portsmouth, Rhode Island. These three DUs represent exposure areas within Tank Farm 1 where Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) releases have occurred. DU 1-1 is defined as soil associated with the Ethyl Blending Plant (EBP) (includes the EBP and associated previously designated Areas of Concern [AOCs] TF1-004, TF1-005 and TF1-018). DU 1-2 and DU 1-3 are defined as soils associated with Transformer Vault 2 (TV2) and Transformer Vault 3 (TV3), respectively. There are other areas within Tank Farm 1 with either completed or ongoing petroleum-related response actions. These include 10 former tanks (Tanks 9 through 18), fuel distribution piping and equipment, and other petroleum-related AOCs. As part of the CERCLA process, a Data Gaps Assessment (DGA) was completed for DU 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 AOCs that were specifically listed on page 2 of the April 2012 dispute resolution agreement (inactive fuel loading area, former oil-water separator (central), former gasoline-water separator (west side), electrical structures, and sludge pits) as requiring additional Category 2 investigations. Also, consistent with the dispute resolution agreement, after investigations and/or response actions are completed for those AOCs, the Navy will 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 prepared.

After completing the FS process, the Navy intends to prepare a Proposed Plan and Record of Decision (ROD) for DU 1-1, 1-2, and 1-3 at Tank Farm 1 (OU 13) that references the supporting information provided by the DGA report and this FS document.

This document was completed by Resolution Consultants (Resolution) for the U.S. Department of the Navy (Navy) and the Naval Facilities Engineering Command Mid-Atlantic (NAVFAC MIDLANT).

Site Description

Tank Farm 1 is a 50-acre former fuel storage and distribution area that is located in the northern portion of the NAVSTA Newport facility. DU 1-1 is located in the southeast portion of Tank Farm 1, while 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.

Regulatory Context

The environmental assessment and response (if necessary) for the specific areas included in this FS report is being conducted under the framework of CERCLA, per the Federal Facility Agreement (FFA) established for the NAVSTA Newport facility (formerly known as the Naval Education and Training Center). The remedial investigation (RI) phase of CERCLA was completed with a DGA Report (Tetra Tech, 2014). During the DGA, soil and groundwater samples were collected. Subsurface soil samples did not present unacceptable risk to human health or the environment. The DGA Report determined that there is unacceptable predicted human health risk above the USEPA target risk range for surface soil at DU 1-1 under a potential future residential or other unrestricted use of the site and recommends proceeding to a FS to evaluate remedial alternatives for the soil. The DGA Report also concluded that Aroclor 1260 concentrations in surface soil at DU 1-2 and DU 1-3 should be further evaluated in the FS. Groundwater at the EBP was also assessed during the DGA; however, the Navy is deferring a final response action decision for groundwater at the EBP until response actions are completed at the other (non-CERCLA) AOCs with the tank farm. As such, soil is the only media of concern for this FS.

Remedial Action Objectives, Preliminary Remediation Goals, and Estimation of Areas and Volumes

The following Remedial Action Objectives (RAOs) were defined in this FS for soil at DU 1-1, based on the protection of human health.

- Prevent exposure by industrial and restricted recreational users to soil containing site contaminants that exceed industrial use scenario Preliminary Remediation Goals (PRGs).

- Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario PRGs.
- Prevent future migration of soil contaminants to groundwater (soil COCs above Rhode Island Department of Environmental Management [RIDEM] GA Leachability Criteria).

The following RAOs were defined in this FS for soil at DU 1-2 and DU 1-3, based on the protection of human health and the environment.

- Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario PRGs.
- Prevent future migration of soil contaminants to groundwater (soil COCs above RIDEM GA Leachability Criteria).
- Prevent exposure by insectivorous mammals and birds to soil containing COCs that exceed ecological PRGs.

To achieve these RAOs, numeric cleanup goals called PRGs were developed for each exposure area based on an evaluation of risk-based PRGs, background concentrations, practical quantitation limits (PQLs), and other site-specific considerations (e.g., ARARs). These PRGs are summarized in the inset tables.

Based on the available data and applying these PRGs, estimated quantities of contaminated soil can be quantified. The following discussion presents the basis of defining the areas and volumes of contaminated soil to be addressed in this FS.

<u>DU 1-1</u>

At DU 1-1, soil concentrations were compared to the Industrial and Residential PRGs. No Industrial or Residential PRGs were developed for subsurface soil based on comparison of maximum subsurface soil concentrations to ARARs and background concentrations. Risk-based goals were not developed for subsurface soil because subsurface soil did not pose an unacceptable risk. The following text discusses the impacted area for each land use scenario (industrial and residential).

- Industrial PRGs: For the purpose of evaluating remedial alternatives, impacted areas totaling approximately 1,800 square feet or 0.04 acres are estimated, based on the data collected in the DGA report. The impacted volume of soil is estimated to be approximately 130 cubic yards based on a 2 foot depth of impact. This volume encompasses the surface soil that exceeds Industrial PRGs (including the RIDEM GA Leachability Criterion for naphthalene).

- Residential PRGs: For the purpose of evaluating remedial alternatives, an impacted area approximately 5,200 square feet or 0.12 acres is estimated, based on the data collected in the DGA report. The impacted volume of soil is estimated to be approximately 400 cubic yards based on a 2 foot depth of impact. This volume encompasses the surface soil that exceeds Residential PRGs (including the RIDEM GA Leachability Criterion for naphthalene).

Preliminary Remedial Goals for DU 1-1

Soil Parameter	PRG (mg/kg)	Regulatory 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
Dibenzo(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
Dibenzo(a,h)anthracene	0.8	I/C DEC
Naphthalene	0.8	Leachability
Arsenic	14	Background

Notes:

RDEC – Residential Direct Exposure Criteria (RIDEM)

I/C DEC – Industrial/Commercial Direct Exposure Criteria (RIDEM)

Leachability – GA Leachability Criteria (RIDEM)

mg/kg – Milligrams per kilogram

DU 1-2 and DU 1-3

Four soil sample locations exceed the selected PRG for PCBs at DU 1-2 and DU 1-3. At DU 1-2, one surface soil sample (TF1-EV2-E) has a PCB concentration greater than the PRG. The sample is located directly east of the door. At DU 1-3, three soil locations (TV3-SB1026, TV3-SB1027, and TV3-SB1032) exceed the selected PRG for PCBs. These sample locations are also located directly east of the door. PCBs were not detected in subsurface soil samples. For the purpose of evaluating remedial alternatives, the extent of exceedances is assumed to be limited and areas of 100 square feet and 150 square feet are estimated at DU 1-2 and DU 1-3, respectively. Assuming an impacted depth of 2 feet, the volume of soil is estimated to be approximately 20 cubic yards.

Preliminary Remedial Goals for DU 1-2 and DU 1-3

Soil Parameter	PRG (mg/kg)	Regulatory Basis
PCBs	1	EPA Residential Guidance Value (USEPA, 1990)

Notes:

mg/kg – Milligrams per kilogram

Remedial Alternatives

Per the stepwise CERCLA process for the development of remedial alternatives, four alternatives were defined, retained, and evaluated in detail in the FS. Since human health or ecological PRGs were not developed for subsurface soil based on comparison of maximum subsurface soil concentrations to ARARs and background, there are no remedial actions required for subsurface soil. Risk-based goals were not calculated for subsurface soil because subsurface soil did not pose an unacceptable risk.

- Alternative S-1 – No Action
  - No action
- Alternative S-2 – Limited Soil Excavation with Land Use Controls
  - Limited soil excavation and off-site disposal for DU 1-1 to meet Industrial PRGs (includes removal of all soils exceeding RIDEM GA Leachability Criteria)
  - Soil excavation and off-site disposal for DU 1-2 and DU 1-3 to remove all surface soil with PRG Exceedances (includes removal of all soils exceeding RIDEM GA Leachability Criteria)

  - Land use controls (LUCs) for DU 1-1 to prevent future residential or 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, to include maintenance of the EBP structure foundation, would also be required to prevent access to soil if it exists below the building. Similarly, for DU 1-2 and 1-3, the soil beneath TV2 and TV3 has not been assessed and LUCs would be required to maintain the foundations of TV2 and TV3 to prevent access to soil below the buildings. If the EBP structure is demolished in the future, the presence or absence of soil beneath the building would be assessed and if soil is present, it would be remediated, if necessary, to meet Industrial PRGs. If TV2 and/or TV3 is demolished in the future, the soil would be assessed and remediated, if necessary, to meet the Residential PRG. If and 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. Demolition of this these buildings is not considered part of the remedy.

- Alternative S-3 – Soil Excavation (with Short-Term Land Use Controls under the EBP, TV2, and TV3 Buildings)
  - Soil excavation and off-site disposal for DU 1-1 to remove all surface soil with Residential and Industrial PRG Exceedances (includes removal of all soils exceeding RIDEM GA Leachability Criteria)
  - Soil excavation and off-site disposal for DU 1-2 and DU 1-3 to remove all surface soil with PRG Exceedances (includes removal of all soils exceeding RIDEM GA Leachability Criteria)
  - Short-term LUCs, to include maintenance of the EBP, TV2, and TV3 foundations, would likely be required to prevent access to soil, if it exists, beneath the buildings. If the EBP, TV2 and/or TV3 buildings are demolished in the future, the presence or absence of soil beneath the buildings would be assessed and, if soil is present, would be remediated, if necessary, to meet Residential and Industrial PRGs (including soils exceeding RIDEM GA Leachability Criteria). If and 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. Demolition of these buildings is not considered part of the remedy.
- Alternative S-4 – Limited Soil Excavation with Soil Cover and Land Use Controls
  - Limited soil excavation and off-site disposal for DU 1-1 to meet RIDEM GA Leachability Criteria

- Soil excavation and off-site disposal for DU 1-2 and DU 1-3 to remove all surface soil with PRG Exceedances (includes removal of all soils exceeding RIDEM GA Leachability Criteria)
- Soil cover for DU 1-1 to prevent direct exposure to contaminated surface soil remaining above Residential and Industrial PRGs
- LUCs for DU 1-1 to prevent disturbance of the soil cover and access to underlying contaminated soils. As a conservative measure, LUCs would also be required for the EBP, TV2 and TV3 structure footprints to prevent access to soil, if it exists, below the buildings. If any of the buildings are demolished 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 Industrial PRGs at DU 1-1 and the Residential PRG at DU 1-2 and 1-3. If and 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. Demolition of these buildings is not considered part of the remedy.

Table ES-1 also presents a summary of the main components of the remedial alternatives described above. Table ES-2 presents an abbreviated detailed evaluation and comparative analysis of remedial alternatives using the seven criteria to be evaluated during the FS phase of the CERCLA process. Two additional criteria, state and community acceptance, will be evaluated as part of the subsequent regulatory and community review phase.

The next step in the CERCLA process is to discuss these candidate alternatives with the regulatory agencies, and then recommend one of them as a remedial alternative for public consideration and comment. The recommended remedial alternative will then be described in a Proposed Plan, to be distributed to the local community and presented at a public meeting to solicit input and comments prior to selecting the final remedy for the site. The final remedy will be documented in a Record of Decision (ROD).

Table ES-1
Summary of Remedial Alternative Components

Main Components	Alternative [1]			
	S-1: No Action	S-2: Limited Soil Excavation with Land Use Controls	S-3: Soil Excavation (with Short-Term Land Use Controls under EBP Building only)	S-4: Limited Soil Excavation with Soil Cover and Land Use Controls
DU 1-1:				
Additional sampling to delineate exceedances at DU 1-1		X	X	X
Excavation of surface soil exceeding the RIDEM GA Leachability Criteria at DU 1-1		X	X	X
Excavation of surface soil exceeding the Industrial PRGs at DU 1-1		X	X	
Excavation of surface soil exceeding the Residential PRGs at DU 1-1			X	
Installation of a 2-foot soil cover at DU 1-1				X
Short-Term LUCs for the Ethyl Blending Plant (EBP), Transformer Vault (TV) 2, and TV3 structure footprints only		X	X	X
Permanent LUCs at DU 1-1		X		X
DU 1-2 and 1-3:				
Additional sampling to delineate exceedances at DU 1-2 and 1-3		X	X	X
Excavation of surface soil exceeding the PRG at DU 1-2 and 1-3		X	X	X

Notes:
1. Only the remedial alternatives retained for detailed analysis are presented here.
LUCs – Land use controls
PRGs – Preliminary Remediation Goals

Table ES-2
Summary of Detailed Evaluation and Comparative Analysis

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long Term Effectiveness and Permanence	Reduction of TMV through Treatment	Short-Term Effectiveness	Implementability	Cost [1]
S-1: No Action	Alternative S-1 would not be protective of human health because contact with contaminated soil would not be prevented. Additionally, Alternative S-1 would not be protective of groundwater because it does not address RIDEM GA Leachability Criteria exceedances in soil.	Does not comply with ARARs	Alternative S-1 is not effective and doesn't provide permanent protection from contaminants.	This alternative does not include/involve treatment.	Since no construction activities or remedial actions are proposed under Alternative S-1, there are no additional short-term risks to the community, workers, and environment.	Alternative S-1 is considered the most implementable since no construction activities or remedial actions are proposed.	Total Cost: $0
S-2: Limited Soil Excavation with Land Use Controls	Alternative S-2 removes all soil that exceeds the Industrial PRGs at DU 1-1 and the PRG at DU 1-2 and 1-3 (includes removal of all soils exceeding RIDEM GA Leachability Criteria). Alternatives S-2 requires implementation of LUCs, which add protection to human health. Alternative S-2 is slightly more protective than Alternative S-4.	Meets ARARs	Alternative S-2 is less effective than Alternative S-3 since contaminated soil remains in place. However, it is considered more effective than Alternative S-4 since all soil exceeding the Industrial PRGs is removed. This alternative utilizes controls to prevent exposure to contaminated soil over the long-term to provide the desired long-term effectiveness.	This alternative does not include/involve treatment.	Under Alternative S-2, limited excavation is proposed and short-term risks to the workers, surrounding community, and environment will be minimal.	Alternative S-2 is more difficult to implement because of the administrative burden and future inspections over the long-term. LUCs and excavation are proven technologies.	Capital Cost: $163,414 O&M: $51,514 Five-Year Reviews: $23,307 Total Cost: $238,000
S-3: Soil Excavation (with Short-Term Land Use Controls under EBP, TV2, and TV3 Buildings only)	Alternative S-3 removes all soil that exceeds the Residential and Industrial PRGs at DU 1-1 as well as the PRG at DU 1-2 and 1-3 (includes removal of all soils exceeding RIDEM GA Leachability Criteria). Alternative S-3 is considered the most effective at protecting human health and the environment. Under Alternative S-3, all contaminated soil is removed from the site; thereby, allowing unrestricted use at the site.	Meets ARARs	Alternative S-3 has the highest long-term effectiveness since it removes all contaminated soil from the site and allows for unrestricted use.	This alternative does not include/involve treatment.	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.	Alternative S-3 is relatively easy to implement. Excavation is a proven technology and there are no long-term components.	Capital Cost: $253,646 O&M: $20,316 Five-Year Reviews: $9,284 Total Cost: $283,000
S-4: Limited Soil Excavation with Soil Cover and Land Use Controls	Alternative S-4 removes all soil that exceeds the RIDEM GA Leachability Criteria from DU 1-1 as well as the PRG at DU 1-2 and 1-3 (includes removal of all soils exceeding RIDEM GA Leachability Criteria). Alternative S-4 is slightly less protective than Alternative S-2 since soil exceeding the Industrial PRGs remains in place. Although contaminated soil remains in place, the soil cover would prevent direct contact, erosion, and transport of remaining surface soil exceeding residential PRGs.	Meets ARARs	Alternative S-4 is less effective than Alternative S-2 since contaminated soil exceeding the Industrial PRGs remains in place. However, this alternative utilizes controls to prevent exposure to contaminated soil over the long-term to provide the desired long-term effectiveness. Additionally, the alternative installs a physical barrier over contaminated soil.	This alternative does not include/involve treatment.	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.	Alternative S-4 is the most difficult to implement because of the administrative burden of future inspections and maintenance over the long-term. LUCs and excavation are proven technologies. Alternative S-4 is slightly more difficult to implement than Alternative S-2.	Capital Cost: $242,127 O&M: $83,215 Five-Year Reviews: $23,307 Total Cost: $349,000

Notes:
LUCs – Land use controls
O&M – Operation and maintenance
ARAR – Applicable or relevant and appropriate requirement
PRGs – Preliminary Remediation Goals

1. For Alternatives S-2, S-3, and S-4, costs associated with potential assessment/remediation of soil beneath the EBP, TV2, and TV3 structures are not included since it is expected that little to no soil is present beneath the building. If remediation is required, it is assumed the cost will be within the acceptable NCP cost range.

1.0 PROJECT BACKGROUND

This Feasibility Study (FS) report presents the development and evaluation of remedial alternatives for Decision Units (DU) 1-1, 1-2, and 1-3 at Tank Farm 1 (Site 7, Operable Unit 13 [OU13]) (the Site), located within the Naval Station (NAVSTA) Newport, in Portsmouth, Rhode Island. These three DUs represent exposure areas within Tank Farm 1 where Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) releases have occurred. DU 1-1 is defined as soil associated with the Ethyl Blending Plant (EBP) (includes the EBP and associated previously designated Areas of Concern [AOCs] TF1-004, TF1-005, and TF1-018). DU 1-2 and DU 1-3 are defined as soil associated with Transformer Vault 2 (TV2) and Transformer Vault 3 (TV3), respectively. There are other areas within Tank Farm 1 with either completed or ongoing petroleum-related response actions. These include 10 former tanks (Tanks 9 through 18), fuel distribution piping and equipment, and other petroleum-related AOCs. As part of the CERCLA process, a Data Gaps Assessment (DGA) was completed for DU 1-1, 1-2, and 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 AOCs that were specifically listed on page 2 of the April 2012 dispute resolution agreement (inactive fuel loading area, former oil-water separator (central), former gasoline-water separator (west side), electrical structures, and sludge pits) as requiring additional Category 2 investigations. Also, consistent with the dispute resolution agreement, after investigations and/or response actions are completed for those AOCs, the Navy will 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 prepared.

After completing the FS process, the Navy intends to prepare a Proposed Plan and Record of Decision (ROD) for DU 1-1, 1-2, and 1-3 at Tank Farm 1 (OU 13) that references the supporting information provided by the DGA report and this FS document.

This document was completed by Resolution Consultants (Resolution) for the U.S. Department of the Navy (Navy) and the Naval Facilities Engineering Command Mid-Atlantic (NAVFAC MIDLANT).

1.1 Purpose and Approach

The DGA report contains a comprehensive summary of historical activities and investigations at Tank Farm 1, along with the Human Health Risk Screening Evaluation (HHRSE) and Ecological Risk Assessment (ERA), and is intended to satisfy the regulatory requirements for the Remedial Investigation (RI) phase of CERCLA. The DGA Report evaluates and presents findings for the EBP (which includes AOCs TF1-004, TF1-005, and TF1-018) and the Transformer Vaults (which include TV2 and TV3) at Tank Farm 1. This FS defines DU 1-1 as soil associated with the EBP (includes the EBP and associated previously designated AOCs TF1-004, TF1-005, and TF1-018). DU 1-2 and DU 1-3 are defined as TV2 and TV3, respectively.

This FS was completed according to the United States Environmental Protection Agency (USEPA) FS guidelines. Each remedial alternative was evaluated according to the following National Contingency Plan (NCP) criteria.

- Overall Protection of Human Health and Environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long-term Effectiveness and Permanence
- Reduction in toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Two additional criteria, state acceptance and community acceptance, will be evaluated as part of the regulatory and community review phase of the CERCLA process, as the Proposed Plan is prepared with the regulatory agencies and reviewed by the community.

1.2 Naval Station Newport Background Information

NAVSTA Newport is a 1,000-acre Navy facility that is located on Aquidneck Island in Rhode Island and spans across the City of Newport and the Towns of Middletown, Portsmouth, and Jamestown

(Figure 1). The facility has been used by the Navy since as early as the Civil War. During World Wars I and II, military activities at the facility increased significantly and housing was provided for many servicemen. In subsequent peacetime years, use of onsite facilities was slowly phased out until 1962, when Newport became the headquarters for the Commander Cruiser-Destroyer Force Atlantic. In April of 1973, the Shore Establishment Realignment Program reorganized naval forces which led to decreased military activity at the facility and resulted in the Navy excessing 1,629 acres of property.

Since 1974, research and development and training have been the primary activities at NAVSTA Newport. The facility was renamed from Naval Education and Training Center (NETC) to NAVSTA Newport in 1998. The major commands located at the NAVSTA facility include the NETC, the Surface Warfare Officers School Command, the Naval Undersea Warfare Center (NUWC), the Naval War College, and others.

In November 1989, NAVSTA Newport (NETC at the time) was added to the National Priorities List (NPL). A Federal Facilities Agreement (FFA) was developed and signed by the Navy, the State of Rhode Island, and USEPA in March of 1992 to outline the response action requirements under the CERCLA regulatory framework at NAVSTA Newport. The FFA was developed, in part, to ensure that the environmental impacts associated with past and present activities at NAVSTA Newport are properly investigated and remediated if needed.

1.3 Tank Farm 1 Background Information

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. The EBP area is located in the southeast portion of Tank Farm 1, while the Transformer Vaults are located in the central portion of Tank Farm 1 (Figure 2). The site was used by the Navy as a fuel storage area and distribution facility from 1940 until it was leased to the 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.

Tank Farm 1 is also used by Department of Defense (DoD) personnel for deer hunting during portions of the year. The property is enclosed along the perimeter with a security fence that restricts public access. 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 DU 1-1, 1-2, and 1-3, have not been finalized (Tetra Tech, 2014).

It should be noted that residential development is not included in the Navy's current development plans.

1.3.1 Site Description

Tank Farm 1 consists of two 2.56-million gallon partial aboveground storage tanks (AST) (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. DU 1-1, which is approximately 0.5 acres, 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 1-3, which each are approximately 0.014 acres, are located in the central portion of Tank Farm 1. DU 1-2 is located southeast of Tank 16 and DU 1-3 is located southwest of Tank 13. Tank Farm 2 is located approximately 200 feet to the southeast of the site.

Most of the Tank Farm 1 area is covered in vegetation, mainly grass, shrubs, and trees, with some cleared areas for access roads and adjacent to UST locations. Public access to the site is restricted by a security fence along the perimeter of the property.

The Tank Farm 1 site is moderately to gently sloping with topography ranging from 148 feet above mean sea level (msl) in the southeastern portion of the site to 14 feet msl in the west central portion of the site closest to Narragansett Bay (Tetra Tech, 2014).

1.3.2 Site History

The Navy has owned the Tank Farm 1 property since the 1920s with the tank farm itself being built in the early 1940s. While the construction date of the EBP is unknown, an engineering report from 1943 described the operations at the EBP and the EBP appears on aerial photographs from 1942.

The historic use of the EBP was to mix aviation gasoline with an anti-knock component called ethyl fluid. Ethyl fluid is composed of 60% tetraethyl lead (TEL), approximately 18% 1,2-dibromoethane (ethylene dibromide or EDB), and approximately 19% ethylene dichloride (EDC), along with some additional minor components. This fluid prevented lead fouling in internal combustion engines. Use

of these three compounds in combustion engines was largely curtailed worldwide near the end of the 20th century, except in aviation fuels and other specialty fuels.

The Transformer Vaults are shown on aerial photographs from 1951. According to a historic plan from 1985, PCB transformers were replaced with non-PCB transformers. No additional information is available about the Transformer Vaults (Tetra Tech, 2014).

1.3.3 Previous Investigations

As discussed in Section 1.0, DU 1-1, 1-2, and 1-3 are currently the only areas within Tank Farm 1 that contain known or potential CERCLA releases. As such, this FS focuses exclusively on DU 1-1, 1-2, and 1-3 and the chemicals of concern (COCs) in soil requiring the consideration of a CERCLA response action. Previous investigations as they relate specifically to DU 1-1, 1-2, and 1-3 at Tank Farm 1 include the 2010 Site Investigation and Remedial Action Report (Shaw, 2010) and 2012-2013 Data Gaps Assessment (DGA; Tetra Tech, 2014).

<u>2010 Site Investigation and Remedial Action Report (Shaw, 2010)</u>

As part of the 2010 Site Investigation, field data was collected by DLA Energy per RIDEM regulations. The investigations were performed under RIDEM UST closure and remediation 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.

DU 1-1: In May 2010, test pits were excavated down to 5 feet below ground surface (bgs) at 11 locations in the vicinity of the EBP. In May-June 2010, 23 soil samples were collected in the vicinity of the EBP. Sample analyses for soil samples collected in 2010 were limited to field screening for petroleum with laboratory analysis for TPH and gasoline-related constituents. Based on field screening results, eight soil samples were submitted to the laboratory for TPH and gasoline-related analysis. TPH results ranged from 31 mg/kg to the west of the EBP [TF1- JB-W OF EBP-W (2.5')] to 160 mg/kg to the north [TF1-EBP-N1 (2.5')] and east [TF1-EBP-E2 (3.5')] of the EBP. Gasoline-related constituents were identified in one sample [TF1-18 C1 (2.5')] west of the EBP at a concentration of 3.7 mg/kg. Analytical results did not detect concentrations of TPH above RIDEM industrial/commercial or residential criteria at the EBP.

DU 1-2 and 1-3: In 2010, surface soil samples were collected in the vicinity of the transformer vaults. One surface soil sample was collected at TV2, at a location outside the door on the east side of the building. One surface soil sample was collected at TV3, at a location near the northeastern corner of the building near a rectifier. The soil sample at TV2 contained 24 mg/kg of the PCB congener Aroclor 1260. The sample at TV3 contained 0.51 mg/kg of Aroclor 1260. No remedial actions were completed at these areas (Shaw, 2010).

2012-2013 Data Gaps Assessment Report (Tetra Tech, 2014)

As part of the 2012-2013 DGA, field investigation of DU 1-1, 1-2, and 1-3 at Tank Farm 1 was conducted to refine the characterization of these areas, as well as quantify potential risks posed by site contamination. An overview of the DGA field activities is presented below.

DU 1-1 Field Activities

Investigation around DU 1-1 included areas adjacent to the EBP structure that were previously identified as AOCs TF1-004, TF1-005, and TF1-018 (see Figure 2). A geophysical investigation was conducted around the northwestern corner of the EBP, where the boiler room was situated, to locate a suspected UST and associated distribution piping. No UST or associated piping was located during the geophysical survey; however, multiple process, water, and electric subsurface utilities were located. All soil boring locations were cleared for utilities at DU 1-1 (Tetra Tech, 2014).

At DU 1-1, a total of 29 soil borings were advanced as part of the DGA (see Figure 3). Of these soil borings, four borings were completed for the purpose of installing bedrock groundwater monitoring wells. Bedrock was encountered at depths ranging from 1.3 feet (at SB-1002) to 9 feet (at SB-1003).

Three soil samples were proposed at each boring location. At each soil boring, an initial surface soil sample was collected. At monitoring well locations, the initial surface soil sample was collected from 0 to 0.5 feet or 0 to 2 feet bgs. At the remaining soil boring locations, the initial surface soil sample was collected from 0 to 1 feet bgs. Subsurface soil samples were proposed at the interval immediately above the bedrock. Additionally, a third soil sample was proposed between the initial surface soil sample and the sample collected above bedrock. Due to the presence of shallow bedrock at the site, only one or two soil samples were collected from most of the soil boring locations at DU 1-1.

The soil samples collected from the soil borings and the well installation borings were analyzed for volatile organic compounds (VOCs), 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) (Tetra Tech, 2014). The analytical results are summarized in Section 1.3.5, Nature and Extent of Contamination.

Groundwater was sampled using low-stress collection techniques following the development of the four newly installed monitoring wells. Groundwater samples were analyzed for VOCs, SVOCs/PAHs, EDB, 1,2-dibromo-3-chloropropane, total metals, and dissolved metals (Tetra Tech, 2014). The analytical results are summarized in Section 1.3.5, Nature and Extent of Contamination.

<u>DU 1-2 and DU 1-3 Field Activities</u>

During the DGA, soil samples were collected from soils around the transformer vaults. During the 2012 sampling event, six soil borings were advanced at each transformer vault. During an October 2013 supplemental sampling event, seven additional locations were sampled, of which five locations are located at DU 1-2 and two locations are located at DU 1-3.

At DU 1-2, 11 surface soil and 6 subsurface soil samples were collected during the DGA (Figure 4). Samples were analyzed for PCBs, GRO, and TPH (Tetra Tech, 2014). The analytical results are summarized in Section 1.3.5, Nature and Extent of Contamination.

At DU 1-3, 9 surface soil and 6 subsurface soil samples were collected during the DGA (Figure 5). Samples were analyzed for PCBs, GRO, and TPH (Tetra Tech, 2014). The analytical results are summarized in Section 1.3.5, Nature and Extent of Contamination.

1.3.4 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). Refer to the DGA Report for more detailed information.

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.

RIDEM has classified the groundwater beneath the site as GB, indicating that the groundwater "may not be suitable for public or private drinking water use without treatment, due to known or presumed degradation." However, the State's groundwater standards are not applicable to the CERCLA remedy because Rhode Island does not have an USEPA-approved Comprehensive State Groundwater Protection Program. The groundwater is classified as a drinking water source based on federal criteria.

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 flood zone.

1.3.5 Nature and Extent of Contamination

A summary of the nature and extent of contamination at DU 1-1, 1-2, and 1-3 is presented below. As part of the DGA (Tetra Tech, 2014), soil sample results were initially compared to background concentrations and RSLs. Groundwater sample results were compared to RSLs and Maximum Contaminant Levels (MCLs). Although the groundwater results from the DGA are discussed below, a final decision on groundwater is being delayed until responses for other AOCs are complete. The following text discusses the nature and extent of soil contamination in relation to the DGA screening criteria.

DU 1-1

The locations of soil borings and monitoring wells in the vicinity of DU 1-1 are shown on Figure 3. Analytical data tables containing the surface soil, subsurface soil, and groundwater analytical data are presented in the DGA Report (Tetra Tech, 2014). 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.

Chemicals detected in one or more surface soil sample included 5 VOCs, 22 SVOCs (primarily PAHs), 23 metals, TPH, and GRO.

- All VOC concentrations were below the EPA RSLs. Of the VOCs detected, carbon disulfide and 1,2,3-trichlorobenzene were detected in just one sample each at trace concentrations, while acetone (a common laboratory contaminant) was detected in all 32 surface soil samples. Methyl acetate and 2-butanone were detected at relatively low concentrations in roughly two-thirds of the surface soil samples collected.
- Of the SVOCs detected, 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. As part of the DGA Report, DU 1-1 soil data were compared to background concentrations identified from the NAVSTA Newport Basewide Background Study (Tetra Tech, 2008) for inorganics in different soil types. The background comparison indicated the surface soil background concentrations for antimony, silver, sodium, and thallium were all non-detect. Therefore, statistical comparison of site surface soil data to background data for these metals was not conducted. The background comparison concluded that DU 1-1 surface soil concentrations of arsenic, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, vanadium, and zinc were found to be statistically greater than background concentrations. Of those analytes, arsenic, chromium, cobalt, iron, manganese, and thallium were detected at concentrations above their respective RSLs.
- TPH were detected in nearly all surface soil samples, while GRO were detected in just 4 surface soil samples at low concentrations. TPH, which is not regulated under CERCLA, was

compared to the RIDEM Residential Direct Exposure Criteria of 500 mg/kg and there were no exceedances.

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.
- Metals were detected in all subsurface soil samples. The subsurface soil background concentrations for antimony, silver, sodium, and thallium were non-detect and cadmium concentrations were only detected in two background samples. Therefore, statistical comparison of site data to background data for these metals was not conducted. The background comparison concluded that subsurface soil concentrations of aluminum, arsenic, beryllium, calcium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc were found to be greater than background concentrations. Of these metals, aluminum, arsenic, chromium, cobalt, and thallium were detected above their respective RSLs.
- Analytical results indicated VOCs, GRO, and TPH were detected in subsurface soil at concentrations below comparison criteria.

The development of ARARs is in Section 2.1 and the comparison to chemical-specific ARARs is in Section 2.3. Based on the comparison in Section 2.3, there were no exceedances of ARARs standards for any of the subsurface soil contaminants that exceeded RSLs.

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 DGA report concluded that the data does not indicate discharges or spills of TEL or ethyl fluid, since the primary components of that fluid (TEL, EDB, and 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.

Four monitoring wells were installed around the EBP, with a single well upgradient (MW1001) and three wells down gradient (MW1000, MW-GZ-101R, and MW-GT-124R). Groundwater samples were collected in August 2012 and analyzed for VOCs, EDB/DBCP, SVOCs, PAHs, and metals. In groundwater samples from the down gradient monitoring wells, 4 VOCs were detected in one well (MW1000) at trace concentrations, 3 SVOCs were detected in one to two wells each, and 17 metals were detected in filtered and unfiltered groundwater samples. At the down gradient wells, benzene, benzo(b)fluoranthene, cobalt, iron, and manganese concentrations were detected above EPA RSLs. However, concentrations of cobalt, iron, and manganese were less than upgradient groundwater concentrations. None of the concentrations detected in the down gradient wells exceeded the federal MCLs; however, manganese exceeded the health advisory value of 300 micrograms per liter in one down gradient well.

<u>DU 1-2 and DU 1-3</u>

The locations of soil borings in the vicinity of the TV2 and TV3 structures are shown on Figures 4 and 5, respectively. Analytical data tables containing the surface soil and subsurface soil analytical data presented in the DGA Report (Tetra Tech, 2014).

During the 2010 sampling event, one surface soil sample (0 to 0.5 ft bgs) was collected from each transformer vault and analyzed for PCBs. During the initial DGA sampling event, 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.

At DU 1-2, Aroclor 1260, GRO, and TPH were detected in surface soil. GRO was detected in 2 of 6 surface soil samples at concentrations below the RIDEM Residential Direct Exposure Criteria (RDEC). TPH was detected in all of the 6 surface soil samples analyzed, but at concentrations below the RIDEM RDEC. Aroclor 1260 was detected in the 2010 surface soil sample (see 2010 Site Investigation and Remedial Action Report discussion above) 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 of 220 µg/kg. 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, Aroclor 1254, GRO, and TPH were detected in surface soil. GRO was detected in 1 of the 6 surface soil samples at concentrations below the RIDEM RDEC. TPH was detected in 5 of the 6 surface soil samples analyzed, but at concentrations below the RIDEM RDEC. Aroclor 1260 was detected in 8 of the 9 surface soil samples collected during the 2010 sampling event (see 2010 Site Investigation and Remedial Action Report discussion above) and the DGA. Aroclor 1260 was detected at concentrations exceeding the RSL of 220 µg/kg. Aroclor 1260 was detected at a maximum concentration of 4300 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.

1.3.6 Fate and Transport

Contaminants of concern at the site are primarily located in the surface soils. 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. This is reinforced by the analytical data, which shows most of the PAH concentrations in the surface soil, much less in the subsurface soils, and only two instances of PAH detection in the groundwater. Additionally, the single PAH exceedance that was detected in MW-GZ-101R was not detected in the duplicate sample, although the reporting limits for this sample and for other samples are elevated above the standard. Certain other PAHs are reported with similarly elevated reporting limits that are above applicable criteria. PAH concentrations were also found to be highest in the immediate vicinity of the EBP building, and concentrations decreased with depth and increased with proximity to the EBP, which shows that PAH contamination is primarily located in the surface soils surrounding the EBP building. The PAHs detected are attributed to site activities and potential spills or improper container handling practices. Constituents of TEL and ethyl fluid were absent from the soil, which means that there were likely no releases of ethyl fluid or TEL at the site.

Detections of metals in the surface soil, subsurface soil, and groundwater exhibit no apparent association with specific areas. The nature of metals exceedances at DU 1-1 lend evidence to the fact that high metals concentrations are not likely the result of any localized spill or any other types

of localized releases that might have occurred during former operations at DU 1-1. All soil samples were compared to the RIDEM GA Leachability Criteria. The RIDEM GA Leachability Criteria demonstrates that soil concentrations below the leachability criterion are protective of the actual and potential uses of groundwater. With the exception of naphthalene, all soil sample concentrations were below the RIDEM GA Leachability Criteria. Therefore, minimal leaching between the surface soils and groundwater is anticipated.

PCB concentrations in soil are attributed to leaks and spills from the transformers. PCBs are nearly insoluble 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. PCBs have the potential to biodegrade; however, the degradation rate is very low (Tetra Tech, 2014).

1.3.7 Summary of Human Health Risk Assessment

This section summarizes the HHRSE performed as part of the DGA report as it relates to DU 1-1, 1-2, and 1-3 (Tetra Tech, 2014).

<u>DU 1-1</u>

For DU 1-1, metals and PAHs were identified as chemicals of potential concern (COPCs) in surface and subsurface soil, and VOCS and PAHs were identified as COPCs in groundwater. Non-carcinogenic hazards and carcinogenic risks are discussed separately for each exposure scenario evaluated below.

Non-cancer hazards were less than or equal to the USEPA target Hazard Index (HI) of 1 for residents and commercial/industrial workers exposed to both surface soil and subsurface soil, as well as residents exposed to groundwater in a hypothetical future scenario.

Cancer risks were within or less than the USEPA's target risk range of 10^{-4} to 10^{-6} for residents and commercial/industrial workers exposed to subsurface soil, commercial/industrial workers exposed to surface soil, as well as residents exposed to groundwater in a hypothetical future scenario.

Carcinogenic risk for surface soil for future residents was at the top of USEPA's target risk range (2×10^{-4}). Primary risk drivers included PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), as well as the metals arsenic and chromium.

Note that during the screening evaluation, chromium was assumed to be hexavalent chromium based on direction given by USEPA Region I for scenarios where chromium speciation is not available. There is no historical evidence of hexavalent chromium use at the site, nor any expectation that the detected chromium is hexavalent chromium. If the chromium were evaluated as trivalent chromium, it would not have been a risk driver (nor even a chemical of potential concern [COPC] in the screening process). However, until chromium speciation is performed, chromium is maintained as a potential COC.

DU 1-2 and DU 1-3

At both DU 1-2 and DU 1-3, Aroclor 1260 was retained as a COPC in surface soil, while Aroclor 1254 was only retained as a COPC in surface soil at DU 1-3. Non-carcinogenic hazards and carcinogenic risks are discussed separately for each exposure scenario evaluated below.

Non-carcinogenic toxicity criteria are not available for Aroclor-1260, the only COPC retained for DU 1-2. Therefore, an HI was not calculated for DU 1-2. While Aroclor-1260 was also a COPC for DU 1-3, Aroclor-1254 was also retained as a COPC and has non-carcinogenic toxicity criteria available. Non-cancer hazards were less than or equal to the USEPA target HI of 1 for residents and commercial/industrial workers exposed to surface soil at DU 1-3.

At DU 1-2, carcinogenic risk for residential exposure to surface soil was equal to the upper bound of the USEPA's target risk range. Carcinogenic risk for industrial exposure to surface soil was within USEPA's target range.

Carcinogenic risks for residential and industrial exposures to surface soil at DU 1-3 were within USEPA's target risk range.

Exposure Parameter Changes

In February 2014, an USEPA directive was published which changed many default exposure parameters for both the residential and commercial/industrial receptors (USEPA, 2014). The HHRSE results were reviewed relative to these changes and it was determined that the conclusions shown above remain the same.

1.3.8 Summary of Ecological Risk Assessment

This section summarizes the ERA performed as part of the DGA report (Tetra Tech, 2014). The ERA evaluated surface soil data collected for DU 1-1, 1-2, and 1-3. The ERA 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 screening-level risk assessment (SLERA). 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 (Tier 1 screening), five VOCs, 20 SVOCs, 10 metals, and two petroleum hydrocarbons were initially selected as COPCs in surface soil because they were either detected at concentrations that exceeded conservative screening levels, they had an Ecological Effects Quotient (EEQ) greater than 1.0 in the conservative food chain model, or because they did not have screening levels.

These chemicals were then further evaluated (Tier 2, Step 3A screening) to refine the list of COPCs, and to better characterize risks to ecological receptors. 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 DU 1-3

Based on the initial screening of the chemical data (Tier 1 screening), one PCB and two petroleum hydrocarbons were initially selected as COPCs at DU 1-2. Two PCBs and two petroleum hydrocarbons were initially selected as COPCs at DU 1-3.

PCBs (specifically Aroclor 1260) were detected in 6 of 12 samples from DU 1-2 with a large difference between the maximum concentration (24,000 µg/kg at TF1-EV2-E) and the next highest concentration (1,000 µg/kg at TF1-TV2-SB1028). Detected concentrations of Aroclor 1260 in other samples from DU 1-2 were ≤ 260 µg/kg, and are considered to generally bound the extent of PCBs in soil at DU 1-2 (Tetra Tech, 2014). PCBs (specifically Aroclor 1260) were also detected in 8 of 9 samples from DU 1-3. Aroclor 1260 concentrations ranged from 26 µg/kg (TF1-TV3-SB1031) to 4,300 µg/kg (TF1-TV3-SB1026).

These chemicals were then further evaluated (Tier 2, Step 3A screening) to refine the list of COPCs, and to better characterize risks to ecological receptors. At DU 1-2 and 1-3, no chemicals were retained as COPCs for further evaluation for terrestrial plants, soil invertebrates, and herbivorous wildlife. However, the DGA report concluded that considering (1) the 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 is to further evaluate these localized areas associated with DU 1-2 and DU 1-3 for the insectivorous wildlife endpoints in a FS.

1.3.9 Conceptual Site Model Summary

DU 1-1

Source: Potential contaminants associated with former operations at DU 1-1 (VOCs, SVOCs, and metals) may have been released by spills or improper container handling practices. During the DGA, 5 VOCs, 22 SVOCs (primarily PAHs), 23 metals, TPH, and GRO were detected in surface soil. 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. 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 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 DU 1-1. During the groundwater investigation, 4 VOCs s, 3 SVOCs, and 17 metals were detected in groundwater samples; however, the concentrations did not result in any excess risk.

Interaction: The primary source medium for exposure is surface soil. Contamination in surface soil could potentially migrate into subsurface soil and groundwater through infiltration.

Receptors: Potential current/future receptors include: residents, construction workers, commercial and industrial workers, trespassers, limited recreational users (hunters), and biota.

Summary of Risks: The DGA Report determined that there is predicted human health risk above the USEPA target risk range for surface soil at DU 1-1 under a potential residential or other unrestricted use of the Site. Current and potential future exposures to subsurface soil and groundwater at DU 1-1 did not result in an unacceptable human health risk. The ERA did not identify unacceptable ecological risk.

DU 1-2 and DU 1-3

Source: At DU 1-2 and 1-3, PCBs may have been spilled or leaked from the transformers. At DU 1-2, Aroclor 1260, GRO, and TPH were detected in surface soil. At DU 1-3, Aroclor 1260, Aroclor 1254, GRO, and TPH were detected in surface soil. PCBs were not detected in subsurface soil at DU 1-2 and 1-3.

Interaction: The primary source medium for exposure is surface soil. Contamination in surface soil could potentially migrate into subsurface soil and groundwater through infiltration.

Receptors: Potential current/future receptors include: residents, construction workers, commercial and industrial workers, trespassers, limited recreational users (hunters), and biota.

Summary of Risks: Aroclor 1260 was detected in 6 of 12 samples from DU 1-2 with a large difference between the maximum concentration (24,000 µg/kg at TF1-EV2-E) and the next highest concentration (1,000 µg/kg at TF1-TV2-SB1028). Detected concentrations of Aroclor 1260 in other samples from DU 1-2 were ≤ 260 µg/kg, and are considered to generally bound the extent of PCBs in soil at DU 1-2. PCBs (specifically Aroclor 1260) were also detected in 8 of 9 samples from DU 1-3. Aroclor 1260 concentrations ranged from 26 µg/kg (TF1-TV3-SB1031) to 4,300 µg/kg (TF1-TV3-SB1026) (Tetra Tech, 2014). Current and potential future exposures to surface and subsurface soil and groundwater at DU 1-2 and DU 1-3 did not result in an unacceptable human health risk. However, based on the development of ARARs later in Section 2.1 and the comparison to chemical-specific ARARs and guidance classified as “to be considered” (TBC) in Section 2.3, PCB levels at DU 1-2 and 1-3 do exceed EPA guidance risk-based PCB standards for unrestricted use.

As discussed in Section 1.3.8, the DGA report concluded that the localized areas associated with the maximum Aroclor 1260 concentrations at DU 1-2 and DU 1-3 should be further addressed to protect insectivorous receptors in the future if soil is spread over a larger area because of site activities.

2.0 DEVELOPMENT OF REMEDIATION CRITERIA AND SCREENING OF TECHNOLOGIES

Based on the results of the DGA Report, contaminants identified at DU 1-1 pose risk to human receptors and require remediation and contaminants identified at DU 1-2 and 1-3 pose risk to ecological receptors and require remediation. In order to best select remediation approaches, criteria are developed based on applicable regulatory requirements and guidance classified as "to be considered" (TBC) and risk-based concentrations of contaminants present at the site. The remediation criteria are presented as Remedial Action Objectives (RAOs) supported by numeric cleanup goals called Preliminary Remediation Goals (PRGs) and regulatory requirements (ARARs). Section 2.1 identifies chemical-, location-, and action-specific ARARs. Section 2.2 provides the basis for and selection of RAOs and Section 2.3 presents site-specific PRGs for surface soil at DU 1-1, 1-2, and 1-3.

2.1 Identification of Preliminary of ARARs and TBCs

ARARs consist of federal and state human health and environmental requirements and guidelines that may affect implementation of remedial alternatives. CERCLA, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), 42 U.S.C. § 6901 *et seq.*, and the NCP, 40 C.F.R. Part 300, require identification of all potential ARARs that must be addressed by the USEPA or parties undertaking the remedial action. Determination of ARARs is site-specific and depends on the chemical contaminants, site/location characteristics, and remedial actions being investigated for site cleanup.

CERCLA governs the liability, cleanup, financial responsibility, and response for hazardous substances released into the environment. CERCLA requires that all remedial actions be consistent with the NCP. The NCP specifies procedures, techniques, materials, equipment, and methods to be employed in identifying, removing, or remediating releases of hazardous substances. In particular, the NCP specifies procedures for determining the appropriate type and extent of remedial action at a site in order to effectively mitigate and minimize damage to, and provide adequate protection of, human health, welfare, and the environment.

The national goal of remedy selection is to protect human health and the environment, to maintain that protection over time, and to minimize untreated waste (40 CFR Part 300.430 of the NCP (55 FR 8846)). In accordance with Section 121(d) of CERCLA, 42 U.S.C. § 9621, site remediation must comply with all applicable or relevant and appropriate laws, regulations, and standards promulgated by the federal government, except where waived. Substantive State environmental and facility siting requirements must also be attained, under Section 121(d)(2)(c) of CERCLA, 42 U.S.C. § 9621,

if they are legally enforceable and consistently enforced statewide, and if the state ARAR is more stringent than the federal ARAR and has been presented to the USEPA in a timely manner. Waiver conditions that may be used, if protection of human health and the environment is to be ensured, include the following:

- The remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed.
- Compliance with such requirements is technically impracticable from an engineering perspective.
- Compliance with such requirement at that facility will result in greater risk to human health and the environment than alternative options.
- The remedial action selected will attain, through use of another method or approach, a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation.
- In the case of a remedial action to be undertaken solely under Section 104 of CERCLA, 42 U.S.C. § 9604, selection of a remedial action that attains such level or standard of control will not provide a balance between the need for protection of public health and welfare and the environment at the facility under consideration, and the availability of money from the fund to respond to other sites, taking into consideration the relative immediacy of such threats.
- With respect to a state standard, requirement, criteria, or limitation, the state has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial action sites within the state.

Section 121(e) of CERCLA, 42 U.S.C. § 9621, codified in the NCP at 40 CFR Part 300.400(e), exempts any response action conducted entirely at the site from having to obtain a federal, state, or local permit, where the action is carried out in compliance with Section 121. Remedial actions conducted on CERCLA sites need comply only with the substantive aspects of ARARs and not with the corresponding administrative requirements.

2.1.1 Definition of ARARs

As defined by the NCP, ARARs are placed into three classifications: applicable requirements, relevant and appropriate requirements, and other requirements to be considered. Applicable requirements are promulgated statutory or regulatory cleanup standards and environmental

protection criteria that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site. Included are federal requirements that are directly applicable, as well as those incorporated by a federally authorized state program. State standards that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements are promulgated statutory or regulatory cleanup standards and environmental protection criteria that while not directly "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a site, address similar situations or problems to those encountered. Other environmental and public health guidelines which may be considered to help determine remedial alternatives, but are not ARARs, are termed To Be Considered (TBC). A requirement may be either "applicable" or "relevant and appropriate," but not both. Three categories of ARARs are considered: chemical-specific, location-specific, and action-specific.

2.1.2 Chemical-Specific ARARs and TBCs

Chemical-specific ARARs are numeric values that provide criteria for evaluating concentrations of specific hazardous contaminants and are developed based upon protection of human health and the environment. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment. The potential chemical-specific ARARs and TBCs that apply to DU 1-1, 1-2, and 1-3 soil are described in Table 2-1 and provide a basis for the numerical values provided in development of site PRGs in Appendix A.

2.1.3 Location-Specific ARARs

Location-specific ARARs serve to protect individual characteristics, resources, and specific environmental features on a site, such as wetlands, water bodies, floodplains, and sensitive ecosystems. Location-specific ARARs may affect or restrict remediation and site activities. Based on review of RIDEM's online GIS Environmental Resource Map, there are no wetlands, water bodies, floodplains, and sensitive ecosystems in the proximity of the DU 1-1, 1-2, and 1-3 at Tank Farm 1 and the DUs are located more than 200 feet from a shoreline feature and are not located within the jurisdiction of the Coastal Resources Management Council. As such, no location-specific ARARs have been identified that apply to remedial actions related to site soil.

2.1.4 Action-Specific ARARs

Action-specific ARARs are technology- or activity-based requirements of activities or processes that may be implemented on a site, including storage, transportation, and disposal methods of hazardous substances as well as construction of facilities or treatment processes. As action-specific

ARARs and TBCs are defined by the components of a potential remedy, they will be discussed as appropriate for each remedial alternative during detailed evaluation of alternatives (Section 4.0).

2.2 Development of Remedial Action Objectives

RAOs consist of medium-specific goals for protecting human health and the environment and provide a basis for remedial alternative development and evaluation during the FS process. RAOs for soil were developed based on the results of the HHRSE and ERA conducted for the site (Tetra Tech, 2014). ARARs (e.g., RIDEM soil standards), TBCs, and background considerations were also utilized in developing RAOs.

USEPA guidelines for baseline risks and hazards at a CERCLA site are generally that non-carcinogenic hazard for each target organ should not exceed a total HI of one, and the total receptor ILCR should not exceed the target risk range of 10^{-6} to 10^{-4}. RAOs are limited to media, geographical areas, and chemicals for which estimated risks and hazards exceed USEPA's risk management criteria. For media which exceed USEPA's risk management criteria, review of ARARs/TBCs may result in additional RAOs which address specific chemical exceedances. As noted in Section 1.3.7, exposure to surface soil at DU 1-1 by potential future residents results in an exceedance of USEPA's risk criteria. The DGA report also concluded that the maximum Aroclor 1260 concentrations at DU 1-2 and 1-3 should be further evaluated in the FS. Therefore, RAOs and PRGs are necessary for the soil at DU 1-1, 1-2, and 1-3.

Future use of the Site is considered in the formulation of RAOs. Future use plans for Tank Farm 1, including DU 1-1, 1-2, and 1-3, have not been finalized (Tetra Tech, 2014). It should be noted that residential development is not included in the Navy's current development plans.

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

- Prevent exposure by industrial and restricted recreational users to soil containing site contaminants that exceed industrial use scenario PRGs.
- Prevent exposure by future residents and other unrestricted users to soil containing site contaminants that exceed residential use scenario PRGs.
- 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 PRGs.
- 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 PRGs.

2.3 Development of Preliminary Remediation Goals

The following sections provide a summary of PRG development related to human and ecological exposures at DU 1-1, 1-2, and 1-3.

DU 1-1

PRGs have been developed for the site to prevent exposure to soils with site-related contaminant concentrations that may present human health risks at DU 1-1 (see Table 2-2). PRGs are developed based on an evaluation of risk-based PRGs, background concentrations, practical quantitation limits (PQLs), and other site-specific considerations (e.g., ARARs). If there are established ARARs for chemical-specific concentrations (e.g., federal or state MCLs), these are often selected as PRGs. In the absence of established ARARs, risk-based PRGs are often developed using USEPA guidance in Development of Risk-Based Preliminary Remediation Goals (USEPA, 1991), following the consideration of background concentrations and PQLs.

Human health risk-based PRGs were developed using the equations presented in USEPA's Risk Assessment Guidance for Superfund, Part B: Preliminary Remediation Goals and the methodology used to develop USEPA's Regional Screening Levels. Exposure factors used in the calculation of risk-based PRGs were the same as those used to estimate risks and hazards in the HHSRE, except as noted below.

Risk-based PRGs were developed for soil associated with potential future cumulative cancer risks greater than 10^{-4} considering the ingestion, dermal contact, and inhalation exposure pathways in a residential exposure scenario at DU 1-1. For those soils, risk-based PRG development was required for each chemical with an individual cancer risk above 10^{-6}. As described in Section 1.3.7, these contaminants include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, arsenic, and chromium (see Table 2-2). As

noted in Section 1.3.7, chromium is being maintained as a potential COC until any speciation analysis is performed.

The human health risk-based PRGs developed in Appendix A correspond to target cancer risk levels of 10^{-6}, 10^{-5}, and 10^{-4} and a target non-cancer HQ of 1. For each of the contaminants, risk-based PRGs were calculated using equations and exposure assumptions presented in Appendix A, Tables 2 and 3. As described in Section 1.3.7, in February 2014, an USEPA directive was published which changed many default exposure parameters for the residential receptor (USEPA, 2014). These parameters are slightly different than those used in the HHRSE and have been used in the development of the risk-based PRGs. Note that Table 3 is taken directly from the USEPA directive and includes additional exposure parameters which are not relevant to the PRG development for Tank Farm 1. Toxicity values used in the calculation of the risk-based PRGs are presented in Appendix A, Table 4. The human health risk-based soil PRGs for each contaminant are summarized in Appendix A, Table 5. The PRGs are selected by considering the ARARs, risk-based PRGs, quantitation limits, and background data. In addition, maximum detected concentrations were compared to RIDEM Residential Direct Exposure Criteria (RDEC), Industrial/Commercial Direct Exposure Criteria (I/C DEC), and GA Leachability Criteria, selected as ARARs for the site. PRGs were developed for analytes with exceedances of these criteria.

For the contaminants listed above which were considered risk-drivers, selected PRGs were identified as follows:

1) The lower of the risk-based goals (point-of-departure: cancer risk = 1×10^{-6} or HQ = 1) or ARAR (if available) was initially selected;

2) The PRGs selected in Step 1 were compared to site-specific background values (if available and applicable) and the greater of the two values was selected as the interim PRG, as PRGs are typically not set at concentrations below naturally-occurring background concentrations;

3) The interim PRGs selected in Step 2 were evaluated against available site data to estimate the potential extent of remediation. Other potential PRGs (e.g., cancer risk = 1×10^{-5} and ARARs) were evaluated similarly against site data, including a review of the corresponding residual risk associated with the potential PRGs. In addition, as part of the evaluation, residual risks were calculated for soils remaining following removal of samples with exceedances of PRGs for the specific scenario. All of this information was considered to select the site-specific PRGs.

Based on the procedure noted above, residential PRGs for soil generally correspond to RIDEM RDEC, except for naphthalene, which is based on the RIDEM Leachability Criteria assuming protection of GA classified groundwater, and arsenic and chromium, which have been shown to have a higher site-specific background concentration[1] than the RIDEM RDEC. Although groundwater beneath Tank Farm 1 is classified by RIDEM as GB, the State's groundwater standards are not applicable to the CERCLA remedy because Rhode Island does not have an USEPA-approved Comprehensive State Groundwater Protection Program. Hence, the GA Leachability Criteria were compared to maximum detected concentrations. Per the NCP, USEPA generally does not require cleanup to below background levels. Therefore, PRGs for arsenic and chromium are set at background levels. Residential PRGs for the remaining contaminants for a potential future resident include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, pyrene, and manganese which are based on RIDEM RDEC.

The PAHs which were considered risk-drivers in surface soil (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) were evaluated following the procedure noted above, beginning with the lower risk-based PRGs at a point-of-departure cancer risk equal to 1×10^{-6}. Assuming that soils exceeding RIDEM RDEC were removed from the data set (due to either being excavated or contained/isolated), additional evaluation of calculated potential exposure point concentrations (95% upper confidence limits [UCLs]) for remaining soils showed the contribution to residual risk from these PAHs as 1×10^{-5}.

Table 5 of Appendix A also presents a comparison of maximum detected subsurface soil concentrations to the RIDEM RDEC and site-specific background concentrations. There were no resulting residential scenario PRGs selected for subsurface soil, based on the selection method described above.

USEPA requires that risks and hazards associated with the selected PRGs for each medium and receptor population be calculated to ensure that these cumulative residual risks meet USEPA acceptable risk range.

[1] Site specific background soil concentrations were calculated for arsenic, chromium, and manganese using the background data set identified in the DGA report. A 95% Upper Prediction Limit was calculated using the USEPA ProUCL software (Version 5.0.00). Data and ProUCL output are provided in Appendix A.

Appendix A, Table 6 presents calculations for residual human health risks associated with residential exposure to surface soils at DU 1-1. The calculation of residual risks uses the exposure factors described above and assumes that soils in this area are remediated to reflect an exposure point concentration equal to the selected PRG.

While the DGA did not show an exceedance of USEPA's target risk criteria for an industrial/commercial (I/C) receptor, the applicability of the RIDEM Remediation Regulations as an ARAR (see Section 2.1) resulted in review of maximum detected chemical concentrations as compared to the RIDEM I/C DEC and GA Leachability criteria. Table 7 in Appendix A presents this comparison as part of development of PRGs appropriate for an industrial use scenario. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, naphthalene, and arsenic exceeded the criteria noted. Per the NCP, USEPA generally does not require cleanup to below background levels. Therefore, the PRGs for arsenic are set at background level.

Similar to the residential scenario, Table 7 of Appendix A also presents a comparison of maximum detected subsurface soil concentrations to the RIDEM I/C DEC and site-specific background concentrations. There were no I/C scenario PRGs selected for subsurface soil, based on the selection method described above.

Table 2-2 presents the PRGs selected, and basis for selection, as appropriate for an industrial use scenario.

<u>DU 1-2 and DU 1-3</u>

Based on the conclusion in the DGA to further assess Aroclor 1260 at DU 1-2 and 1-3, ecological PRGs have been developed for the site to prevent exposure to soils with site-related contaminant concentrations that may present risks to ecological receptors (see Table 2-3). Risk-based PRGs were developed for insectivorous receptors exposed to PCBs in soil associated with DU 1-2 and 1-3. Because DU 1-2 and 1-3 are the same size and because the PRG calculation is not based on site-specific uptake factors or toxicity values, the calculated PRGs are the same for both exposure areas.

Ecological risk-based PRGs were developed using the food web equations presented in the DGA report (Tetra Tech, 2014). The ecological risk-based PRGs developed in Appendix A correspond to a HQ of 1. PRGs were developed for two insectivorous receptors, the short-tailed shrew and the American robin based on the exposure assumptions (e.g., body weight, ingestion rate, bioaccumulation factor) used in the Tier 2, Step 3A food web model in the DGA report (Tetra Tech, 2014). PRGs were developed using the geometric mean of the TRVs based on both no observed

adverse effects levels (NOAELs) and lowest observed adverse effects levels (LOAELs). Due to the small size of the Transformer Vaults, it is assumed that the shrew and robin obtain only a portion of their diets from within the exposure area. Because the uptake factors and TRVs are the same for both Aroclor 1254 and Aroclor 1260, the PRGs are applicable to the Total PCB concentration in soil.

As indicated in Appendix A, PRGs are calculated for each receptor based on the geometric mean of the NOAEL- and the LOAEL-based TRVs and an area use factor (AUF) of 0.1 (assumes each receptor obtains 10% of their diet from DU 1-2 and 1-3). Typically, risk managers consider the range of PRGs derived for multiple receptors and different levels of protection. Based on the small size of DU 1-2 and 1-3, the low quality habitat available, and the conservative nature of the food web (i.e., use of NOAELs, exclusive invertebrate diet assumed), a PRG based on a NOAEL-based TRV would be overly protective. Therefore, the geometric mean of the NOAEL- and LOAEL-based TRVs was determined to be appropriate for the derivation of the PRGs. The lower of the PRGs derived for the short-tailed shrew and the American robin is recommended as the ecological PRG for PCBs. This corresponds to a value of 3.4 mg/kg which is the PRG derived based on the short-tailed shrew.

Although the human health risk assessment did not identify unacceptable risks for DU 1-2 and 1-3, the applicability of the RIDEM Remediation Regulations as an ARAR (see Section 2.1) resulted in review of maximum detected chemical concentrations as compared to the RIDEM Res DEC, I/C DEC, and GA Leachability criteria. Table 11 of Appendix A presents this comparison as part of the development of the PRG for DU 1-2 and 1-3. The ecological PRG of 3.4 mg/kg is lower than the RIDEM criteria. The PRG selected for DU 1-2 and 1-3 is based on a lower EPA residential risk-based guidance value of 1 mg/kg, contained in EPA's Guidance on Remedial Actions for Superfund Sites with PCB Contamination (USEPA, 1990). Table 2-3 presents the selected PRG for DU 1-2 and 1-3. No PCBs were detected in subsurface soil at DU 1-2 and 1-3 and therefore, the selected PRG is only applicable to surface soil.

2.4 Estimation of Areas and Volumes

Comparing the available site characterization data to the RAOs and PRGs developed in this Section, estimated quantities of contaminated soil can be quantified. The following discussion presents the basis of defining the areas and volumes of contaminated soil to be addressed in this FS.

DU 1-1

Table 2-4 provides a comparison of DU 1-1 surface soil data to the proposed PRGs. Figure 6 shows the surface soil sample locations with PRGs exceedances for one or more PAH compound. As shown on Figure 6, the extent of impacts due to PAHs has not been fully defined to the north, east, and south of the EBP building. Further, the elevated PAHs detected in surface soil at EBP-MW-GT-124R, which is located adjacent to an asphalt roadway and relatively far from the EBP building, are thought to be the result of the boring's close proximity to the asphalt roadway and not the result of releases associated with DU 1-1. This possibility should be further evaluated as part of further sampling to fully delineate the extent of surface soil to be remediated.

As shown on Figure 6 and Table 2-4, two surface soil sample locations on the north and south sides of the EBP building exceed RIDEM's GA Leachability Criteria for naphthalene. Five additional surface soil sample locations exceed RIDEM's I/C DEC. The extent of surface soil exceeding RIDEM GA Leachability Criteria and I/C DEC should also be further delineated during further sampling or alternatively, through confirmation soil sampling for remedial actions involving excavation of the impacted surface soil.

Figure 7 shows the surface soil sample locations with PRG exceedances for arsenic, chromium, and/or manganese. The extent of surface soil impacted by metals has not been defined and as discussed earlier, the metals concentrations do not appear to show any pattern and are 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. The extent of metals impacts should be further evaluated through further sampling. Further, chromium speciation should be conducted on surface soil samples during future sampling and if hexavalent chromium is determined not to be present, chromium would be eliminated as a COC.

Figure 8 summarizes all surface soil sample locations that have PRG exceedances for PAHs and/or metals and shows an estimated extent of surface soil impacts for the purpose of evaluating remedial alternatives.

- Industrial PRGs: For the purpose of evaluating remedial alternatives, impacted areas totaling approximately 1,800 square feet or 0.04 acres are estimated, based on the data collected in the DGA report. The impacted volume of soil is estimated to be approximately 130 cubic yards based on a 2 foot depth of impact. This volume encompasses the surface soil that exceeds Industrial PRGs (including the RIDEM GA Leachability Criterion for naphthalene).

- Residential PRGs: For the purpose of evaluating remedial alternatives, an impacted area approximately 5,200 square feet or 0.12 acres is estimated, based on the data collected in the DGA report. The impacted volume of soil is estimated to be approximately 400 cubic yards based on a 2 foot depth of impact. This volume encompasses the surface soil that exceeds Residential PRGs (including the RIDEM GA Leachability Criterion for naphthalene).

There are two surface soil sample locations (EBP-SB1020 and EBP-SB1012; 0 to 1 foot depth) that exceed the RIDEM GA Leachability Criteria for naphthalene. The extent of each of these exceedances is assumed to be limited and an area of 400 square feet (20 by 20 foot square) is estimated for each of the two locations. Assuming an impacted depth of 2 feet, the volume of soil is estimated to be 30 cubic yards per area or 60 cubic yards in total. Note that this volume is included in the overall impacted soil volume of approximately 400 cubic yards described above.

Table 2-5 provides a comparison of subsurface soil data to PRGs for surface soil and no PRGs were exceeded. As described in Section 2.3, PRGs were not developed for subsurface soil based on comparison of maximum subsurface soil concentrations to ARARs and background values. As such, impacted subsurface soil was not identified at DU 1-1 that requires remedial response actions.

<u>DU 1-2 and DU 1-3</u>

Table 2-6 provides a comparison of DU 1-2 and 1-3 surface soil data to the proposed PRG. Figures 9 and 10 show the surface soil sample location with PRG exceedance at DU 1-2 and DU 1-3, respectively. As shown on Figure 9, one surface soil sample (TF1-EV2-E) has a PCB concentration greater than the PRG at DU 1-2. The sample is located directly east of the door. At DU 1-3, three surface soil samples (TV3-SB1026, TV3-SB1027, and TV3-SB1032) have a PCB concentration that exceeds the PRG (Figure 10). For the purpose of evaluating remedial alternatives, the extent of exceedances is assumed to be limited and areas of 100 square feet and 150 square feet are estimated at DU 1-2 and DU 1-3, respectively. Assuming an impacted depth of 2 feet, the volume of soil is estimated to be approximately 20 cubic yards total.

Table 2-7 provides a comparison of subsurface soil data to PRGs. PCB concentrations were not detected in subsurface soil samples and therefore, the selected PRG applies only to surface soil.

2.5 General Response Actions

General response actions are developed to satisfy the RAOs for the site. The range of applicable general response actions for surface soil at DU 1-1, 1-2, and 1-3 are as follows:

- No Action
- Limited Action (land use controls [LUCs])
- Containment
- Removal
- Disposal
- Treatment

No remedial activities would be implemented under the No Action response action. However, per the NCP and CERCLA RI/FS guidance, it is considered throughout the FS process as a baseline against which other alternatives can be compared.

2.6 Identification and Screening of Technology Types and Process Options

A preliminary list of potential remedial technologies has been developed for each of the general response actions listed in Section 2.5. These remedial technologies and associated process options are presented and screened in this subsection. Several factors were used to determine feasibility and, in turn, to screen out those technologies that clearly should not be considered for use at the site. The factors used in this screening process were based on the current USEPA guidance for conducting RI/FSs under CERCLA and included, but were not limited to, the following:

- Effectiveness in handling the estimated areas or volumes of media and in meeting the RPGs
- Potential impacts to human health and the environment during construction and implementation
- Proven effectiveness and reliability with respect to the contaminants and conditions at the site
- Implementability in terms of both the technical and administrative feasibility
- Relative costs as far as technologies or process options that accomplish the same result

Table 2-6 presents technology and process option screening for soil. The table presents a brief technology description and the justification for the elimination or further consideration of each technology.

3.0 DEVELOPMENT AND SCREENING OF SOIL ALTERNATIVES

Remedial alternatives for surface soils at DU 1-1, 1-2, and 1-3 are developed in the following sections. As discussed in Section 2.4, PRGs were not developed for subsurface soil based on a comparison of maximum subsurface soil concentrations to ARARs and background values. Additionally, surface soil PRGs were not exceeded in subsurface soil. Hence, there are no remedial actions required for subsurface soil. Remedial technologies not screened from further consideration in Section 2.6 have been used as the basis for developing potential site-specific remedial alternatives listed in this section. Feasible remedial technologies and process options have been combined into comprehensive site remedial alternatives that address the RAOs detailed in Section 2.2.

3.1 Development of Soil Alternatives

The remedial alternatives for the impacted surface soil in the proximity of DU 1-1, 1-2, and 1-3 are discussed below and are also summarized in Table 3-1. Further details are provided in Section 4.0 (Detailed Evaluation) for those alternatives which survive the screening process (Section 3.2).

3.1.1 Alternative S-1 – No Action

This alternative is used as a baseline for comparison to the other alternatives in accordance with the NCP (USEPA, 1990) and RI/FS guidance (USEPA, 1988). There are no remedial actions involved with this alternative.

3.1.2 Alternative S-2 – Limited Soil Excavation with Land Use Controls

Under this alternative, limited soil excavation and off-site disposal would remove all surface soils exceeding the selected PRG for DU 1-2 and 1-3. Limited soil excavation and off-site disposal would also remove surface soils exceeding Industrial PRGs (including RIDEM GA Leachability Criteria) at DU 1-1. LUCs would be established to address direct exposure to surface soils exceeding Residential PRGs at DU 1-1, which would include a series of documented controls and site inspections to prevent residential or other unrestricted use of the DU. Additionally as a conservative measure, LUCs would be implemented to maintain the EBP (DU 1-1), TV2 (DU 1-2) and TV3 (DU 1-3) structure foundations to prevent access to soils below the buildings.

<u>Limited Excavation</u>

At DU 1-1, seven soil boring locations (TF1-EBP-SB1004, TF1-EBP-SB1012, TF1-EBP-SB1016, TF1-EBP-SB1017, TF1-EBP-SB1018, TF1-EBP-SB1020, and TF1-EBP-SB1036) exceed the Industrial PRGs.

The RIDEM GA Leachability Criteria served as the basis of the Industrial PRG for naphthalene due to the exceedances at soil boring locations TF1-EBP-SB1012 and TF1-EBP-SB1020. Estimated areas and volumes are summarized in Section 2.4.

Four soil samples exceed the PRG for PCBs at DU 1-2 and 1-3. At DU 1-2, one soil location (TF1-EV2-E) exceeds the selected PRG for PCBs. At DU 1-3, three soil locations (TV3-SB1026, TV3-SB1027, and TV3-SB1032) exceed the selected PRG for PCBs. Estimated areas and volumes are summarized in Section 2.4.

Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. Further sampling would 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.

All excavated soil will be stockpiled at an approved location. Details regarding stockpile management (e.g., stormwater controls and temporary covers) will be developed during the remedial design phase. Prior to disposal, waste characterization samples will be collected from the stockpiled soil.

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 do 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.

<u>Land Use Controls</u>

At DU 1-2 and 1-3, all surface soil with PCB concentrations exceeding the PRG would be removed; however, LUCs would be required as a conservative measure, for the TV2 and TV3 structure foundations to prevent exposure to soil beneath the buildings. In the event TV2 and/or TV3 is demolished in the future, the soil would be assessed and remediated, if necessary, to meet the Residential PRG. At DU 1-1, soil would remain on-site at concentrations greater than PRGs ; 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. 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 PRGs. 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 and 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. Demolition of these buildings is not considered part of this alternative.

Additionally, five-year reviews would be required since contaminants will remain in excess of levels that allow for unrestricted use and unlimited exposure. Five-year reviews of Tank Farm 1 would be conducted as part of the facility-wide five-year review process.

For this remedial alternative, the LUC RD would limit development of the site for residential use. In accordance with the Record of Decision (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.

3.1.3 Alternative S-3 – Soil Excavation (with Short-Term Land Use Controls under EBP, TV2 and TV3 Buildings, only)

This alternative involves excavation of the contaminated surface soils at DU 1-1, 1-2, and 1-3 that exceed the respective PRGs for each DU. Excavated soil will be transported off-site for disposal, reuse, or recycling. At DU 1-2 and 1-3, all surface soil with PCB concentrations exceeding PRGs would be removed. At DU 1-1, all surface soil in excess of both the Residential and Industrial PRGs would be removed. The RIDEM GA Leachability Criteria served as the basis of the Residential and Industrial PRGs for naphthalene due to the exceedances at soil boring locations TF1-EBP-SB1012 and TF1-EBP-SB1020. Additionally as a conservative measure, short-term LUCs would be implemented to maintain the EBP (DU 1-1), TV2 (DU 1-2) and TV3 (DU 1-3) structure foundations to prevent access to soils below the buildings.

Excavation

At DU 1-1, approximately 400 cubic yards of soil would be excavated. Additionally, approximately 20 cubic yards of soil would be removed from DU 1-2 and 1-3. Estimated areas and volumes are described are described in Section 2.4. Actual quantities would be determined during the RD.

Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. Further sampling would 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 the EBP are hexavalent chromium; however, if hexavalent chromium is determined not to be present, then chromium would no longer be a COC.

All excavated soil will be stockpiled at an approved location. Details regarding stockpile management (e.g., stormwater controls and temporary covers) will be developed during the remedial design phase. Prior to disposal, waste characterization samples will be collected from the stockpiled soil.

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 do 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.

Short-term Land Use Controls

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 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, if 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 Residential and Industrial PRGs. 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.

As long as the short-term LUCs are needed for the EBP, TV2 and TV3 foundations, five-year reviews will be performed under this alternative to evaluate the continued adequacy of the remedy. The five-year reviews would be performed as part of the facility-wide five year reviews.

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.

3.1.4 Alternative S-4 – Limited Soil Excavation with Soil Cover and Land Use Controls

This alternative would use a clean soil cover to isolate the contaminated surface soils at DU 1-1 that exceed Residential and Industrial PRGs based on direct exposure. At DU 1-2 and 1-3, all PCB concentrations exceeding PRGs would be removed for off-site disposal and further sampling would be performed to verify that the full extent of soil exceeding the PRG has been removed. A soil cover will reduce exposure risks at DU 1-1 by preventing direct contact with the contaminated soil. Since the excavation at DU 1-2 and 1-3 will remove contaminated soil exceeding the PRG, a cover is not warranted in these two areas.

Prior to installation of the soil cover, limited soil excavation and off-site disposal would be conducted at DU 1-1 to remove soils exceeding the RIDEM GA Leachability Criteria for naphthalene around two soil boring locations (TF1-EBP-SB1012 and TF1-EBP-SB1020). Refer to Section 2.4 for estimated areas and volumes of surface soil exceeding RIDEM GA Leachability Criteria. All excavated soil will be stockpiled at an approved location. Details regarding stockpile management (e.g., stormwater controls and temporary covers) will be developed during the remedial design phase. Prior to disposal, waste characterization samples will be collected from the stockpiled soil.

Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. As discussed in Section 3.1.3, further sampling would also include analysis for hexavalent chromium at a few locations. Refer to Section 2.4 for the estimated area of surface soils impacts at DU 1-1. For purposes of this 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 will 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 do not exceed the RIDEM GA Leachability Criteria. Maintenance of the cover would be required over time including mowing, shrub removal, and integrity inspections. LUCs will be established and five-year reviews would be performed to evaluate the success of the remedial actions. Five-year reviews of Tank Farm 1 would be conducted as part of the facility-wide five-year review process. 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 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 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 PRGs at DU 1-1 and the Residential PRG at DU 1-2 and 1-3. If and 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.

For this remedial alternative, the LUC RD would limit development of DU 1-1 for residential use, prevent disturbance of the cover at DU 1-1, and require maintenance of the building foundations at DU 1-1, 1-2, an 1-3. In accordance with the Record of Decision (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.

3.1.5 Alternative S-5 – On-Site Consolidation and Soil Cover with Land Use Controls

This alternative is similar to Alternative S-4 but would include 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. Prior to on-site consolidation, limited soil that exceeded RIDEM GA Leachability Criteria would be segregated for off-site disposal. Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. The excavated soils would be placed in one area and covered with a clean soil cover. The soil cover would meet RI Remediation Regulation standards for preventing exposure to soils exceeding RDECs. For cost purposes, it is assumed the soil cover would consist of two feet of clean fill. This would be finished with a layer of topsoil and grass seed. Stormwater runoff controls will be required during installation of the 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 consolidated soil do not exceed the RIDEM GA Leachability Criteria.

LUCs would only be required for the area consisting of the soil cover since all contaminated soil will be underneath the cover. By consolidating the contaminated surface soil, the remainder of the site would be free of surface soils exceeding residential and industrial PRGs and allow for unrestricted use and unlimited exposure upon completion of the remedial action. Maintenance of the cover would be required over time including mowing, shrub removal, and integrity inspections. LUCs will be established for the site, and five-year reviews would be performed to evaluate the success of the remedial actions. 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 beneath the building, if it exists. Similarly, for DU 1-2 and 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 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 EBP, TV2 and/or TV3 structures is not considered part of this alternative. However, once the buildings are demolished and the foundations removed, if underlying soil is present, it would be assessed and remediated if needed to meet Residential and Industrial PRGs at DU 1-1 and Residential PRGs at DU 1-2 and 1-3. If and 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.

3.2 Screening of Soil Alternatives

Initial screening of remedial alternatives developed in Section 3.1 is performed in Section 3.2 to initiate the evaluation of each alternative. In addition, the screening process is used to potentially eliminate one or more alternatives that do not appear advantageous to carry through to the

detailed evaluation in Section 4.0. This initial screening process includes an assessment of the advantages and disadvantages of each alternative on the basis of their effectiveness, implementability, and cost, in accordance with the RI/FS guidance (USEPA, 1988).

The effectiveness of each remedial alternative was assessed using the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reductions in toxicity, mobility, and volume through treatment
- Short-term effectiveness

The implementability of each remedial alternative was assessed using the following criteria:

- Technical feasibility
- Administrative feasibility
- Applicability based on site conditions and layout

The costs were initially assessed using engineering judgment, considering capital costs for equipment and construction and O&M estimates.

Tables 3-2 through 3-6 present the initial screening of the remedial alternatives for DU 1-1, 1-2, and 1-3. Based on this screening, alternatives S-1, S-2, S-3 and S-4 were retained for detailed evaluation. S-5 was removed from further evaluation 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 result.

4.0 DETAILED ANALYSIS OF SOIL ALTERNATIVES

A detailed evaluation of candidate remedial alternatives is conducted to evaluate each of the alternatives individually, and subsequently apply the evaluation comparatively among them (refer to Section 5.0). The following seven criteria are evaluated during the FS phase of the CERCLA process. Two additional criteria, state and community acceptance, will be evaluated as part of the subsequent regulatory and community review phase.

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

4.1 Alternative S-1 – No Action

4.1.1 Detailed Description

The no action alternative, as required under the NCP, would involve no remedial response activities and would provide no additional protection of human health or the environment; this alternative provides a baseline for comparison to other alternatives.

4.1.2 Criteria Analysis

A detailed discussion of the specific attributes of each FS Criteria is presented in below and summarized in Table 4-1.

Overall protection of human health and the environment: Based on the results of the DGA Report, the no action alternative does not provide long-term protection of human health at the EBP or long-term protection of the environment at the Transformer Vaults. The alternative does not achieve the RAOs described in Section 2.2.

Compliance with ARARs: Table B-1 in Appendix B presents an evaluation of chemical-specific ARARs and TBCs associated with Alternative S-1. Under current conditions, chemical-specific ARARs and TBCs have not been met. Therefore, this alternative would not meet ARARs.

Long-term effectiveness and permanence: Since no remedial actions would occur under this alternative, the estimated risks to human health would remain. This alternative does not include any controls to reduce potential exposures to contamination.

Reduction of toxicity, mobility or volume through treatment: This alternative does not involve/ include treatment.

Short-term effectiveness: Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to workers or the community from the remedy. Additionally, there are no short-term impacts to natural habitats.

Implementability: This alternative would require no implementation.

Cost: No costs would be anticipated under the no action alternative.

4.2 Alternative S-2 – Limited Soil Excavation with Land Use Controls

4.2.1 Detailed Description

Under this alternative, limited soil excavation and off-site disposal would be performed to remove soils exceeding the Industrial PRGs (including RIDEM GA Leachability Criteria) at DU 1-1 and to remove soils exceeding the selected PRG for DU 1-2 and DU 1-3. As discussed in Section 3.0, no remedial actions are required for subsurface soil and subsurface soil concentrations do not exceed surface soil PRGs.

At DU 1-1, seven soil boring locations (TF1-EBP-SB1004, TF1-EBP-SB1012, TF1-EBP-SB1016, TF1-EBP-SB1017, TF1-EBP-SB1018, TF1-EBP-SB1020, and TF1-EBP-SB1036) exceed the Industrial PRGs. For the purpose of evaluating remedial alternatives, impacted areas totaling approximately 1,800 square feet or 0.04 acres are estimated, based on the data collected in the DGA report. The impacted volume of soil is estimated to be approximately 130 cubic yards based on a 2 foot depth of impact. Soil would remain onsite at concentrations greater than the Residential PRGs at DU 1-1; therefore, LUCs would be established to prevent residential and unrestricted recreational use of the property, and thus prevent the exposure of such receptors to COCs in surface soil.

Four soil sample locations exceed the selected PRG for PCBs at DU 1-2 and DU 1-3. At DU 1-2, one soil location (TF1-EV2-E) exceeds the selected PRG for PCBs. At DU 1-3, three soil locations (TV3-SB1026, TV3-SB1027, and TV3-SB1032) exceed the selected PRG for PCBs. For the purpose of evaluating remedial alternatives, the extent of each exceedance is assumed to be limited to areas of 100 square feet and 150 square feet at DU 1-2 and DU 1-3, respectively. Assuming an impacted

depth of 2 feet, the volume of soil is estimated to be approximately 20 cubic yards in total. As part of the excavation at DU 1-2 and 1-3, all PCB concentrations exceeding the PRG will be removed. Therefore, LUCs are not required at DU 1-2 and 1-3, except to prevent access to soil beneath the TV2 and TV3 building foundations as a conservative measure as described below. Details of each component of Alternative S-2 are as follows.

Soil Removal and Disposal – The goal of the removal is to address Industrial PRG exceedances at seven former sample locations at DU 1-1 and the PRG exceedances for four former sample locations at DU 1-2 and DU 1-3 as described in the following paragraphs. The areas currently targeted for excavation are presented on Figures 8, 9, and 10 and estimated areas and volumes are provided below.

Exposure Area	Area of Proposed Soil Removal (sq. feet)	Volume of Proposed Soil Removal (cubic yards)
DU 1-1	1,800	130
DU 1-2 and DU 1-3	250	20

Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. Further sampling would 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 area would be re-graded and seeded. Due to the shallow depth of the excavation, it is assumed that no backfill would be needed.

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

LUCs and Inspections – Following the removal excavation, soil would remain at DU 1-1 at concentrations greater than PRGs; therefore, LUCs, monitoring, and inspections (also described below) will be required to complete the remedy. As discussed above, all surface soil with PCB concentrations exceeding the PRG at DU 1-2 and DU 1-3 will be removed; however, LUCs are required, as a conservative measure, to prevent access to soil beneath the TV2 and TV3 building

foundations. The intent of LUCs at DU 1-1 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 would also be included as part of the 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, LUCs would also be required for the EBP foundation to prevent access to soil, if it exists, below the building. 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 PRGs for DU 1-1 and Residential PRGs for DU 1-2 and 1-3. If and 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.

LUCs would be required for approximately 400 cubic yards of the DU 1-1 soils, based on an area of 5,200 square feet. Of the 400 cubic yards, approximately 65 cubic yards (or 890 square feet) of soil are covered by the EBP structure.

For this remedial alternative, the LUC RD would prohibit development of DU 1-1 for residential and unrestricted recreational use and require maintenance of the building foundations at DU 1-1, 1-2, and 1-3. 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.

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 cleanup levels 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 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 – Contamination would remain in excess of levels that allow for unrestricted use and unlimited exposure; therefore, five-year reviews would be required under this alternative to evaluate the continued adequacy of the remedy. The five-year reviews would be performed as part of the facility-wide five year reviews.

4.2.2 Criteria Analysis

A detailed discussion of the specific attributes of each of the FS Criteria is presented below and summarized in Table 4-2.

Overall protection of human health and the environment: The Limited Soil Excavation with Land Use Controls alternative removes soil concentrations exceeding the RIDEM GA Leachability Criteria at DU 1-1 and DU 1-2; thereby, reducing the potential for naphthalene and PCB concentrations to migrate to groundwater. Additionally, the alternative removes soil concentrations exceeding the Industrial PRGs at DU 1-1; thereby, reducing the risk to industrial workers. This alternative also removes soil concentrations exceeding the PRG at DU 1-2 and DU 1-3; thereby fully addressing the risk to the environment at the Transformer Vaults.

Soil contamination will remain present at DU 1-1 above Residential PRGs. By implementing the LUCs at DU 1-1, residential and unrestricted recreational use of DU 1-1 is prohibited so that contact with COCs at concentrations that would cause an unacceptable risk to human receptors is prevented for the life of the remedy.

Compliance with ARARs: Tables B-2a and B-2b in Appendix B present an evaluation of chemical-specific and action-specific ARARs and TBCs associated with Alternative S-2. Location-specific ARARs were not identified. With proper execution of this alternative, all chemical-specific ARARs and TBCs will be met and action-specific ARARs and TBCs would be complied with.

Long-term effectiveness and permanence: By removing the soil concentrations that exceed the RIDEM GA Leachability Criteria, this alternative is effective at reducing the potential for naphthalene and PCB concentrations to migrate to groundwater. Additionally, the alternative removes soil concentrations exceeding the Industrial PRGs at DU 1-1, 1-2, and 1-3; thereby, reducing the risk to industrial workers.

As part of this alternative, no COCs would remain above PRGs at DU 1-2 and 1-3. Since all PCB concentrations exceeding the PRGs will be removed, DU 1-2 and 1-3 would be suitable for unrestricted reuse, with exception of maintaining the TV2 and TV3 building foundations. DU 1-1 would be suitable for continued use similar to the current use, and LUCs would restrict potential residential receptors from coming into contact with the soil, under scenarios that could pose unacceptable exposure. Five-year reviews would be conducted to evaluate the continued adequacy of the remedy.

Reduction of toxicity, mobility or volume through treatment: This alternative does not involve/include treatment.

Short-term effectiveness: Alternative S-2 would be effective in the short term as long as work is done properly, with the necessary controls in place. Risks to the community would be minor with the implementation of this alternative. During excavation and environmental monitoring, short-term risks to workers would be mitigated through use of proper personal protective equipment (PPE). Additionally, minor short-term impacts to the ecological habitat would occur during environmental sampling and excavation. Since there is no risk to existing receptors, Alternative S-2 would be effective immediately after implementation.

Implementability: Excavation and LUCs are proven technologies used to address soil contamination at a site. The resources required for implementation of this alternative are readily available. Additionally, the preparation and implementation of a LUC RD would require administrative processes that can be easily implemented.

Cost: As part of this alternative, costs are associated with the excavation, environmental sampling, implementation of LUCs, and five-year reviews. The cost associated with this alternative is summarized below. Note that costs associated with potential assessment/remediation of soil beneath the EBP, TV2 and TV3 structures are not included. Additional details on the price breakdown are presented in Appendix C.

Cost Component	Present Value (PV) Cost
Capital Cost	$163,414
O&M Costs	$51,514
Periodic Annual Costs (30-year period)	$23,307
Total PV Cost of Alternative[1]	$238,000

[1] Rounded to the nearest $1,000

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

4.3 Alternative S-3 – Soil Excavation (with Short-Term Land Use Controls under EBP, TV2 and TV3 Buildings only)

4.3.1 Detailed Description

This alternative involves excavation of all surface soils that exceed industrial and residential PRGs in DU 1-1 and the selected PRG for the Transformer Vaults at DU 1-2 and DU 1-3. As discussed in Section 3.0, PRGs were not developed for subsurface soil based on a comparison of maximum subsurface soil concentrations to ARARs and background values. Additionally, surface soil PRGs were not exceeded in subsurface soil. Therefore, there are no remedial actions required for subsurface soil. Excavated soil will be transported off-site for disposal, reuse, or recycling. At DU 1-2 and DU 1-3, all surface soil with PCB concentrations exceeding the PRG would be removed; however, short-term LUCs would be required, as a conservative measure, to prevent access to soil beneath the TV2 and TV3 building foundations . 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, short-term LUCs would be required for the EBP foundation to prevent access to the underlying soil, if it exists. If the EBP, TV2, and TV3 buildings are demolished and the foundations removed, the underlying material would be assessed and, if soil is present, it would be remediated if needed to meet Residential and Industrial PRGs. Short-term LUCs would prevent disturbance of the building foundations without approval of the Navy and regulatory agencies, and five-year reviews would be performed to evaluate the success of the remedial actions. Details of each component of Alternative S-3 are discussed below.

Soil Removal and Disposal – The goal of the removal is to address all surface soils that exceed the PRGs for DU 1-1, 1-2, and 1-3. The areas currently targeted for excavation are presented on Figures 8, 9, and 10 and estimated areas and volumes are provided below.

Exposure Area	Area of Proposed Soil Removal (sq. feet)	Volume of Proposed Soil Removal (cubic yards)
DU 1-1	5,200	400
DU 1-2 and DU 1-3	250	20

Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. Further sampling would 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.

Erosion control measures (i.e., silt fences) will be installed around the excavation areas before the excavation begins. During the excavation, dust control and air monitoring will be performed, as necessary. 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.

Short-Term LUCs and Inspections – Following the excavation, surface soils that exceed the respective PRGs in the proximity of DU 1-1, 1-2, and 1-3 will be removed. However, no sampling has been performed underneath the EBP, TV2 or TV3 structures and the presence of absence of soil beneath the foundations has not been assessed. Therefore, short-term LUCs would likely be required until the EBP, TV2 and/or TV3 structures are demolished and the presence or absence of soil beneath the buildings can be assessed. Short-term LUCs would be required over approximately 65 cubic yards (or 890 square feet) of material covered by the EBP structure. Similarly, short-term LUCs would be required over approximately 11 cubic yards (or 155 square feet) for each of the TV2 and TV3 structures. Short-term LUCs would prevent disturbance of the building foundations and restrict access to the underlying soil, if it exists, without approval of the Navy and regulatory agencies. Short-term LUCs would also include maintenance of the structure foundations. The demolition of the structures 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 Residential and Industrial PRGs. 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.

The short-term LUC implementation actions 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 short-term LUCs until the cleanup levels 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 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 – As long as short-term LUCs are needed for DU 1-1, DU 1-2 and 1-3, five-year reviews will be performed under this alternative to evaluate the continued adequacy of the remedy. The five-year reviews would be performed as part of the facility-wide five year reviews.

4.3.2 Criteria Analysis

A detailed discussion of the specific attributes of each FS Criteria is presented below and summarized in Table 4-3.

Overall protection of human health and the environment: The Soil Excavation (with Short-Term Land Use Controls under EBP, TV2, and TV3 Buildings only) alternative removes soil concentrations at DU 1-1, 1-2, and 1-3 exceeding the respective PRGs. Since no sampling has been performed underneath the EBP, TV2, and TV3 structures and the presence or absence of soil has not been

assessed, short-term LUCs would likely be required until the structures are demolished and the presence or absence of soil beneath the buildings can be assessed and remediated, if necessary. Once the underlying material is assessed and remediated (if needed), all contaminants will be removed from DU 1-1, 1-2, and 1-3; thereby, allowing for unrestricted use and unlimited exposure upon completion of the remedial action. This alternative is protective of human health and the environment.

Compliance with ARARs: Tables B-3a and B-3b in Appendix B present an evaluation of chemical-specific and action-specific ARARs and TBCs associated with Alternative S-3. Location-specific ARARs were not identified. With proper execution of this alternative, all chemical-specific ARARs and TBCs will be met and action-specific ARARs and TBCs would be complied with.

Long-term effectiveness and permanence: This alternative is effective at eliminating the risk to potential future receptors. The Soil Excavation (with Short-Term Land Use Controls under the EBP, TV2, and TV3 Buildings only) alternative removes soil concentrations at DU 1-1, 1-2, and 1-3 exceeding the respective PRGs. Since no sampling has been performed underneath the EBP, TV2, and TV3 structures and the presence or absence of soil has not been assessed, short-term LUCs would likely be required until the EBP, TV2, and/or TV3 structures are demolished and the soil, if present, beneath the buildings can be assessed and remediated, if necessary. Once that is completed, all contaminants will be removed from the site. By removing the contaminant source, no additional remedial actions will be required to address CERCLA contaminants at DU 1-1, 1-2, and 1-3. This alternative is effective and permanent.

Reduction of toxicity, mobility or volume through treatment: This alternative does not involve/ include treatment.

Short-term effectiveness: Alternative S-3 would be effective in the short term as long as work is done properly, with the necessary controls in place. Risks to the community would be minor with the implementation of this alternative. During excavation and environmental monitoring, short-term risks to workers would be mitigated through use of proper PPE. Additionally, minor short-term impacts to the ecological habitat would occur as part of this alternative. Alternative S-3 would be effective immediately after implementation.

Implementability: Excavation is a proven technology used to address soil contamination at a site. The resources required for implementation of this alternative are readily available.

With the proper planning and design, excavation of the contaminated soil will be relatively easy to implement. Prior to implementing this alternative, a work plan would be prepared to include the specifications of the sampling approach, soil removal, and site restoration. In addition, the work plan would address the necessary health and safety requirements during the field work.

Cost: The estimated cost associated with this alternative is presented below. Note that costs associated with potential assessment/remediation of soil beneath the EBP, TV2 and TV3 structures are not included. The O&M and period costs presented below are based on an assumed 10-year duration, including two five-year reviews and annual LUC inspections. The actual timing of demolition of the EBP, TV2 and TV3 structures is not known. Additional details on the price breakdown are presented in Appendix C.

Cost Component	PV Cost
Capital Cost	$253,646
O&M Costs	$20,316
Periodic Annual Costs (10-year period)	$9,284
Total PV Cost of Alternative[1]	$283,000

[1] Rounded to the nearest $1,000

Note: Costs associated with potential assessment and remediation of the 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.

4.4 Alternative S-4 – Limited Soil Excavation with Soil Cover and Land Use Controls

4.4.1 Detailed Description

As discussed in Section 3.0, PRGs were not developed for subsurface soil based on a comparison of maximum subsurface soil concentrations to ARARs and background values. Additionally, surface soil PRGs were not exceeded in subsurface soil. Therefore, there are no remedial actions required for subsurface soil. This alternative would use clean soil cover to isolate the contaminated surface soils at DU 1-1. The soil cover will reduce exposure risks at the site by preventing direct contact with the contaminated soil. Additionally, limited soil excavation and off-site disposal would be conducted to remove soils exceeding the RIDEM GA Leachability Criteria for naphthalene around two soil boring locations at DU 1-1 (TF1-EBP-SB1012 and TF1-EBP-SB1020). The DU 1-2 and 1-3 excavations would remove soils exceeding the selected PRG for these areas. Maintenance of the cover at DU 1-1 would be required over time including mowing, shrub removal, and integrity inspections. LUCs will be established and five-year reviews would be performed to evaluate the success of the remedial actions. As a conservative measure, LUCs would be required for the EBP, TV2 and TV3

structure footprints to prevent access to soil, if it exists, below the buildings. If any of the buildings are demolished 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 Industrial PRGs at DU 1-1 and the Residential PRG at DU 1-2 and 1-3. Details of each component of Alternative S-4 are discussed below.

Soil Removal and Disposal – Prior to installation of the cover, soil removal will be performed to address RIDEM GA Leachability Criteria exceedances of naphthalene at two former sample locations at DU 1-1. In addition, soil removal will be performed to address the PRG for DU 1-2 and DU 1-3 at one sample location at DU 1-2 and three sample locations at DU 1-3. The areas currently targeted for excavation are presented on Figures 8, 9, and 10 and estimated areas and volumes are provided below.

Exposure Area	Area of Proposed Soil Removal (sq. feet)	Volume of Proposed Soil Removal (cubic yards)
DU 1-1	800	60
DU 1-2 and DU 1-3	250	20

Further sampling will be needed to delineate the extent of surface soils that exceed PRGs at DU 1-1, 1-2, and 1-3. Further sampling would 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 area would be re-graded seeded. Due to the shallow depth of the excavation, it is assumed that no backfill would be needed.

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

Soil Cover – After the limited soil removal is performed, a clean soil cover meeting RIDEM Remediation Regulation standards will be placed over all soils that exceed the PRGs at DU 1-1. Further sampling will be performed to determine the area required to be covered. As discussed in Section 3.1.3, further sampling would also include analysis for hexavalent chromium at a few locations. Sampling and analysis assumptions are included in the cost backup (Appendix C).

An estimate of the impacted area at DU 1-1 is provided in Section 2.4. The size of the cover will be determined based on the results of the further sampling. The areas currently targeted for the soil cover are presented on Figure 8 and estimated areas and volumes are provided below.

Exposure Area	Area of Proposed Soil Cover (sq. feet)	Volume of Proposed Soil Cover (cubic yards)
DU 1-1	5,200	480
DU 1-2 and DU 1-3	0	0

The soil cover would consist of approximately two feet of clean fill. This would be finished with a layer of topsoil and grass seed. The cover system will prevent direct contact, erosion, and transport of remaining surface soil exceeding residential PRGs. Prior to installing the cover, 2 samples of fill (1 sample per fill type) will be collected to ensure no contamination is present in the fill. Alternate covers are possible, such as those using geotextile materials and those using a system of asphalt pavement; however, the 2-foot soil cover is a common approach and was used here for comparison purposes.

LUCs and Inspections – LUCs would be applied to DU 1-1 that would restrict cover disturbance and require maintenance of the soil cover, as well as perform associated inspections and reporting. 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. Similarly, for DU 1-2 and 1-3, the soil beneath TV2 and TV3 has not been assessed and 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 building foundations and underlying material 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 building structures is not considered part of this alternative. However, if any of the buildings are demolished and foundations removed, the presence or absence of underlying soil would be assessed and remediated if needed to meet PRGs. If and 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.

LUCs would be required for approximately 400 cubic yards of the DU 1-1 soils, based on an area of 5,200 square feet. Of the 400 cubic yards, approximately 65 cubic yards (or 890 square feet) of soil

is covered by the EBP structure. LUCs would also be required over approximately 11 cubic yards (or 155 square feet) for each of the TV2 (DU 1-2) and TV3 (DU 1-3) structures.

To implement LUCs, the Navy would prepare a LUC RD that would document the LUCs, O&M requirements, inspection requirements, and organizations responsible for implementation of the LUCs. Requirements for management of excavated soil as part of any future construction activities (including sampling and disposal of contaminated soils) at DU 1-1 would also be included as part of the LUCs. For this remedial alternative, the LUC RD would also limit development of the site for residential use.

The LUC implementation actions including 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 cleanup levels 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 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.

<u>Five-Year Reviews</u> – Contamination would remain in excess of levels that allow for unrestricted use and unlimited exposure, therefore, five-year reviews would be required under this alternative to

evaluate the continued adequacy of the remedy. The five-year reviews would be performed as part of the facility-wide five year reviews.

4.4.2 Criteria Analysis

A detailed discussion of the specific attributes of each FS Criteria is presented in below and summarized in Table 4-4.

Overall protection of human health and the environment: The Limited Soil Excavation with Soil Cover and Land Use Controls alternative prevents direct contact, erosion, and transport of surface soil exceeding residential PRGs at DU 1-1, 1-2, and 1-3. Additionally, the alternative removes soil concentrations exceeding the RIDEM GA Leachability Criteria; thereby, reducing the potential for naphthalene and PCB concentrations to migrate to groundwater. As part of this alternative, all soil concentrations that exceed the PRG for PCBs will be removed from DU 1-2 and 1-3, with the exception of potentially impacted soils beneath the TV2 and TV3 structure foundations. Soil contamination will remain present at DU 1-1. LUCs would be implemented at DU 1-1 so that the cover remains intact and an unacceptable risk to human receptors is prevented for the life of the remedy.

Compliance with ARARs: Tables B-4a and B-4b in Appendix B present an evaluation of chemical-specific and action-specific ARARs and TBCs associated with Alternative S-4. Location-specific ARARs were not identified. With proper execution of this remedy would, all chemical-specific ARARs and TBCs will be met and action-specific ARARs and TBCs would be complied with.

Long-term effectiveness and permanence: By removing the soil concentrations that exceed the RIDEM GA Leachability Criteria, this alternative is effective at reducing the potential for unacceptable naphthalene concentrations at DU 1-1 to migrate to groundwater. Upon completion of the PCB removal, no contaminants remain above PRGs at DU 1-2 and 1-3, with the exception of potential soil contamination beneath the TV2 and TV3 building foundations. The remaining type and quantity of contaminants at DU 1-1 following implementation of this alternative is similar to current conditions. Exposure to COCs would be prevented by the cover. In order to ensure the integrity of the cover, LUCs, consisting of cover disturbance restrictions, maintenance, and inspections, would be performed.

DU 1-1, 1-2, and 1-3 would be suitable for continued use similar to the current use, and LUCs would restrict potential receptors from coming into contact with the soil, under scenarios that could pose unacceptable exposure. Five-year reviews would be conducted to evaluate the continued adequacy of the remedy.

Reduction of toxicity, mobility or volume through treatment: This alternative does not involve/ include treatment.

Short-term effectiveness: Alternative S-4 would be effective in the short term as long as work is done properly, with the necessary controls in place. Risks to the community would be minor with the implementation of this alternative. During excavation, installation of the cover, and environmental monitoring, short-term risks to workers would be mitigated through use of proper PPE. Additionally, minor short-term impacts to the ecological habitat would occur as part of this alternative.

Implementability: Excavation, installation of a soil cover, and LUCs are proven technologies used to address soil contamination at a site. The resources required for implementation of this alternative are readily available.

With the proper planning and design, Alternative S-4 will be relatively easy to implement. Prior to implementing this alternative, a work plan would be prepared to include the specifications of the sampling approach, soil removal, cover design, and site restoration. The work plan would also address the necessary health and safety requirements during the field work. Lastly, the preparation and implementation of a LUC RD would require administrative processes that can be easily implemented.

Cost: As part of this alternative, costs are associated with the excavation, soil cover, environmental sampling, implementation of LUCs, and five-year reviews. The cost associated with this alternative is presented below. Note that costs associated with potential assessment/remediation of soil beneath the EBP, TV2 and TV3 structures are not included. Additional details on the price breakdown are presented in Appendix C.

Cost Component	Present Value (PV) Cost
Capital Cost	$242,127
O&M Costs	$83,215
Periodic Annual Costs (30-year period)	$23,307
Total PV Cost of Alternative[1]	$349,000

[1] Rounded to the nearest $1,000

Note: Costs associated with potential assessment and remediation of the 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.

5.0 COMPARATIVE ANALYSIS AND COST SENSITIVITY ANALYSIS OF SOIL ALTERNATIVES

In the sections that follow, a comparative analysis of each alternative is presented along with a cost sensitivity analysis.

5.1 Comparative Analysis

This comparative analysis evaluates the relative performance of each of the candidate alternatives, using the individual detailed evaluation of the specific criteria presented in Section 4.0. To organize the comparative process, the evaluation criteria are grouped into the following categories, which are sorted by the order of importance specified in CERCLA RI/FS guidance:

- Threshold criteria
- Primary balancing criteria
- Modifying criteria

Threshold criteria, according to the NCP, must be achieved by the selected site remedy. The two evaluation factors that are considered to be threshold criteria are listed below. If these criteria not achieved by a particular remedy, then that remedy does not satisfy the minimum expectations for CERCLA response actions.

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

Primary balancing criteria are used to weigh the pros and cons of remedies that already satisfy threshold criteria. Specifically, these criteria are used to provide an assessment of the permanence of each remedial alternative, while ensuring their implementability and cost-effectiveness. Further, these criteria encourage the use of treatment technologies that reduce the toxicity, mobility, and volume of contaminants rather than technologies that solely prevent exposure. Primary balancing criteria consist of the following five NCP evaluation criteria:

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

The final category, *modifying criteria*, are not included in FS evaluations, but are essential in stakeholder discussions and selection of an ultimate site response. This final category of NCP criteria are listed below, but are not included in this FS evaluation, per CERCLA guidance (USEPA, 1988).

- State acceptance
- Community acceptance

Upon finalization of this FS Report, the Navy, RIDEM and other stakeholders will use this FS Report as a reference tool, and will consider the input and expectations of the community in recommending a remedial alternative for implementation. The selected remedy will then be presented to a broader audience in the form of a Proposed Plan, for formal community discussion and comment. Upon stakeholder concurrence on an appropriate site response, the Navy will prepare a ROD to document the selected remedy, and will proceed with contracting the RD and implementation phases of work, as necessary based on the selected remedy.

5.1.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment, within the limits of the RAOs defined for this FS, is a key threshold criterion that must be attained by an alternative to be eligible for selection in the ROD.

Alternative S-3 is considered the most effective at protecting human health and the environment. Under Alternative S-3, contaminated soil is removed from DU 1-1, 1-2, and 1-3. 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 DU 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. 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 PRGs (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 because contact with contaminated soil would not be prevented.

5.1.2 Compliance with ARARs

Appendix B presents the ARARs for the four alternatives. Alternatives S-2, S-3, and S-4 meet the chemical-specific and action-specific ARARs. Alternative S-1 does not comply with ARARs since it does not prevent exposure to contaminated soil exceeding the PRGs.

5.1.3 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 DU 1-1, 1-2, and 1-3 that exceed PRGs. 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.

5.1.4 Reduction of Toxicity, Mobility, and Volume through Treatment

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

5.1.5 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 DU 1-1, 1-2, and 1-3, short-term risks are not considered significant under any of the remedial alternatives discussed in this FS.

5.1.6 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 PRGs, 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 PRGs 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 DU 1-1 (0.5 acres) and DU 1-2 and 1-3 (both are 0.014 acres), all remedial alternatives discussed in this FS can be implemented with relative ease.

5.1.7 Cost

The costs associated with the four alternatives are summarized in Appendix C. Alternative S-1 is considered the least expensive, followed by Alternatives S-2, S-3, and S-4.

Cost Component	Alternative S-1	Alternative S-2	Alternative S-3	Alternative S-4
Capital Costs	$0	$163,414	$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	$238,000	$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.

5.2 Cost Sensitivity Analysis

There are uncertainties associated with quantitative estimates for each of the remedial alternatives. Each of these uncertainties can have an effect on the resulting estimated costs. Through the preparation of this FS, the most significant uncertainties for DU 1-1, 1-2, and 1-3 include, but are not limited to, the following items:

- Sizes of remediation areas
- Locations of residual contamination
- Required spacing for delineation/confirmation sampling
- Design of soil cover
- Estimate of contingency costs
- Estimate of O&M and five-year review costs

Varying the estimates for these specific cost elements can provide an indication of how the resulting costs of remedial alternatives could potentially change. Using the cost spreadsheets provided in Appendix C, the following two factors have been selected to estimate their impact in *reducing* potential costs:

- Eliminate contingency costs
- Apply a reduction to O&M and Five-Year Review costs

Based on an evaluation of the cost spreadsheets provided in Appendix C, the following three factors have been selected to quantify their impact in *increasing* potential costs:

- Increase area and volume of soil excavation (applicable to Alternatives S-2, S-3, and S-4) and quantities of imported fill (Alternative S-4)
- Increase cost of annual LUC inspections and five-year reviews (applicable to Alternatives S-2, S-3, and S-4)
- Increase quantities of delineation/confirmation samples and analyses (applicable to Alternatives S-2, S-3, and S-4), quantities of waste characterization samples (applicable to Alternatives S-2 and S-3); quantities of clean fill samples (Alternative S-4); and data validation hours (applicable to Alternatives S-2, S-3, and S-4).

Table 5-1 presents the resulting cost impacts if these items are altered. Table 5-1 also includes details on the specific quantities and costs that were adjusted for this cost sensitivity analysis. The comparison provided in Table 5-1 reveals a general trend when particular cost variables are adjusted. However, the overall cost impact resulting from these changes does not impact the comparative analysis of alternatives costs. For example, the upper-end cost estimate for Alternative S-3 is greater than the upper-end cost estimate for Alternative S-2. Similarly, the upper-end cost estimate for Alternative S-4 is greater than the upper-end cost estimate for Alternative S-3. In summary, if the area or volume of contaminated soil varies during remedial design or remedy

implementation, it would not have an impact on the cost component of the comparative analysis presented in this FS. Similarly for the other factors assessed, variations during design or implementation would not be expected to alter the cost component of the comparative analysis.

6.0 REFERENCES

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Tables

Table 2-1
Chemical-Specific ARARs And TBCs

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 PRG for surface soil at DU 1-2 and 1-3 to be protective of unrestricted use by humans.
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 and Leachability Criteria were used in the development of PRGs for soil.

Table 2-2
Preliminary Remediation Goals (PRGs) for Surface Soil at Decision Unit 1-1

Analyte	Selected PRG (mg/kg)	Basis[1]
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
Dibenzo(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
Dibenzo(a,h)anthracene	0.8	I/C DEC
Naphthalene	0.8	Leachability
Arsenic	14	Background

Notes

1. See Appendix A for PRG development and basis:
   RDEC and I/C DEC - RIDEM Remediation Regulations, DEM-DSR-01-93, 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 2-3
Preliminary Remediation Goals (PRGs) for Surface Soil at Decision Units 1-2 and 1-3

Analyte	Selected PRG (mg/kg)	Basis[1]
PCBs	1	EPA Residential Guidance Value

Notes

1. See Appendix A for PRG development and basis:
   Note that the selected PRG represents the lower of the EPA Residential Guidance Value (USEPA, 1990), ecological based PRG for insectivores, and the applicable RIDEM Remediation Regulation criteria.

Table 2-4
Analytical Results - Surface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-MW-SB-1000-0005	TF1-EBP-SB1000-0001	TF1-EBP-MW-SB-1001-0005	TF1-EBP-MW-SB-1001-0005-D	TF1-EBP-MW-SB-1001-0005-AVG	TF1-EBP-SB1001-0001	TF1-EBP-SB1002-0001	TF1-EBP-SB1002-0001-D	TF1-EBP-SB1002-0001-AVG	TF1-EBP-SB1003-0001	TF1-EBP-SB1004-0001	TF1-EBP-SB1005-0001	TF1-EBP-SB1006-0001	TF1-EBP-SB1007-0001
LOCATION ID			TF1-EBP-SB1000	TF1-EBP-SB1000	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1002	TF1-EBP-SB1002	TF1-EBP-SB1002	TF1-EBP-SB1003	TF1-EBP-SB1004	TF1-EBP-SB1005	TF1-EBP-SB1006	TF1-EBP-SB1007
SAMPLE DATE			07/30/12	08/07/12	07/31/12	07/31/12	07/31/12	08/08/12	08/07/12	08/07/12	08/07/12	08/08/12	08/07/12	08/07/12	08/08/12	08/08/12
DEPTH INTERVAL (FT)	Residential	Industrial	0 - 0.5	0 - 1	0 - 0.5	0 - 0.5	0 - 0.5	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
SACODE	PRG	PRG	NORMAL	NORMAL	ORIG	DUP	AVG	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)																
BENZO(A)ANTHRACENE	900	7800	110 J	29	52	69	60.5	40	33	38	35.5	36	40	12 U	86	140
BENZO(A)PYRENE	400	800	90 J	25 J	54	67	60.5	38 J	28 J	25 J	26.5 J	34 J	34 J	10 J	74 J	100 J
BENZO(B)FLUORANTHENE	900	7800	130 J	50	83	100	91.5	72	54	56	55	67	68	23 J	160	200
BENZO(G,H,I)PERYLENE	800		43 U	12 J	38 U	35 U	36.5 U	18 J	15 J	14 J	14.5 J	15 J	18 J	6.8 J	37	42
BENZO(K)FLUORANTHENE	900		51 J	16 J	26	34	30	24	19 J	20 J	19.5 J	25	22 J	12 U	62	72
CHRYSENE	400		130 J	30 J	61	79	70	47 J	34 J	40 J	37 J	43 J	48 J	8.7 J	110	150 J
DIBENZO(A,H)ANTHRACENE	400	800	22 U	6.2 J	20 U	23 U	21.5 U	7.9 J	6.4 J	6.3 J	6.35 J	7 J	9.6 J	2.4 J	17 J	19 J
FLUORANTHENE	20000		240 J	63	100	130	115	89	70	73	71.5	84	110	25	200	350 J
INDENO(1,2,3-CD)PYRENE	900		60 U	19 J	46 U	50 U	48 U	25	21 J	20 J	20.5 J	22 J	24	8.2 J	51	55
NAPHTHALENE	800	800	8.9 J	10 U	5.4 J	6.3 J	5.85 J	10 U	11 U	12 U	11.5 U	11 U	11 U	12 U	3.9 J	26
PYRENE	13000		200 J	44	96	120	108	58	53	51	52	62	63	19 J	120	200
METALS (MG/KG)																
ALUMINUM			12600	14900	14000	13800	13900	11400	14300	12400	13400	12800	11600	14200	10300	14700
ANTIMONY			0.25 J	0.13 J	0.17 J	0.18 J	0.175 J	0.14 J	0.12 J	0.11 J	0.115 J	0.17	0.14 J	0.17 J	0.15 J	0.21 J
ARSENIC	14	14	11.2	9.4	13.4	12.8	13.1	10 J	8.4	6.4	7.4	7.8 J	**20.7**	10.5	7.5 J	8.8 J
BARIUM			23.8	31.6	20.5	19.9	20.2	19.8	24.6	19.3	22	30.2	16.2	19.5	24.8	27.7
BERYLLIUM			0.48	0.55	0.4	0.43	0.415	0.39	0.46	0.37	0.415	0.43	0.52	0.51	0.32	0.5
CADMIUM			0.15	0.09	0.12	0.11	0.115	0.14	0.11	0.09	0.1	0.14	0.12	0.14	0.07 J	0.16
CALCIUM			863	469 J	539	487	513	1520 J	630 J	494 J	562 J	1050	821 J	596 J	850 J	911 J
CHROMIUM	18		14.3	13.5	16.7	14.8	15.8	13.8	15.3	14.4	14.8	14.6	13.5	16.8	14.4	14.1
COBALT			8.9	6.7	7	5.3	6.15	14.6	7.2	8.1	7.65	6.4	10.9	10.9	5.6	5.9
COPPER			16.4	11.2	13	13.1	13	17.7	12.5	11.6	12	13.2	15.8	19.9	15.1	12.1
IRON			24700	17900	21100	23200	22200	25000	18600	18500	18600	21200	31600	23500	19700	16500
LEAD			27.1 J	17.7	22 J	20.9 J	21.4 J	15.9	16.2	11.9	14	28.9	15.1	13.8	18.5	27.2
MAGNESIUM			2500	1860	2180	2230	2200	2960	2220	2360	2290	2540	2450	2310	2550	2120
MANGANESE	390		252	263	271	194	232	307	202	201	202	293	191	375	155	220
MERCURY			0.09	0.16	0.38 J	0.22 J	0.3 J	0.04	0.08	0.08	0.08	0.07	0.06	0.07	0.08	0.12
NICKEL			16.8	14.5	12	12.8	12.4	20.6	14.4	15.7	15	16.7	23.2	19.1	13.8	12.8
POTASSIUM			456	358	360	340	350	438 J	447	319	383	379	309	448	780 J	440 J
SELENIUM			0.49 J	0.69	0.62 J	0.66 J	0.64 J	0.41 J	0.64	0.5	0.57	0.52	0.4	0.67	0.54	0.61
SILVER			0.09	0.08	0.09	0.1	0.095	0.05 J	0.06 J	0.05 J	0.055 J	0.09	0.05 J	0.06 J	0.08 J	0.1
SODIUM			39.7 J	34.7 J	27.2 J	27.6 J	27.4 J	35.4 J	35.1 J	25.7 J	30.4 J	35.2 J	25.6 J	29.8 J	80.1 J	43 J
THALLIUM			0.08	0.11	0.11	0.11	0.11	0.05 J	0.1	0.07	0.085	0.08	0.06 J	0.1	0.09 J	0.12

Table 2-4
Analytical Results - Surface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-MW-SB-1000-0005	TF1-EBP-SB1000-0001	TF1-EBP-MW-SB-1001-0005	TF1-EBP-MW-SB-1001-0005-D	TF1-EBP-MW-SB-1001-0005-AVG	TF1-EBP-SB1001-0001	TF1-EBP-SB1002-0001	TF1-EBP-SB1002-0001-D	TF1-EBP-SB1002-0001-AVG	TF1-EBP-SB1003-0001	TF1-EBP-SB1004-0001	TF1-EBP-SB1005-0001	TF1-EBP-SB1006-0001	TF1-EBP-SB1007-0001
LOCATION ID			TF1-EBP-SB1000	TF1-EBP-SB1000	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1002	TF1-EBP-SB1002	TF1-EBP-SB1002	TF1-EBP-SB1003	TF1-EBP-SB1004	TF1-EBP-SB1005	TF1-EBP-SB1006	TF1-EBP-SB1007
SAMPLE DATE			07/30/12	08/07/12	07/31/12	07/31/12	07/31/12	08/08/12	08/07/12	08/07/12	08/07/12	08/08/12	08/07/12	08/07/12	08/08/12	08/08/12
DEPTH INTERVAL (FT)	Residential	Industrial	0 - 0.5	0 - 1	0 - 0.5	0 - 0.5	0 - 0.5	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
SACODE	PRG	PRG	NORMAL	NORMAL	ORIG	DUP	AVG	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
VANADIUM			26.5	22.4	27.1	27.4	27.2	24.2	22	20.3	21.2	27.7	19.5	23.4	20.3	25.1
ZINC			45.1	34.8	34.8	36.6	35.7	48.9	33.8	33.2	33.5	42.4	56.6	41.8	34.7	37.2
MISCELLANEOUS PARAMETERS (%)																
TOTAL SOLIDS			90	92	85	81	83	92	82	84	83	90	87	82	84	88
MISCELLANEOUS VOLATILES (UG/KG)																
1,2-DIBROMO-3-CHLOROPROPANE			3 UJ	3.5 UJ	3.8 UJ	5 UJ	4.4 UJ	2.8 UJ	3 UJ	5.5 UJ	4.25 UJ	5.2 UJ	3 UJ	2.8 UJ	2.4 UJ	6.5 UJ
1,2-DIBROMOETHANE			3 UJ	3.5 UJ	3.8 UJ	5 UJ	4.4 UJ	2.8 UJ	3 UJ	5.5 UJ	4.25 UJ	5.2 UJ	3 UJ	2.8 UJ	2.4 UJ	6.5 UJ
PETROLEUM HYDROCARBONS (MG/KG)																
GASOLINE RANGE ORGANICS			2.7 U	2.9 UJ	2.7 U	4 U	3.35 U	2.8 U	3.1 UJ	2.7 UJ	2.9 UJ	3 U	3.2 UJ	2.7 U	3.1 J	3.1 J
TPH (C09-C36)			150	51	97	66	81.5	64	33	28	30.5	44	51	23	57	56

Notes:
1. Blue shading indicates Residential PRG exceeded.
2. Green shading indicates Industrial and Residential PRGs exceeded.

PRG = Preliminary Remediation Goal

Table 2-4
Analytical Results - Surface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1007-0102	TF1-EBP-SB1008-0001	TF1-EBP-SB1009-0001	TF1-EBP-SB1010-0001	TF1-EBP-SB1011-0001	TF1-EBP-SB1011-0001-D	TF1-EBP-SB1011-0001-AVG	TF1-EBP-SB1012-0001	TF1-EBP-SB1013-0001	TF1-EBP-SB1014-0001	TF1-EBP-SB1015-0001	TF1-EBP-SB1016-0001	TF1-EBP-SB1017-0001	TF1-EBP-SB1018-0001
LOCATION ID			TF1-EBP-SB1007	TF1-EBP-SB1008	TF1-EBP-SB1009	TF1-EBP-SB1010	TF1-EBP-SB1011	TF1-EBP-SB1011	TF1-EBP-SB1011	TF1-EBP-SB1012	TF1-EBP-SB1013	TF1-EBP-SB1014	TF1-EBP-SB1015	TF1-EBP-SB1016	TF1-EBP-SB1017	TF1-EBP-SB1018
SAMPLE DATE			08/08/12	08/08/12	08/08/12	08/06/12	08/06/12	08/06/12	08/06/12	08/06/12	08/08/12	08/06/12	08/16/12	08/06/12	08/08/12	08/06/12
DEPTH INTERVAL (FT)	Residential	Industrial	1 - 2	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
SACODE	PRG	PRG	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)																
BENZO(A)ANTHRACENE	900	7800	4.7 J	220	470	220	360 J	150 J	255 J	**8100**	480	540	640	**2200**	**1300**	**1400**
BENZO(A)PYRENE	400	800	4.1 J	150 J	280 J	160 J	270 J	100 J	185 J	**5300**	360 J	**480**	**600**	**1900**	**980**	**940**
BENZO(B)FLUORANTHENE	900	7800	8.8 J	290	440	320 J	460 J	210 J	335 J	**7500**	550	680	810	**3000**	**1400**	**1500**
BENZO(G,H,I)PERYLENE	800		2.3 J	60	92	79	100 J	44 J	72 J	**2400 J**	120	150 J	220	**1100**	420	230
BENZO(K)FLUORANTHENE	900		10 U	110	160	120	180 J	67 J	124 J	**3200 J**	220	340 J	290	**1200**	570	670
CHRYSENE	400		10 UJ	240	**500**	260	**440 J**	170 J	305 J	**9100**	**550**	**640**	**820**	**2600**	**1400**	**1500**
DIBENZO(A,H)ANTHRACENE	400	800	10 U	26	44	28	48	20 J	34 J	**960 J**	56	68	91	280	140	140
FLUORANTHENE	20000		9.2 J	590	1300	550	900 J	300 J	600 J	**23000**	1400	1400	1500	8000	3000	4800
INDENO(1,2,3-CD)PYRENE	900		3.7 J	80	130	170 J	270 J	64 J	167 J	**3900 J**	170	310 J	280	**1800**	590	640
NAPHTHALENE	800	800	10 U	19 J	100	56	49	14 J	31.5 J	**2000 J**	72	72	120	610	140	160
PYRENE	13000		6.3 J	280	1000	420	770 J	220 J	495 J	13000 J	1000	1200	1200	4400 J	2300	2800
METALS (MG/KG)																
ALUMINUM			18600	12500	9340	7380	6790	8020	7400	6720	8440	8030	10400	7940	9700	8770
ANTIMONY			0.09 J	0.18 J	0.1 J	0.09 J	0.08 J	0.08 J	0.08 J	0.15 J	0.11 J	0.14 J	0.13	0.16 J	0.12 J	0.11 J
ARSENIC	14	14	7.6 J	10.8 J	5 J	9.4	5.2	4.4	4.8	5	4.6 J	4.6	7.9	6.3	5.5 J	4
BARIUM			20.8	22.8	17.1	18.4	16.7	18.6	17.6	21.4	18	23	19	22.7	24.8	17.5
BERYLLIUM			0.65 J	0.41	0.34	0.35	0.24	0.28	0.26	0.28	0.26	0.26	0.32	0.32	0.38	0.32
CADMIUM			0.09 J	0.19	0.07	0.07 J	0.16 J	0.12	0.14 J	0.08 J	0.12	0.1	0.1	0.18	0.16	0.16
CALCIUM			654 J	944 J	775 J	657 J	800 J	954 J	877 J	801 J	986 J	1520 J	761	1000 J	857 J	765 J
CHROMIUM	18		**20.2 J**	17	11.6	11.3	10.6	13.6	12.1	10.6	12.3	10.8	12	13	13.1	12.3
COBALT			8.8 J	8.1	4.9	6.2	5.3	5.4	5.35	7.3	5.2	5.6	6.1	7	7.2	6.6
COPPER			14.1 J	14.6	14.4	11.9	11.1	11.9	11.5	15.6	11.3	13.1	14.1	20.1	14.7	16.6
IRON			29200 J	21400	17800	21600	16400	16500	16400	18700	18800	14600	17300	17400	17800	17100
LEAD			11.4 J	21.3	18.2	28.9 J	51.8 J	127 J	89.4 J	54.4 J	28.8	27.9 J	27.9	60.1 J	25.4	22.4 J
MAGNESIUM			3900 J	2510	2240	2560	2410	2350	2380	2170	2390	2170	2470	2390	2530	2980
MANGANESE	390		284 J	194	137	128	130	137	134	157	159	194	183	233	217	180
MERCURY			0.03 J	0.07	0.05	0.01 J	0.03 J	0.02 J	0.025 J	0.11 J	0.08	0.07 J	0.13	0.1 J	0.08	0.03 J
NICKEL			25.3 J	15.7	11.4	14.3	12	12.8	12.4	13	12.6	11.7	14.4	13.8	15.1	14.2
POTASSIUM			294	550 J	652 J	558	528	716	622	612	655 J	514	466	580	570 J	405
SELENIUM			0.6 J	0.45	0.51	0.27 J	0.29 J	0.38	0.335 J	0.33 J	0.38 J	0.35 J	0.47	0.4 J	0.4	0.34 J
SILVER			0.06 J	0.07 J	0.05 J	0.04 J	0.06	0.07 J	0.065 J	0.06 J	0.08 J	0.06 J	0.07 J	0.07 J	0.06 J	0.05 J
SODIUM			31.5 J	45.3 J	44.7 J	57.5 U	32.4 U	40.9 J	28.6 J	41.2 U	39.7 J	41.6 U	45.9 J	41.7 U	42.8 J	29 U
THALLIUM			0.08 J	0.08 J	0.07	0.04 J	0.05 J	0.08	0.065 J	0.05 J	0.07 J	0.05 J	0.07 J	0.06 J	0.08	0.06 J

Table 2-4
Analytical Results - Surface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1007-0102	TF1-EBP-SB1008-0001	TF1-EBP-SB1009-0001	TF1-EBP-SB1010-0001	TF1-EBP-SB1011-0001	TF1-EBP-SB1011-0001-D	TF1-EBP-SB1011-0001-AVG	TF1-EBP-SB1012-0001	TF1-EBP-SB1013-0001	TF1-EBP-SB1014-0001	TF1-EBP-SB1015-0001	TF1-EBP-SB1016-0001	TF1-EBP-SB1017-0001	TF1-EBP-SB1018-0001
LOCATION ID			TF1-EBP-SB1007	TF1-EBP-SB1008	TF1-EBP-SB1009	TF1-EBP-SB1010	TF1-EBP-SB1011	TF1-EBP-SB1011	TF1-EBP-SB1011	TF1-EBP-SB1012	TF1-EBP-SB1013	TF1-EBP-SB1014	TF1-EBP-SB1015	TF1-EBP-SB1016	TF1-EBP-SB1017	TF1-EBP-SB1018
SAMPLE DATE			08/08/12	08/08/12	08/08/12	08/06/12	08/06/12	08/06/12	08/06/12	08/06/12	08/08/12	08/06/12	08/16/12	08/06/12	08/08/12	08/06/12
DEPTH INTERVAL (FT)	Residential	Industrial	1 - 2	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1
SACODE	PRG	PRG	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
VANADIUM			24.3 J	27.5	15.2	15	13.1	16.6	14.8	17.7	17.8	16.4	17.4	16.5	18.6	14
~~ZINC~~			49.6 J	38.8	27	32.5 J	36 J	33.6	34.8 J	40.9 J	30.9	30.2 J	33.1	43 J	37.1	38.8 J
MISCELLANEOUS PARAMETERS (%)																
TOTAL SOLIDS			89	86	89	92	89	81	85	86	87	93	87	88	90	92
MISCELLANEOUS VOLATILES (UG/KG)																
1,2-DIBROMO-3-CHLOROPROPANE			3 UJ	6 UJ	4.2 U	2.4 UJ	1.4 UJ	3 UJ	2.2 UJ	2.8 UJ	4.8 UJ	2.5 UJ	2.5 UJ	1.4 UJ	4 U	2.4 UJ
1,2-DIBROMOETHANE			3 UJ	6 UJ	4.2 U	2.4 UJ	1.4 UJ	3 UJ	2.2 UJ	2.8 UJ	4.8 UJ	2.5 UJ	2.5 UJ	1.4 UJ	4 U	2.4 U
PETROLEUM HYDROCARBONS (MG/KG)																
GASOLINE RANGE ORGANICS			2.9 UJ	2.6 U	2.6 U	2.8 U	2.7 UJ	3.9 U	3.3 UJ	2.7 UJ	2.6 UJ	2.3 UJ	2.7 U	4.2 UJ	2.8 UJ	2.9 UJ
TPH (C09-C36)			22 U	60	77	37	87 J	43 J	65 J	48	64	120	90	150	64	25

Notes:

1. Blue shading indicates Residential PRG exceeded.
2. Green shading indicates Industrial and Residential PRGs exceeded.

PRG = Preliminary Remediation Goal

Table 2-4
Analytical Results - Surface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1019-0001	TF1-EBP-SB1019-0102	TF1-EBP-SB1019-0102-D	TF1-EBP-SB1019-0102-AVG	TF1-EBP-MW-SB101R-0002	TF1-EBP-SB1020-0001	TF1-EBP-SB1021-0001	TF1-EBP-SB1022-0001	TF1-EBP-SB1035-0001	TF1-EBP-SB1036-0001	TF1-EBP-SB1036-0102	TF1-EBP-MW-SB-124R-0002
LOCATION ID			TF1-EBP-SB1019	TF1-EBP-SB1019	TF1-EBP-SB1019	TF1-EBP-SB1019	TF1-EBP-SB101R	TF1-EBP-SB1020	TF1-EBP-SB1021	TF1-EBP-SB1022	TF1-EBP-SB1035	TF1-EBP-SB1036	TF1-EBP-SB1036	TF1-EBP-SB124R
SAMPLE DATE			08/06/12	08/08/12	08/08/12	08/08/12	08/01/12	08/06/12	08/06/12	08/06/12	08/06/12	08/06/12	08/08/12	08/02/12
DEPTH INTERVAL (FT)	Residential	Industrial	0 - 1	1 - 2	1 - 2	1 - 2	0 - 2	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	1 - 2	0 - 2
SACODE	PRG	PRG	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)														
BENZO(A)ANTHRACENE	900	7800	48	12 U	7.4 J	6.7 J	140	**2800**	170	430	580	**2700**	12 U	**8000**
BENZO(A)PYRENE	400	800	33 J	12 UJ	4.5 J	5.25 J	97	**2100**	110 J	390	**520**	**2000**	6.4 J	**6000**
BENZO(B)FLUORANTHENE	900	7800	76	12 U	9.1 J	7.55 J	160	**3000**	230	640	720	**2800**	18 U	**8800**
BENZO(G,H,I)PERYLENE	800		19 J	12 U	3.4 J	4.7 J	52 U	**1300**	52	140	140	**1200**	5.8 J	**2800**
BENZO(K)FLUORANTHENE	900		28	12 U	12 U	12 U	52	**1500**	75	220	400	**1300**	12 U	**3900**
CHRYSENE	400		56	12 U	12 UJ	12 UJ	140	**3000**	190 J	**590**	**730**	**3000**	5.6 J	**9100**
DIBENZO(A,H)ANTHRACENE	400	800	9.2 J	12 U	12 U	12 U	35 U	**420**	24	58	67	310	2.8 J	**650 J**
FLUORANTHENE	20000		130	12 U	12 J	9 J	190	7800	2200	1100	1400	8400	21 J	18000
INDENO(1,2,3-CD)PYRENE	900		47 J	12 U	3.3 J	4.65 J	70 U	**1900**	74 J	190	210	**1800**	7.3 J	**4800**
NAPHTHALENE	800	800	12 U	12 U	12 U	12 U	4.3 J	**810**	18 J	55	110	530	12 U	140
PYRENE	13000		91	12 U	10 J	8 J	160	4500 J	250	970	1300	5000	12 U	**14000**
METALS (MG/KG)														
ALUMINUM			18500	15200	12600	13900	15100	8550	10100	10900	6900	15800	16400	11500
ANTIMONY			0.1 J	0.12 J	0.08 J	0.1 J	0.13 J	0.14 J	0.11 J	0.1 J	0.11 J	0.32 J	0.18 J	0.28
ARSENIC	14	14	9.5	10.6 J	6.1 J	8.35 J	12.4	6.9	7	7.2	3.8	12	13.5 J	11.6
BARIUM			24.6	31.4	23	27.2	28	20.1	21.6	34.7	19.5	33.6	40.8	19.8
BERYLLIUM			0.44	0.49	0.41	0.45	0.6	0.33	0.38	0.44	0.26	0.48	0.54	0.4
CADMIUM			0.16 J	0.14	0.09 J	0.115 J	0.1	0.31 J	0.22	0.42	0.11	0.19 J	0.14	0.09
CALCIUM			788 J	706 J	859 J	782 J	458	777 J	561 J	7140 J	722 J	816 J	724 J	698
CHROMIUM	18		**21**	16.7	14.4	15.6	15.4	12.3	12.2	13.1	9.9	17.8	**24.3**	15.4
COBALT			8.6	7.3	7.7	7.5	8	11	8	11.1	5.6	7.4	6.5	8.2
COPPER			17.5	13.6	15.1	14.4	13	13.5	13.9	13.1	14.5	15.9	13	22.4
IRON			28500	22000	18400	20200	24300	19800	17500	17900	18300	23600	19200	29100
LEAD			29.7 J	10.6	13.6	12.1	12.8 J	52.6 J	48.7 J	80.3 J	57.4 J	71.2 J	15.8	24.6
MAGNESIUM			4220	2720	2700	2710	2310	2020	2150	2090	2080	2820	2190	3370
MANGANESE	390		257	256	222	239	231	**575**	220	**425**	131	284	256	235
MERCURY			0.37 J	0.07	0.05	0.06	0.03	0.08 J	0.14	0.15	0.08	0.48 J	0.17	0.02 J
NICKEL			22.4	18.8	15.5	17.2	16.8	20.8	14.4	17.8	12.5	17.2	14.7	17.5
POTASSIUM			358	478 J	477 J	478 J	396	427	453	468	635	425	469 J	243
SELENIUM			0.58	0.64	0.41 J	0.525 J	0.53 J	0.41 J	0.52	0.5	0.29 J	0.73	0.73	0.35 U
SILVER			0.05 J	0.07 J	0.04 J	0.055 J	0.11	0.06	0.07 J	0.06 J	0.05 J	0.08	0.08 J	0.03 U
SODIUM			31.8 U	36.4 J	38.8 J	37.6 J	31.4 J	32.6 U	30.6 J	52.3 J	30 J	37.9 U	42.9 J	26 U
THALLIUM			0.1	0.11 J	0.08 J	0.095 J	0.08	0.06	0.08	0.1	0.06 J	0.11	0.15	0.03 J

Table 2-4
Analytical Results - Surface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1019-0001	TF1-EBP-SB1019-0102	TF1-EBP-SB1019-0102-D	TF1-EBP-SB1019-0102-AVG	TF1-EBP-MW-SB101R-0002	TF1-EBP-SB1020-0001	TF1-EBP-SB1021-0001	TF1-EBP-SB1022-0001	TF1-EBP-SB1035-0001	TF1-EBP-SB1036-0001	TF1-EBP-SB1036-0102	TF1-EBP-MW-SB-124R-0002
LOCATION ID			TF1-EBP-SB1019	TF1-EBP-SB1019	TF1-EBP-SB1019	TF1-EBP-SB1019	TF1-EBP-SB101R	TF1-EBP-SB1020	TF1-EBP-SB1021	TF1-EBP-SB1022	TF1-EBP-SB1035	TF1-EBP-SB1036	TF1-EBP-SB1036	TF1-EBP-SB124R
SAMPLE DATE			08/06/12	08/08/12	08/08/12	08/08/12	08/01/12	08/06/12	08/06/12	08/06/12	08/06/12	08/06/12	08/08/12	08/02/12
DEPTH INTERVAL (FT)	Residential	Industrial	0 - 1	1 - 2	1 - 2	1 - 2	0 - 2	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	1 - 2	0 - 2
SACODE	PRG	PRG	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
VANADIUM			22	21.5	18.6	20	19.7	18.5	16	17.4	14.7	24.6	22	15.3
~~ZINC~~			48.2 J	39.2	32.5	35.8	45.4	82.2 J	38.1	72.6	33.6	55.5 J	44	51.5
MISCELLANEOUS PARAMETERS (%)														
TOTAL SOLIDS			81	84	84	84	83	89	90	86	91	80	81	92
MISCELLANEOUS VOLATILES (UG/KG)														
1,2-DIBROMO-3-CHLOROPROPANE			3 UJ	2.5 UJ	3 UJ	2.75 UJ	2.4 UJ	3 UJ	2.8 UJ	2.4 UJ	2.5 UJ	3.2 UJ	2.4 UJ	2.8 UJ
1,2-DIBROMOETHANE			3 UJ	2.5 UJ	3 UJ	2.75 UJ	2.4 UJ	3 UJ	2.8 UJ	2.4 UJ	2.5 UJ	3.2 UJ	2.4 UJ	2.8 UJ
PETROLEUM HYDROCARBONS (MG/KG)														
GASOLINE RANGE ORGANICS			3.1 UJ	2.5 U	3.7 J	2.48 J	3.2 U	3.3 U	2.6 U	2.4 U	3.1 U	2.8 U	2.8 U	2.6 J
TPH (C09-C36)			22	8.9 U	8 U	8.45 U	100	140	42	74	65	120	16 U	300

Notes:
1. Blue shading indicates Residential PRG exceeded.
2. Green shading indicates Industrial and Residential PRGs exceeded.

PRG = Preliminary Remediation Goal

Table 2-5
Analytical Results - Subsurface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1000-0203	TF1-EBP-SB1001-0708	TF1-EBP-SB1001-0810	TF1-EBP-SB1003-0203	TF1-EBP-SB1003-0405	TF1-EBP-SB1004-0203	TF1-EBP-SB1005-0204	TF1-EBP-SB1006-0204	TF1-EBP-SB1008-0203	TF1-EBP-SB1009-0204	TF1-EBP-SB1010-0204	TF1-EBP-SB1010-0405	TF1-EBP-SB1011-0405	TF1-EBP-SB1012-0204	TF1-EBP-SB1013-0204
LOCATION ID			TF1-EBP-SB1000	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1003	TF1-EBP-SB1003	TF1-EBP-SB1004	TF1-EBP-SB1005	TF1-EBP-SB1006	TF1-EBP-SB1008	TF1-EBP-SB1009	TF1-EBP-SB1010	TF1-EBP-SB1010	TF1-EBP-SB1011	TF1-EBP-SB1012	TF1-EBP-SB1013
SAMPLE DATE			08/07/12	08/08/12	08/08/12	08/08/12	08/08/12	08/07/12	08/07/12	08/08/12	08/08/12	08/08/12	08/06/12	08/06/12	08/06/12	08/06/12	08/08/12
DEPTH INTERVAL (FT)	Residential	Industrial	2 - 3	7 - 8	8 - 10	2 - 3	4 - 5	2 - 3	2 - 4	2 - 4	2 - 3	2 - 4	2 - 4	4 - 5	4 - 5	2 - 4	2 - 4
SACODE	PRG	PRG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)																	
BENZO(A)ANTHRACENE	900	7800	10 U	21 J	17 J	13 J	11 U	6.8 U	11 U	8.9 J	2.6 J	12 U	20 J	13 U	30	130	10 U
BENZO(A)PYRENE	400	800	10 UJ	15 J	12 J	8.2 J	5.3 J	4.3 J	8.3 J	6.2 J	11 UJ	12 UJ	23 J	10 J	22 J	84 J	10 UJ
BENZO(B)FLUORANTHENE	900	7800	2.9 U	38	28	22 J	10 J	8 U	17 U	14 J	4.6 J	3.6 J	46	18 U	45	160	10 U
BENZO(G,H,I)PERYLENE	800		10 U	10 J	8.1 J	6.6 J	3.1 J	3.4 J	12 J	4.2 J	11 U	12 U	20 J	11 J	12 J	43	10 U
BENZO(K)FLUORANTHENE	900		10 U	9.4 J	5.6 J	5.1 J	11 U	11 U	11 U	12 U	11 U	12 U	8.1 J	13 U	16 J	55	10 U
CHRYSENE	400		10 UJ	20 J	16 J	9.5 J	11 U	11 UJ	7.4 J	3.4 J	11 UJ	12 UJ	18 J	8.2 J	34 J	130	10 U
DIBENZO(A,H)ANTHRACENE	400	800	10 U	4.5 J	2.2 J	3.1 J	11 U	2.1 J	3 J	12 U	11 U	12 U	4.2 J	3 J	3.6 J	16 J	10 U
FLUORANTHENE	20000		2 U	43	36	31	12 U	9.2 U	19 J	17 J	4.3 J	2.5 J	30	34 U	89	280	10 U
INDENO(1,2,3-CD)PYRENE	900		10 U	13 J	8.5 J	8.4 J	4 J	3.6 J	7.1 J	5.2 J	11 U	12 U	34 J	13 J	27 J	91 J	10 U
NAPHTHALENE	800	800	10 U	11 U	9.7 U	11 U	11 U	11 U	11 U	12 U	11 U	12 U	11 U	13 U	6 J	12 U	10 U
PYRENE	13000		10 U	26	25	18 J	11 U	8.9 U	16 U	11 J	2.9 J	12 U	22 U	25 U	64	200	10 U
METALS (MG/KG)																	
ALUMINUM			15200	13900	9590	13500	10800	13300	14700	13000	12700	12100	9000	9740	10100	15700	10800
ANTIMONY			0.05 J	0.14 J	0.09 J	0.11 J	0.11 J	0.07 J	0.08 J	0.08 J	0.07 J	0.06 J	0.05 J	0.08 J	0.08 J	0.12 J	0.08 J
ARSENIC	14	14	7.2	11.9 J	11 J	9.9 J	9.6 J	5.5	7.4	6.8 J	5.6 J	4 J	3.3	4.7	5.4	10.9	5.6 J
BARIUM			24.7	24.9	11.3	21.2	17.5	19.2	18	20.5	15.1	15.4	15.7	18.8	15	36	14.6
BERYLLIUM			0.4	0.61	0.42	0.49	0.47	0.36	0.38	0.43	0.37	0.33	0.31	0.36	0.31	0.51	0.34
CADMIUM			0.04 J	0.08 J	0.16	0.11	0.11	0.06 J	0.12	0.11	0.09 J	0.12	0.06 J	0.1 J	0.06 J	0.16 J	0.09
CALCIUM			543 J	518 J	799	457 J	490 J	570 J	459 J	592 J	477 J	499 J	626 J	1060 J	560 J	796 J	544 J
CHROMIUM	18		17.5	16.2	13.9	14.7	13.9	15.2	17	14.4	14.3	14	10.7	11.8	11.6	17.3	13
COBALT			8.5	12.4	20.3	8.2	14.5	7.9	7.6	9	6.7	6.5	8.7	6.7	9.3	9.6	8.6
COPPER			10.7	14.7	14.3	10.5	10.7	12.1	10.4	13.4	9.4	6.8	9.4	10.8	18.8	14.6	13.7
IRON			21200	23200	25400	23400	22400	19400	24300	19800	17700	17100	13100	16200	24900	23200	20400
LEAD			8.9	14.9	8.7	11.9	8.5	8.3	11.2	10.8	8.9	7.4	6.1 J	8.1 J	22.6 J	13.5 J	7.4
MAGNESIUM			2740	2540	2410	2330	2160	2770	3020	2770	2590	2430	2040	2430	2780	3030	2980
MANGANESE	390		232	280	345	208	242	211	186	231	206	184	266	255	211	299	321
MERCURY			0.03 J	0.12	0.03 J	0.03 J	0.04	0.03 J	0.06	0.1	0.04	0.04	0.02 J	0.02 J	0.008 J	0.23 J	0.02 J
NICKEL			17.1	19.1	23.5	16.4	18.7	14.8	20.8	15.4	13.7	14.4	10.1	11.2	18	19.7	18.3
POTASSIUM			571	406 J	230	276 J	287 J	418	279	430 J	395 J	383 J	428	493	404	371	384 J
SELENIUM			0.54	0.63	0.27 U	0.48	0.38 J	0.49	0.39 J	0.34 U	0.34 J	0.39 U	0.31 J	0.32 J	0.23 J	0.59	0.33 U
SILVER			0.05 J	0.06 J	0.03 J	0.05 J	0.04 J	0.04 J	0.04 J	0.04 J	0.04 J	0.03 J	0.02 J	0.01 J	0.02 J	0.05 J	0.02 J
SODIUM			36.9 J	37.3 J	32 U	27.1 J	28.3 J	30.7 J	24.8 J	33.4 J	30.7 J	31.5 J	39 U	47.5 U	26.9 U	37.2 U	24.1 J
THALLIUM			0.09	0.1	0.02 J	0.07	0.05 J	0.08 J	0.07 J	0.08 J	0.08 J	0.07 J	0.06 J	0.06 J	0.04 J	0.1	0.05 J
VANADIUM			22.1	22.5	16.8	20.1	18.2	19.4	18.3	18.6	19.2	17.7	17	18	13	20.7	13.9
ZINC			32.8	42.7	50.8	40.2	41.5	30	41.7	32.8	30.9	29.8	21 J	23.5 J	41.8 J	43.4 J	34

Table 2-5
Analytical Results - Subsurface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1000-0203	TF1-EBP-SB1001-0708	TF1-EBP-SB1001-0810	TF1-EBP-SB1003-0203	TF1-EBP-SB1003-0405	TF1-EBP-SB1004-0203	TF1-EBP-SB1005-0204	TF1-EBP-SB1006-0204	TF1-EBP-SB1008-0203	TF1-EBP-SB1009-0204	TF1-EBP-SB1010-0204	TF1-EBP-SB1010-0405	TF1-EBP-SB1011-0405	TF1-EBP-SB1012-0204	TF1-EBP-SB1013-0204
LOCATION ID			TF1-EBP-SB1000	TF1-EBP-SB1001	TF1-EBP-SB1001	TF1-EBP-SB1003	TF1-EBP-SB1003	TF1-EBP-SB1004	TF1-EBP-SB1005	TF1-EBP-SB1006	TF1-EBP-SB1008	TF1-EBP-SB1009	TF1-EBP-SB1010	TF1-EBP-SB1010	TF1-EBP-SB1011	TF1-EBP-SB1012	TF1-EBP-SB1013
SAMPLE DATE			08/07/12	08/08/12	08/08/12	08/08/12	08/08/12	08/07/12	08/07/12	08/08/12	08/08/12	08/08/12	08/06/12	08/06/12	08/06/12	08/06/12	08/08/12
DEPTH INTERVAL (FT)	Residential	Industrial	2 - 3	7 - 8	8 - 10	2 - 3	4 - 5	2 - 3	2 - 4	2 - 4	2 - 3	2 - 4	2 - 4	4 - 5	4 - 5	2 - 4	2 - 4
SACODE	PRG	PRG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
MISCELLANEOUS PARAMETERS (%)																	
TOTAL SOLIDS			95	87	96	93	92	85	81	81	85	82	88	72	93	83	90
MISCELLANEOUS VOLATILES (UG/KG)																	
1,2-DIBROMO-3-CHLOROPROPANE			3.2 UJ	2.8 UJ	3 UJ	3.5 UJ	2.4 UJ	2.4 UJ	3 U	2.5 UJ	2.8 U	2.5 UJ	3 UJ	3 UJ	2.4 UJ	2.4 UJ	2.5 UJ
1,2-DIBROMOETHANE			3.2 UJ	2.8 UJ	3 UJ	3.5 UJ	2.4 UJ	2.4 UJ	3 U	2.5 UJ	2.8 U	2.5 UJ	3 UJ	3 U	2.4 UJ	2.4 UJ	2.5 U
PETROLEUM HYDROCARBONS (MG/KG)																	
GASOLINE RANGE ORGANICS			3 J	2.3 U	2.1 U	3.3 UJ	2.4 UJ	2.6 UJ	3.1 UJ	3 UJ	2.7 UJ	3.6 U	2.7 J	3.3 UJ	2.2 UJ	2.9 U	2.8 UJ
TPH (C09-C36)			12 U	28	13 U	21 U	13 U	9.6 U	14 U	8.3 U	8.3 U	12 U	8.9 U	9 U	12 U	37	4.6 U

Notes:
1. Blue shading indicates Residential PRG exceeded.
2. Green shading indicates Industrial and Residential PRGs exceeded.

PRG = Preliminary Remediation Goal

Table 2-5
Analytical Results - Subsurface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1014-0203	TF1-EBP-SB1015-0204	TF1-EBP-SB1016-0506	TF1-EBP-SB1017-0204	TF1-EBP-SB1018-0304	TF1-EBP-SB1020-0203	TF1-EBP-SB1021-0204	TF1-EBP-SB1022-0203	TF1-EBP-SB1035-0304
LOCATION ID			TF1-EBP-SB1014	TF1-EBP-SB1015	TF1-EBP-SB1016	TF1-EBP-SB1017	TF1-EBP-SB1018	TF1-EBP-SB1020	TF1-EBP-SB1021	TF1-EBP-SB1022	TF1-EBP-SB1035
SAMPLE DATE			08/06/12	08/08/12	08/06/12	08/08/12	08/06/12	08/06/12	08/06/12	08/06/12	08/06/12
DEPTH INTERVAL (FT)	Residential	Industrial	2 - 3	2 - 4	5 - 6	2 - 4	3 - 4	2 - 3	2 - 4	2 - 3	3 - 4
SACODE	PRG	PRG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)											
BENZO(A)ANTHRACENE	900	7800	3.4 U	6.7 J	59	7.4 J	3.3 U	21 J	8.3 U	9 U	2.9 U
BENZO(A)PYRENE	400	800	12 UJ	5.1 J	44 J	5.2 J	12 UJ	16 J	6.7 J	7.6 J	11 UJ
BENZO(B)FLUORANTHENE	900	7800	5.9 U	11 J	90	14 J	5.2 U	36	14 U	17 U	5.3 U
BENZO(G,H,I)PERYLENE	800		12 U	8.7 J	26	4 J	12 U	12 J	4 J	6.2 J	11 U
BENZO(K)FLUORANTHENE	900		12 U	12 U	34	11 U	12 U	11 J	9.6 U	12 U	11 U
CHRYSENE	400		12 UJ	12 U	70	2.5 J	12 UJ	21 J	3.6 J	5.4 J	11 UJ
DIBENZO(A,H)ANTHRACENE	400	800	12 U	2.8 J	9.8 J	11 U	12 U	4.8 J	2.4 J	3 J	11 U
FLUORANTHENE	20000		6.3 U	14 J	150	14 J	5.3 U	43	14 U	19 U	5.2 U
INDENO(1,2,3-CD)PYRENE	900		3.5 J	5 J	55 J	4.9 J	12 U	23 J	8.8 J	13 J	4 J
NAPHTHALENE	800	800	12 U	12 U	4.6 J	11 U	12 U	11 U	9.6 U	12 U	11 U
PYRENE	13000		5 U	8.7 J	120	10 J	4.2 U	36	13 U	16 U	4 U
METALS (MG/KG)											
ALUMINUM			12800	15900	10800	12400	14700	15200	15200	14400	11600
ANTIMONY			0.07 J	0.11 J	0.14 J	0.11 J	0.08 J	0.13 J	0.18 J	0.44 J	0.07 J
ARSENIC	14	14	5.2	8.6 J	7.5	6.1 J	5	11.1	10.9	10.5	4.9
BARIUM			19.2	33.4	28.4	21	30.6	33.6	35.2	34.5	16.9
BERYLLIUM			0.42	0.51	0.37	0.36	0.46	0.48	0.54	0.44	0.31
CADMIUM			0.07 J	0.23	0.15	0.13	0.06 J	0.19 J	0.09 J	0.07 J	0.06
CALCIUM			500 J	513 J	1590 J	966 J	693 J	458 J	864 J	1710 J	435 J
CHROMIUM	18		14.5	15.4	12.2	13.8	14.6	16.5	14	24.2	13
COBALT			9.1	10	8.5	7.3	6.3	6.9	6.4	7.6	6.5
COPPER			11.5	10.2	12.7	10.6	9.4	10.9	11.8	43.3	10.6
IRON			19500	20500	18600	16600	18300	19400	18600	38200	15800
LEAD			8.4 J	10.5	12.8 J	8.7	8.8 J	14.3 J	13.6 J	10 J	7.6 J
MAGNESIUM			2900	2630	2260	2420	2340	2470	2040	2520	2410
MANGANESE	390		213	315	235	200	222	236	252	336	193
MERCURY			0.03 J	0.03 J	0.2 J	0.06	0.05 J	0.11 J	0.04 J	0.04 J	0.02 J
NICKEL			16.3	17.9	15	14.8	17	17.2	13.6	27	13
POTASSIUM			404	355 J	563	434 J	336	322	330	334	328
SELENIUM			0.51	0.67	0.47 J	0.46 J	0.55 J	0.57 J	0.72	0.59	0.45 J
SILVER			0.04 J	0.08 J	0.06 J	0.05 J	0.06 J	0.07	0.07	0.06 J	0.02 J
SODIUM			37 U	35.3 J	63.7 U	50 J	45 U	29.5 U	38.2 U	39.6 U	31.7 U
THALLIUM			0.07 J	0.1	0.09 J	0.08 J	0.09 J	0.11	0.13	0.11	0.06
VANADIUM			18.8	20.2	15.7	18.6	20.3	19	19.7	22	18.2
ZINC			30.6 J	39.1	31.9 J	31.8	61.6 J	40.2 J	31.9 J	37.9 J	25.8 J

Table 2-5
Analytical Results - Subsurface Soil at Decision Unit 1-1

SAMPLE ID			TF1-EBP-SB1014-0203	TF1-EBP-SB1015-0204	TF1-EBP-SB1016-0506	TF1-EBP-SB1017-0204	TF1-EBP-SB1018-0304	TF1-EBP-SB1020-0203	TF1-EBP-SB1021-0204	TF1-EBP-SB1022-0203	TF1-EBP-SB1035-0304
LOCATION ID			TF1-EBP-SB1014	TF1-EBP-SB1015	TF1-EBP-SB1016	TF1-EBP-SB1017	TF1-EBP-SB1018	TF1-EBP-SB1020	TF1-EBP-SB1021	TF1-EBP-SB1022	TF1-EBP-SB1035
SAMPLE DATE			08/06/12	08/08/12	08/06/12	08/08/12	08/06/12	08/06/12	08/06/12	08/06/12	08/06/12
DEPTH INTERVAL (FT)	Residential	Industrial	2 - 3	2 - 4	5 - 6	2 - 4	3 - 4	2 - 3	2 - 4	2 - 3	3 - 4
SACODE	PRG	PRG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
MISCELLANEOUS PARAMETERS (%)											
TOTAL SOLIDS			84	84	85	87	80	85	94	79	86
MISCELLANEOUS VOLATILES (UG/KG)											
1,2-DIBROMO-3-CHLOROPROPANE			2.5 UJ	3.2 UJ	2.8 UJ	2.8 UJ	3 UJ	2.8 UJ	3 UJ	2.4 UJ	3.5 UJ
1,2-DIBROMOETHANE			2.5 UJ	3.2 UJ	2.8 UJ	2.8 UJ	3 UJ	2.8 UJ	3 UJ	2.4 UJ	3.5 U
PETROLEUM HYDROCARBONS (MG/KG)											
GASOLINE RANGE ORGANICS			2.5 UJ	3.3 UJ	3.9 UJ	2.4 UJ	2.7 U	3.1 U	2.4 UJ	3.4 UJ	3.4 UJ
TPH (C09-C36)			8.6 U	20 U	26	11 U	18 U	34	47	18 U	12 U

Notes:
1. Blue shading indicates Residential PRG exceeded.
2. Green shading indicates Industrial and Residential PRGs exceeded.

PRG = Preliminary Remediation Goal

Table 2-6
Analytical Results - Surface Soil at Decision Units 1-2 and 1-3

EXPOSURE UNIT		DU 1-2: Transformer Vault 2											
SAMPLE ID		TF1-EV2-E	TF1-TV2-SS-1020-0001	TF1-TV2-SS-1021-0001	TF1-TV2-SS-1022-0001	TF1-TV2-SS-1023-0001	TF1-TV2-SS-1024-0001	TF1-TV2-SS-1025-0001	TF1-TV2-SS1026-0001	TF1-TV2-SS1027-000.9	TF1-TV2-SS1028-000.8	TF1-TV2-SS1029-000.8	TF1-TV2-SS1030-0001
LOCATION ID		TF1-EV2-E	TF1-TV2-SB1020	TF1-TV2-SB1021	TF1-TV2-SB1022	TF1-TV2-SB1023	TF1-TV2-SB1024	TF1-TV2-SB1025	TF1-TV2-SB1026	TF1-TV2-SB1027	TF1-TV2-SB1028	TF1-TV2-SB1029	TF1-TV2-SB1030
SAMPLE DATE	Surface	May-June 2010	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	10/22/13	10/22/13	10/22/13	10/22/13	10/22/13
DEPTH INTERVAL (FT)	Soil	0-0.5	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0-1	0-0.9	0-0.8	0-0.8	0-1
SACODE	PRG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
PCBS (UG/KG)													
AROCLOR-1016		3800 U	8.3 U	8 U	8.9 U	9.2 U	9.5 U	8.7 U	9.4 U	8.6 U	11 U	9.1 U	9 U
AROCLOR-1221		3800 U	8.3 U	8 U	8.9 U	9.2 U	9.5 U	8.7 U	9.4 U	8.6 U	11 U	9.1 U	9 U
AROCLOR-1232		3800 U	9.8 U	9.4 U	10 U	11 U	11 U	10 U	11 U	10 U	13 U	11 U	11 U
AROCLOR-1242		3800 U	8.3 U	8 U	8.9 U	9.2 U	9.5 U	8.7 U	9.4 U	8.6 U	11 U	9.1 U	9 U
AROCLOR-1248		3800 U	8.3 U	8 U	8.9 U	9.2 U	9.5 U	8.7 U	9.4 U	8.6 U	11 U	9.1 U	9 U
AROCLOR-1254		3800 U	8.3 U	8 U	8.9 U	9.2 U	9.5 U	8.7 U	9.4 U	8.6 U	11 U	9.1 U	9 U
AROCLOR-1260	1,000	**24000**	8.3 U	260	8.9 U	9.2 U	9.5 U	8.7 U	180 J	180 J	1000 J	250 J	9 U
TOTAL AROCLOR	1,000	**24000**	8.51 U	260	9.06 U	9.46 U	9.71 U	8.89 U	180	180	1000	250	0 U
MISCELLANEOUS PARAMETERS (%)													
TOTAL SOLIDS			95	89	89	89	86	93	84	94	74	88	92
PETROLEUM HYDROCARBONS (MG/KG)													
GASOLINE RANGE ORGANICS			0.96 J	1.3 J	1.2 U	1.8 U	1.4 U	1.1 U					
TPH (C09-C36)			220	150	290	320	330	51					

Table 2-6
Analytical Results - Surface Soil at Decision Units 1-2 and 1-3

EXPOSURE UNIT		DU 1-3: Transformer Vault 3									
SAMPLE ID		TF1-EV3-N	TF1-TV3-SS-1026-0001	TF1-TV3-SS-1027-0001	TF1-TV3-SS-1028-0001	TF1-TV3-SS-1029-0001	TF1-TV3-SS-1030-0001	TF1-TV3-SS-1031-0001	TF1-TV3-SS1032-0001	TF1-TV3-SS1032-0001-	TF1-TV3-SS1033-000.9
LOCATION ID		TF1-EV3-N	TF1-TV3-SB1026	TF1-TV3-SB1027	TF1-TV3-SB1028	TF1-TV3-SB1029	TF1-TV3-SB1030	TF1-TV3-SB1031	TF1-TV3-SB1032		TF1-TV3-SB1033
SAMPLE DATE	Surface	May-June 2010	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	10/22/13	10/22/13	10/22/13
DEPTH INTERVAL (FT)	Soil	0-0.5	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0 - 1	0-1	0-1	0-0.9
SACODE	PRG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	DUP	NORMAL
PCBS (UG/KG)											
AROCLOR-1016		38 U	91 U	8.7 U	8.9 U	8.4 U	9.2 U	8.9 U	7.8 U	8.7 U	8.3 U
AROCLOR-1221		38 U	91 U	8.7 U	8.9 U	8.4 U	9.2 U	8.9 U	7.8 U	8.7 U	8.3 U
AROCLOR-1232		38 U	110 U	10 U	10 U	9.8 U	11 U	10 U	9.1 U	10 U	9.8 U
AROCLOR-1242		38 U	91 U	8.7 U	8.9 U	8.4 U	9.2 U	8.9 U	7.8 U	8.7 U	8.3 U
AROCLOR-1248		38 U	91 U	8.7 U	8.9 U	8.4 U	9.2 U	8.9 U	7.8 U	8.7 U	8.3 U
AROCLOR-1254		38 U	91 U	8.7 U	8.9 U	8.4 U	9.2 U	8.9 U	7.8 U	8.7 U	380 J
AROCLOR-1260	1,000	510	**4300**	**1600 J**	110	180 J	9.2 U	26	970 J	**1100 J**	560 J
TOTAL AROCLOR	1,000	510	**4300**	**1600 J**	110	180 J	9.46 U	26	970	**1100**	940
MISCELLANEOUS PARAMETERS (%)											
TOTAL SOLIDS			84	86	86	92	92	91	92	93	95
PETROLEUM HYDROCARBONS (MG/KG)											
GASOLINE RANGE ORGANICS			2.7 U	2.5 UJ	2.3 J	2.1 UJ	1 UJ	2 UJ			
TPH (C09-C36)			350	400	250	240	340	17 U			

Table 2-7
Analytical Results - Subsurface Soil at Decision Units 1-2 and 1-3

EXPOSURE UNIT		DU 1-2: Transformer Vault 2								DU 1-3: Transformer Vault 3					
SAMPLE ID		TF1-TV2-SB-1020-0204	TF1-TV2-SB-1021-0204	TF1-TV2-SB-1022-0204	TF1-TV2-SB-1022-0204-D	TF1-TV2-SB-1022-0204-AVG	TF1-TV2-SB-1023-0204	TF1-TV2-SB-1024-0204	TF1-TV2-SB-1025-0204	TF1-TV3-SB-1026-0204	TF1-TV3-SB-1027-0204	TF1-TV3-SB-1028-0204	TF1-TV3-SB-1029-0204	TF1-TV3-SB-1030-0204	TF1-TV3-SB-1031-0204
LOCATION ID		TF1-TV2-SB1020	TF1-TV2-SB1021	TF1-TV2-SB1022	TF1-TV2-SB1022	TF1-TV2-SB1022	TF1-TV2-SB1023	TF1-TV2-SB1024	TF1-TV2-SB1025	TF1-TV3-SB1026	TF1-TV3-SB1027	TF1-TV3-SB1028	TF1-TV3-SB1029	TF1-TV3-SB1030	TF1-TV3-SB1031
SAMPLE DATE	Surface	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12	08/03/12
DEPTH INTERVAL (FT)	Soil	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4
SACODE	PRG	NORMAL	NORMAL	ORIG	DUP	AVG	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
PCBS (UG/KG)															
AROCLOR-1016		9.1 U	8.8 U	8.7 U	8.1 U	8.4 U	8.7 U	9.9 U	9 U	8.3 U	8.9 U	9.9 U	9 U	8.4 U	8.6 U
AROCLOR-1221		9.1 U	8.8 U	8.7 U	8.1 U	8.4 U	8.7 U	9.9 U	9 U	8.3 U	8.9 U	9.9 U	9 U	8.4 U	8.6 U
AROCLOR-1232		11 U	10 U	10 U	9.5 U	9.75 U	10 U	12 U	10 U	9.7 U	10 U	12 U	10 U	9.9 U	10 U
AROCLOR-1242		9.1 U	8.8 U	8.7 U	8.1 U	8.4 U	8.7 U	9.9 U	9 U	8.3 U	8.9 U	9.9 U	9 U	8.4 U	8.6 U
AROCLOR-1248		9.1 U	8.8 U	8.7 U	8.1 U	8.4 U	8.7 U	9.9 U	9 U	8.3 U	8.9 U	9.9 U	9 U	8.4 U	8.6 U
AROCLOR-1254		9.1 U	8.8 U	8.7 U	8.1 U	8.4 U	8.7 U	9.9 U	9 U	8.3 U	8.9 U	9.9 U	9 U	8.4 U	8.6 U
AROCLOR-1260	1,000	9.1 U	8.8 U	8.7 U	8.1 U	8.4 U	8.7 U	9.9 U	9 U	8.3 U	8.9 U	9.9 U	9 U	8.4 U	8.6 U
TOTAL AROCLOR	1,000	9.37 U	8.97 U	8.3 U	8.89 U	8.6 U	8.89 U	10.2 U	9.14 U	8.5 U	9.06 U	10.2 U	9.29 U	8.61 U	8.8 U
MISCELLANEOUS PARAMETERS (%)															
TOTAL SOLIDS		91	92	86	86	86	88	86	89	88	87	83	90	92	89
PETROLEUM HYDROCARBONS (MG/KG)															
GASOLINE RANGE ORGANICS		1.2 J	1.2 U	1.3 U	1.4 UJ	1.35 UJ	1.4 U	1.4 U	1.3 U	2.4 UJ	2.9 UJ	3 UJ	2.3 UJ	1.3 UJ	1.3 UJ
TPH (C09-C36)		11 U	10 U	7.8 U	9.4 U	8.6 U	5.4 U	7.2 U	6.9 U	8.4 U	14 U	8.6 U	13 U	6.2 U	6.3 U

Table 3-1
Components of Surface Soil Remedial Alternatives

Alternative	Key Components
S-1: No Action	• No remedial action • For comparison only
S-2: Limited Soil Excavation with Land Use Controls	• Install erosion controls • Surface soil excavation with confirmation sampling at DU 1-2 and 1-3 to remove all soil exceeding the PRG for DU 1-2 and 1-3 • Limited surface soil excavation at DU 1-1 to address Industrial PRG exceedances • Further sampling to delineate all soil exceeding Industrial PRGs at DU 1-1 and PRG at DU 1-2 and 1-3 • Off-site disposal of excavated soils from both exposure areas • Re-grading and site restoration • Implement LUCs restricting residential use at DU 1-1 and perform associated inspections and reporting • Implementation of LUCs prohibiting disturbance of the EBP, TV2, and TV3 structure foundations without approval of the Navy and regulatory agencies until the presence or absence of underlying soil can be assessed and remediated, if needed • Five-year reviews to evaluate remedy
S-3: Soil Excavation (with Short-Term Land Use Controls Under EBP Building Only)	• Future sampling to delineate the extent of surface soil exceedances • Site preparation for excavation; create soil staging pad • Install erosion controls • Excavate contaminated soil to an anticipated depth of 2 ft bgs at DU 1-1, 1-2, and 1-3 to remove all surface soil exceeding the PRGs for the respective exposure areas • Off-site disposal of excavated soils from both exposure areas • Re-grading and site restoration • Implementation of short-term LUCs prohibiting disturbance of the EBP, TV2, and TV3 building foundations without approval of the Navy and regulatory agencies until the presence or absence of underlying soil can be assessed and remediated, if needed • Five-year reviews to evaluate remedy
S-4: Limited Soil Excavation with Soil Cover and Land Use Controls	• Future sampling to delineate the extent of surface soil exceedances • Surface soil excavation at DU 1-2 and 1-3 to remove all soil exceeding the PRG for DU 1-2 and 1-3 • Limited surface soil excavation and disposal off-site to address RIDEM GA Leachability Criteria exceedances at DU 1-1 • Off-site disposal of excavated soils from both exposure areas • Site preparation for containment at DU 1-1

Alternative	Key Components
	• Install a 2-foot soil cover at DU 1-1, consisting of 2 feet of clean fill, over the contaminated soil, with topsoil and grass seed. • Re-grading and site restoration • Periodic maintenance of the cover including mowing, shrub removal, and integrity inspections. • Implement LUCs for DU 1-1, which restrict residential use and digging on the cover, and perform associated inspections/reports • Implementation of LUCs prohibiting disturbance of the EBP, TV2, and TV3 building foundations without approval of the Navy and regulatory agencies until the presence or absence of underlying soil can be assessed and remediated, if needed • Five-year reviews to evaluate remedy
S-5: On-Site Consolidation and Soil Cover with Land Use Controls (Screened Out)	• Future sampling to delineate the extent of surface soil exceedances • Site preparation including erosion controls installation • Limited surface soil excavation to address RIDEM GA Leachability Criteria exceedances at DU 1-1 and DU 1-2. • Off-site disposal of excavated soils • Excavate remaining contaminated soil at DU 1-1 and DU 1-3 to an anticipated depth of 2 ft bgs and consolidate excavated soil in one location • Install soil cover, consisting of geotextile layer covered with 2 feet of clean fill, over stockpiled soil. • Complete cover with topsoil and grass seed. • Re-grading and site restoration • Maintenance of the cover would be required over time including mowing, shrub removal, and integrity inspections. • Implement LUCs, which restrict residential use and digging on the cover, and perform associated inspections/reports • Implementation of LUCs prohibiting disturbance of the EBP, TV2, and TV3 building foundations without approval of the Navy and regulatory agencies until the presence or absence of underlying soil can be assessed and remediated, if necessary • Five-year reviews to evaluate remedy

Table 3-2
Screening of Remedial Alternative S-1: No Action

Description: No remedial activities are included under this alternative.

	Effectiveness	Implementability	Cost
Advantages:	• None	• No action makes this the easiest alternative to implement	• No capital costs • No O&M costs
Disadvantages:	• Does not mitigate on-site risk to residential receptors and ecological receptors, or address exceedances of the RIDEM I/C DECs or GA Leachability Criteria	• Additional remedial actions may be required in the future	• Costs of additional remedial actions (if required)

Conclusion: The No Action alternative is not protective of the environment. However, it is used as a baseline in comparison with other alternatives. **This alternative will be retained for detailed analysis.**

Table 3-3
Screening of Remedial Alternative S-2: Limited Soil Excavation with Land Use Controls

Description: Under this alternative, soil excavation and off-site disposal of soil at DU 1-2 and 1-3 would be conducted to meet the selected PRG for PCBs. Additionally, limited soil excavation and off-site disposal would be done at DU 1-1 to remove soils exceeding the Industrial PRGs for DU 1-1. LUCs would be established at DU 1-1 and inspections would be conducted to prevent residential and other unrestricted use of the DU 1-1 area. LUCs would also be implemented for the EBP foundation at DU 1-1 until the presence or absence of soil underneath the EBP structure could be assessed and remediated, if needed. Similarly, LUCs for DU 1-2 and 1-3 would be implemented for the TV2 and TV3 foundations to prevent access to soil below the buildings until it could be assessed and remediated, if needed.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Removes soil exceeding the Industrial PRGs (including RIDEM GA Leachability Criteria) at DU 1-1 • Removes soil exceeding the PRG (including RIDEM GA Leachability) at DU 1-2 and 1-3	• LUCs and soil excavations are proven technologies and easy to implement.	• Low capital costs • Low O&M costs
Disadvantages:	• Does not remove all contaminants • Limits use of property for residential uses	• Long-term actions are required	• Five-year Review costs

Conclusion: The Limited Soil Excavation with Land Use Controls alternative is protective of human health and the environment. This alternative is less difficult to implement than other alternatives. **This alternative will be retained for detailed analysis.**

Table 3-4
Screening of Remedial Alternative S-3: Soil Excavation (with Short-Term Land Use Controls under EBP, TV2 and TV3 Buildings only)

Description: Under this alternative, contaminated surface soil from DU 1-1, 1-2, and 1-3 will be excavated and disposed off-site. Short-term LUCs would be implemented for the EBP foundation at DU 1-1 until the presence or absence of soil underneath the EBP structure could be assessed and remediated, if needed. Similarly, short-term LUCs for DU 1-2 and 1-3 would be implemented for the TV2 and TV3 foundations to prevent access to soil below the buildings until it could be assessed and remediated, if needed. This alternative would address all surface soils exceeding selected PRGs and therefore, would allow for unrestricted use and unlimited exposure upon completion of the remedial action.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Removes contaminated soil	• Excavation is a proven technology	• Low O&M costs
Disadvantages:	• Transportation to off-site facilities increases the potential for current and future liability	• Moderate amount of logistical considerations required during excavation	• Moderate capital cost • Five-year Review costs while short-LUCs are needed

Conclusion: The Soil Excavation (with Short-Term Land Use Controls under EBP, TV2 and TV3 Buildings only) alternative is protective of human health and the environment and allows for unrestricted use. This alternative is moderately difficult to implement. **This alternative will be retained for detailed analysis.**

Table 3-5
Screening of Remedial Alternative S-4: Limited Soil Excavation with Soil Cover and Land Use Controls

Description: This alternative would use a soil cover to provide a barrier to the contaminated surface soils at DU 1-1. Prior to containment, limited soil excavation and off-site disposal would be conducted to remove soils exceeding the RIDEM GA Leachability Criteria at DU 1-1 and remove soils exceeding the PRG at DU 1-2 and 1-3. LUCs will be established for DU 1-1, and five-year reviews would be performed to evaluate the success of the remedial actions. LUCs would also be implemented for the EBP, TV2 and TV3 foundations until the presence or absence of soil underneath the structures could be assessed and remediated, if needed.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Eliminates exposure to contaminated soils	• A soil cover is a proven technology	• Low capital costs
Disadvantages:	• Does not remove all contaminants at the EBP	• Maintenance will be required	• Moderate O&M cost • Five-year Review costs

Conclusion: The Limited Soil Excavation with Soil Cover and Land Use Controls alternative is protective of human health and the environment. However, maintenance of the soil cover will be required since contaminants remain in place. **This alternative will be retained for detailed analysis.**

Table 3-6
Screening of Remedial Alternative S-5: On-Site Consolidation and Soil Cover with Land Use Controls

Description: This alternative is similar to Alternative S-4 but would include excavation and consolidation of contaminated material. After the contaminated material is consolidated, the material would be covered with a soil cover. Land use controls will be established for the consolidation area, and five-year reviews would be performed to evaluate the success of the remedial actions. Short-term LUCs would also be implemented until the presence or absence of soil underneath the EBP, TV2 and TV3 structures could be assessed and remediated, if needed.

	Effectiveness	**Implementability**	**Cost**
Advantages:	• Eliminates exposure to contaminated soils	• Excavation and a soil cover are proven technologies	• None
Disadvantages:	• Does not remove all contaminants	• Moderate amount of logistical considerations required during excavation • Maintenance will be required	• High capital cost • Five-year Review costs

Conclusion: The On-Site Consolidation and Soil Cover with Land Use Controls alternative is protective of human health and the environment. This remedial alternative has the highest cost and only a relatively small area that would be made available for unlimited use/unrestricted exposure as result. **This alternative will not be retained for detailed analysis.**

Table 4-1
Detailed Evaluation of S-1: No Action

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative would not provide any protection of human health from risks identified at DU 1-1 in the DGA Report.
Ecological Protection	This alternative would not provide any protection of the environment from risks assumed at DU 1-2 and 1-3 in the DGA Report.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under current conditions, chemical-specific ARARs have not been met. Therefore, this alternative would not meet ARARs. Refer to Table B-1 in Appendix B for a list and evaluation of ARARs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since this alternative includes no controls to reduce potential direct contact with contaminated soil, the residual risk would be the same as that identified in the DGA Report.
Adequacy and Reliability of Controls	This alternative does not include any controls to reduce potential future exposures to surface soil.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to the community from the remedy.
Protection of Workers during Remedial Actions	Since this alternative involves no construction or monitoring measures, there would be no additional short-term risks to workers from the remedy.
Environmental Impacts	Since this alternative involves no construction or monitoring measures, there would be no additional short-term environmental impacts associated with the remedy.

Evaluation Criteria	Detailed Analysis
Time to Achieve Remedial Action Objectives	This alternative does not meet RAOs
IMPLEMENTABILITY	
Ability to Construct and Operate	No construction of operation would be performed under this alternative.
Reliability of the Technology	No technologies would be implemented under this alternative.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	No monitoring would be conducted under this alternative. Therefore, the effectiveness would not be evaluated.
Ability to Obtain Approvals and Coordinate with Other Agencies	No approvals would likely be needed for this alternative.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	No off-site treatment, storage, or disposal services would be needed under this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists would be needed under this alternative.
Availability of Technology	No technologies would be needed for this alternative.
COSTS	
Total Cost	$0

Table 4-2
Detailed Evaluation of S-2: Limited Soil Excavation with Land Use Controls

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative removes soil concentrations exceeding the Industrial PRGs (including RIDEM GA Leachability Criteria) at DU 1-1; thereby, reducing the risk to industrial workers. Surface soil exceeding the PRG (including the RIDEM GA Leachability Criteria) would also be fully removed at DU 1-2 and 1-3. By implementing LUCs at DU 1-1, contact with COCs at concentrations that would cause an unacceptable risk to residential and unrestricted human receptors is prevented.
Ecological Protection	This alternative would address ecological protection through the removal of soil at DU 1-2 and 1-3 that exceeds the PRG for those DUs.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific and action-specific ARARs will be met. Therefore this alternative would meet ARARs. Refer to Tables B-2a and B-2b in Appendix B for a list and evaluation of ARARs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	The type and quantity of contaminants remaining at the site following implementation of this limited action remedy is similar to current conditions at DU 1-1, except for the removal of soil concentrations exceeding the Industrial PRGs. As part of this alternative, all soil concentrations that exceed the PRG at DU 1-2 and 1-3 will be removed. However, soil contamination will remain present at DU 1-1. LUCs would be implemented to restrict potential residential receptors from coming into contact with soil that could pose unacceptable exposure.
Adequacy and Reliability of Controls	Adequacy of this alternative will be confirmed during the five-year reviews. LUCs are reliable if properly enforced.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.

Evaluation Criteria	Detailed Analysis
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Short-term community risks associated with off-site disposal of contaminated soil would be minor.
Protection of Workers during Remedial Actions	Short-term worker risks associated with environmental sampling and excavation would be mitigated through the use of proper PPE.
Environmental Impacts	Short-term, minor impacts to ecological habitat due to excavation and environmental sampling would occur.
Time to Achieve Remedial Action Objectives	RAOs would be achieved once the limited excavation is performed and LUCs are implemented. It is assumed implementation of this alternative will take approximately 1 year.
IMPLEMENTABILITY	
Ability to Construct and Operate	LUCs and excavation are common and easy to implement.
Reliability of the Technology	Excavation and LUCs are known to be reliable.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Samples around the excavation would be conducted to evaluate the effectiveness of the remedy. Five-year reviews will also be conducted to monitor effectiveness.
Ability to Obtain Approvals and Coordinate with Other Agencies	Approval for disposal of contaminated soils would require coordination with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Multiple facilities would be able to accept the excavated materials for final disposition.
Availability of Necessary Equipment and Specialists	There are many contractors available to provide the equipment and services required by this alternative.
Availability of Technology	This alternative contains commonly-used technologies.

Evaluation Criteria	Detailed Analysis
COSTS	
Capital Costs	$163,414
O&M	$51,514
Five-Year Reviews	$23,307
Total Cost[1]	$238,000

[1] Rounded to the nearest $1,000

Note: Costs associated with potential assessment/remediation of the 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.

Table 4-3
Detailed Evaluation of S-3: Soil Excavation (with Short-Term Land Use Controls under EBP, TV2 and TV3 Buildings only)

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative removes soil concentrations exceeding the PRGs for DU 1-1, 1-2, and 1-3. Short-term LUCs would be implemented until the presence or absence of soil underneath the EBP, TV2 and TV3 structures could be assessed and remediated, if needed. Once that is done, unrestricted use and unlimited exposure would be achieved for all DUs.
Ecological Protection	This alternative would address ecological protection through the removal of soil at DU 1-2 and 1-3 that exceeds the PRG for those DUs.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific and action-specific ARARs will be met. Therefore this alternative would meet ARARs. Refer to Tables B-3a and B-3b in Appendix B for a list and evaluation of ARARs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Upon completion of the excavation, all contaminants will be removed from the site.
Adequacy and Reliability of Controls	Excavation is an adequate and reliable means for removing contaminated material. Adequacy of this alternative will be confirmed during the five-year reviews.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Short-term community risks associated with off-site disposal of contaminated soil would be minor.
Protection of Workers during Remedial Actions	Short-term worker risks associated with environmental sampling and excavation would be mitigated through the use of

Evaluation Criteria	Detailed Analysis
	proper PPE.
Environmental Impacts	Short-term, minor impacts to ecological habitat due to excavation and environmental sampling would occur.
Time to Achieve Remedial Action Objectives	RAOs would be achieved once the excavation is performed. It is assumed implementation of this alternative will take approximately 1 year.
IMPLEMENTABILITY	
Ability to Construct and Operate	Excavation is common and easy to implement.
Reliability of the Technology	Excavation is known to be reliable.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur.
Ability to Monitor Effectiveness	Samples around the excavation would be conducted to evaluate the effectiveness of the remedy. Five-year reviews will also be conducted to monitor effectiveness while short-LUCs are in place.
Ability to Obtain Approvals and Coordinate with Other Agencies	Approval for disposal of contaminated soils would require coordination with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Multiple facilities would be able to accept the excavated materials for final disposition.
Availability of Necessary Equipment and Specialists	There are many contractors available to provide the equipment and services required by this alternative.
Availability of Technology	This alternative contains commonly-used technologies.
COSTS	
Capital Costs	$253,646
O&M	$20,316
Five-Year Reviews	$9,284
Total Cost[1]	$283,000

[1] Rounded to the nearest $1,000

Note: Costs associated with potential assessment/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.

Table 4-4
Detailed Evaluation of S-4: Limited Soil Excavation with Soil Cover and Land Use Controls

Evaluation Criteria	Detailed Analysis
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	This alternative removes soil concentrations exceeding the RIDEM GA Leachability Criteria at DU 1-1; thereby, reducing the potential for naphthalene concentrations to migrate to groundwater. Surface soil exceeding the PRGs (including the RIDEM GA Leachability Criteria) would also be fully removed at DU 1-2 and 1-3. This alternative prevents direct contact, erosion, and transport of surface soil exceeding the PRGs at DU 1-1 through installation of a soil cover. LUCs would be implemented so that the soil cover remains intact and an unacceptable risk to human receptors is prevented for the life of the remedy.
Ecological Protection	This alternative would address ecological protection through the removal of soil at DU 1-2 and 1-3 that exceeds the PRG for those DUs.
COMPLIANCE WITH ARARs	
Chemical-, Location-, and Action-Specific	Under this alternative, chemical-specific and action-specific ARARs will be met. Therefore this alternative would meet ARARs. Refer to Tables B-4a and B-4b in Appendix B for a list and evaluation of ARARs associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	The type and quantity of contaminants remaining at the site following implementation of this remedy is similar to current conditions, except for the removal of soil concentrations exceeding the RIDEM GA Leachability Criteria, which would also fully address exceedances of the PRG for DU 1-2 and 1-3. Exposure to the COCs at DU 1-1 would be prevented by the soil cover. Additionally, LUCs would be implemented to ensure the integrity of the cover at DU 1-1.
Adequacy and Reliability of Controls	Adequacy of this alternative will be confirmed during the five-year reviews. LUCs are reliable if properly enforced.
REDUCTION OF TMV THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No treatment would be performed under this alternative.
Amount Destroyed or Treated	No treatment would be performed under this alternative.
Degree of Expected Reductions of TMV through treatment	No treatment would be performed under this alternative.

Evaluation Criteria	Detailed Analysis
Degree to which Treatment is Irreversible	No treatment would be performed under this alternative.
Type and Quantity of Residuals Remaining after Treatment	No treatment would be performed under this alternative.
SHORT-TERM EFFECTIVENESS	
Protection of Community during Remedial Actions	Short-term community risks associated with off-site disposal of contaminated soil would be minor.
Protection of Workers during Remedial Actions	Short-term worker risks associated with environmental sampling, excavation, and soil cover installation would be mitigated through the use of proper PPE.
Environmental Impacts	Short-term, minor impacts to ecological habitat due to excavation, soil cover installation, and environmental sampling would occur.
Time to Achieve Remedial Action Objectives	RAOs would be achieved once the limited excavation is performed, soil cover installation is complete, and LUCs are implemented. It is assumed implementation of this alternative will take approximately 1 year.
IMPLEMENTABILITY	
Ability to Construct and Operate	LUCs, excavation, and soil covers are common technologies. With the proper planning and design, the alternative would be relatively easy to implement.
Reliability of the Technology	Excavation, soil covers, and LUCs are known to be reliable.
Ease of undertaking Additional Remedial Actions, if needed	If further action is deemed necessary in the future, this alternative would allow for additional remedial actions to occur following removal of the soil cover.
Ability to Monitor Effectiveness	Samples around the excavation would be conducted to evaluate the effectiveness of the remedy. Five-year reviews will also be conducted to monitor effectiveness.
Ability to Obtain Approvals and Coordinate with Other Agencies	Approval for disposal of contaminated soils would require coordination with other agencies.
Availability of Off-Site Treatment, Storage, and Disposal Services and Capacity	Multiple facilities would be able to accept the excavated materials for final disposition.
Availability of Necessary Equipment and Specialists	There are many contractors available to provide the equipment and services required by this alternative.
Availability of Technology	This alternative contains commonly-used technologies.

Evaluation Criteria	Detailed Analysis
COSTS	
Capital Costs	$242,127
O&M	$83,215
Five-Year Reviews	$23,307
Total Cost[1]	$349,000

[1] Rounded to the nearest $1,000

Note: Costs associated with potential assessment/remediation of the 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.

Table 5-1
Cost Sensitivity Analysis Summary

Cost Estimate Scenarios	Alternative S-2	Alternative S-3	Alternative S-4
	Limited Soil Excavation with Land Use Controls	Soil Excavation (with Short-Term Land Use Controls under EBP, TV2 and TV3 Buildings)	Limited Soil Excavation with Soil Cover and Land Use Controls
Lower-end cost projection(1)	$182,000	$222,000	$266,000
Baseline cost estimate(2)	$238,000	$283,000	$349,000
Upper-end cost projection(3)	$311,000	$420,000	$476,000

Notes:
(1) Cost rounded to nearest $1,000. Eliminate contingency costs; apply a 25% reduction to O&M and Five-Year Review costs
(2) Cost rounded to nearest $1,000. Cost estimate as provided in the baseline alternative (Appendix C)
(3) Cost rounded to nearest $1,000. Cost estimates expanded as follows:

Alternative S-2: Increase area and volume of limited excavation to from 150 cubic yards to 300 cubic yards (based on 4,000 sf x 2 ft); increase number of delineation samples by 20%; increase number of waste characterization samples to 2 samples (1 sample per 250 cubic yards); increase data validation hours to 40; increase cost of annual LUC site inspection and Five-Year Reviews by 20%

Alternative S-3: Increase area and volume of excavation at DU 1-1 from 400 cubic yards to 800 cubic yards (based on 10,400 sf) and increase area and volume of excavation at DU 1-2 and DU 1-3 from 20 cubic yards to 40 cubic yards; increase number of delineation samples by 20%; increase number of waste characterization samples to 4 samples (1 sample per 250 cubic yards); increase data validation hours to 40; increase cost of annual LUC site inspection and Five-Year Reviews by 20%

Alternative S-4: Increase area and volume of limited excavation from 60 cubic yards to 120 cubic yards at DU 1-1 and from 20 cubic yards to 40 cubic yards at DU 1-2 and DU 1-3; increase area of cap from 5,200 sf to 10,400 sf; increase number of delineation samples by 20%; increase number of clean fill samples to 4 samples (1 sample per 250 cubic yards per fill type); increase cost of O&M and Five-Year Reviews by 20%

Figures

RESOLUTION CONSULTANTS

Drawn:	JB	11/20/2015
Approved:	MK	11/20/2015
Project #:	60266436	

Map Location

N

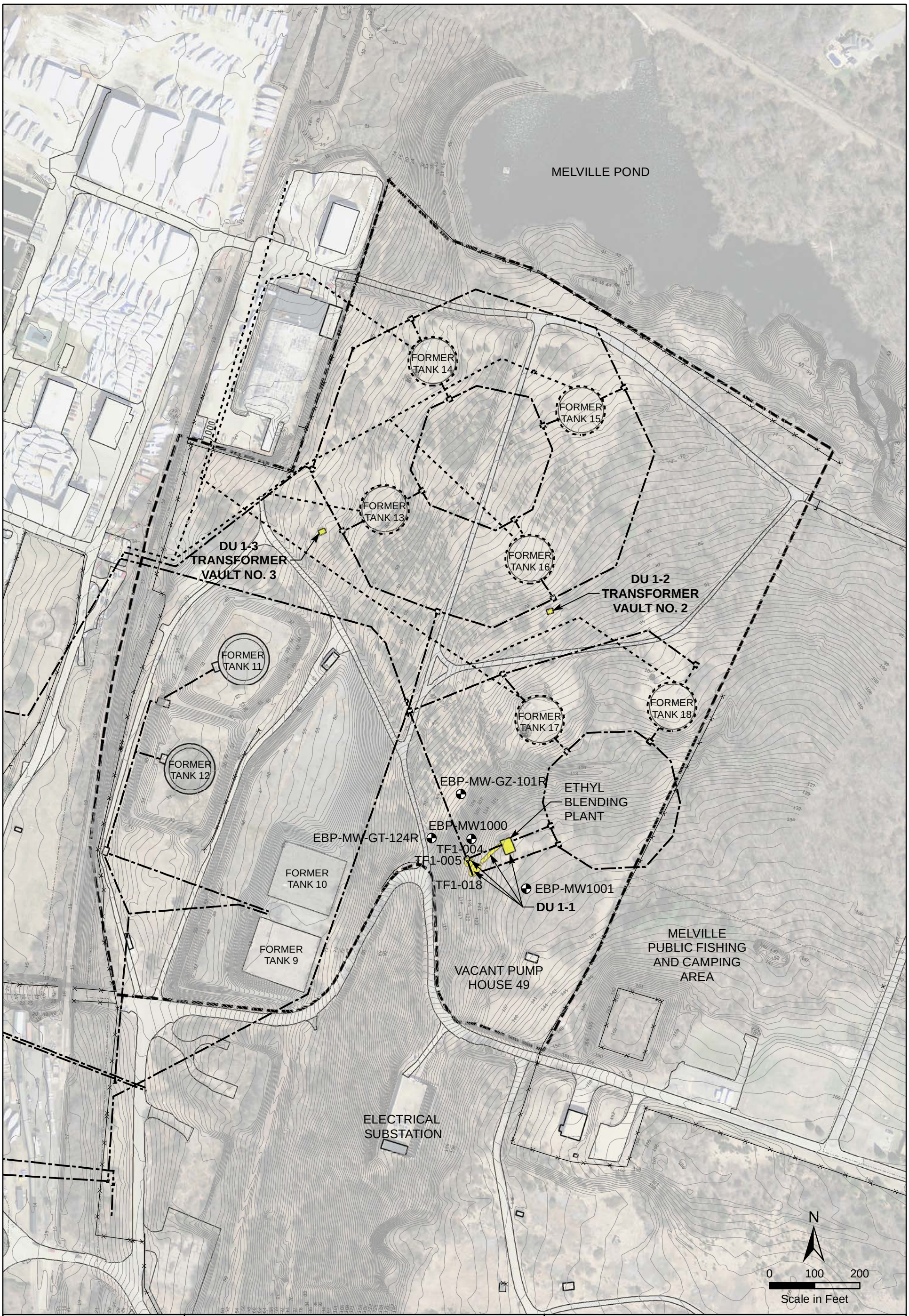
0 1,200 2,400

Scale in Feet

FIGURE 1
SITE LOCUS

TANK FARM 1 - SITE 7
NAVSTA NEWPORT, RHODE ISLAND

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



RESOLUTION CONSULTANTS

Drawn:	JB	11/22/2015
Approved:	MK	11/22/2015
Project #:	60266436	

Legend

- Monitoring Well Location
- Chain Link Fence
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)
- AOCs Investigated during Data Gaps Assessment
- Site 7 Boundary

FIGURE 2
TANK FARM 1 LAYOUT

TANK FARM 1 - SITE 7
NAVSTA NEWPORT, RHODE ISLAND

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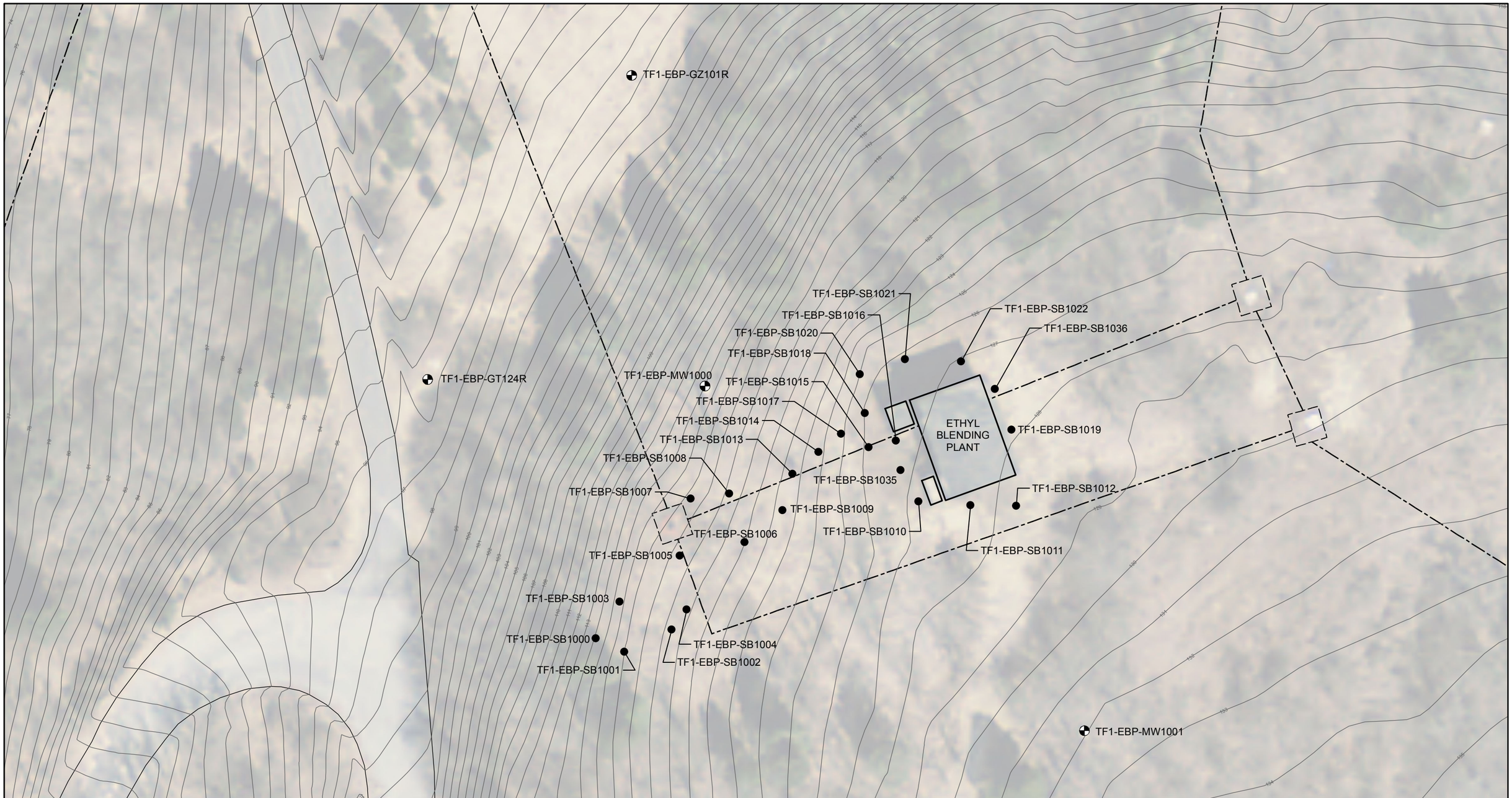


RESOLUTION CONSULTANTS

Drawn:	JB	12/3/2015
Approved:	NO	12/3/2015
Project #:	60266436	

Legend

- Monitoring Well Location
- Soil Boring
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

Note:
The 2010 sample locations were not included since they were not analyzed for the COCs addressed in the FS.

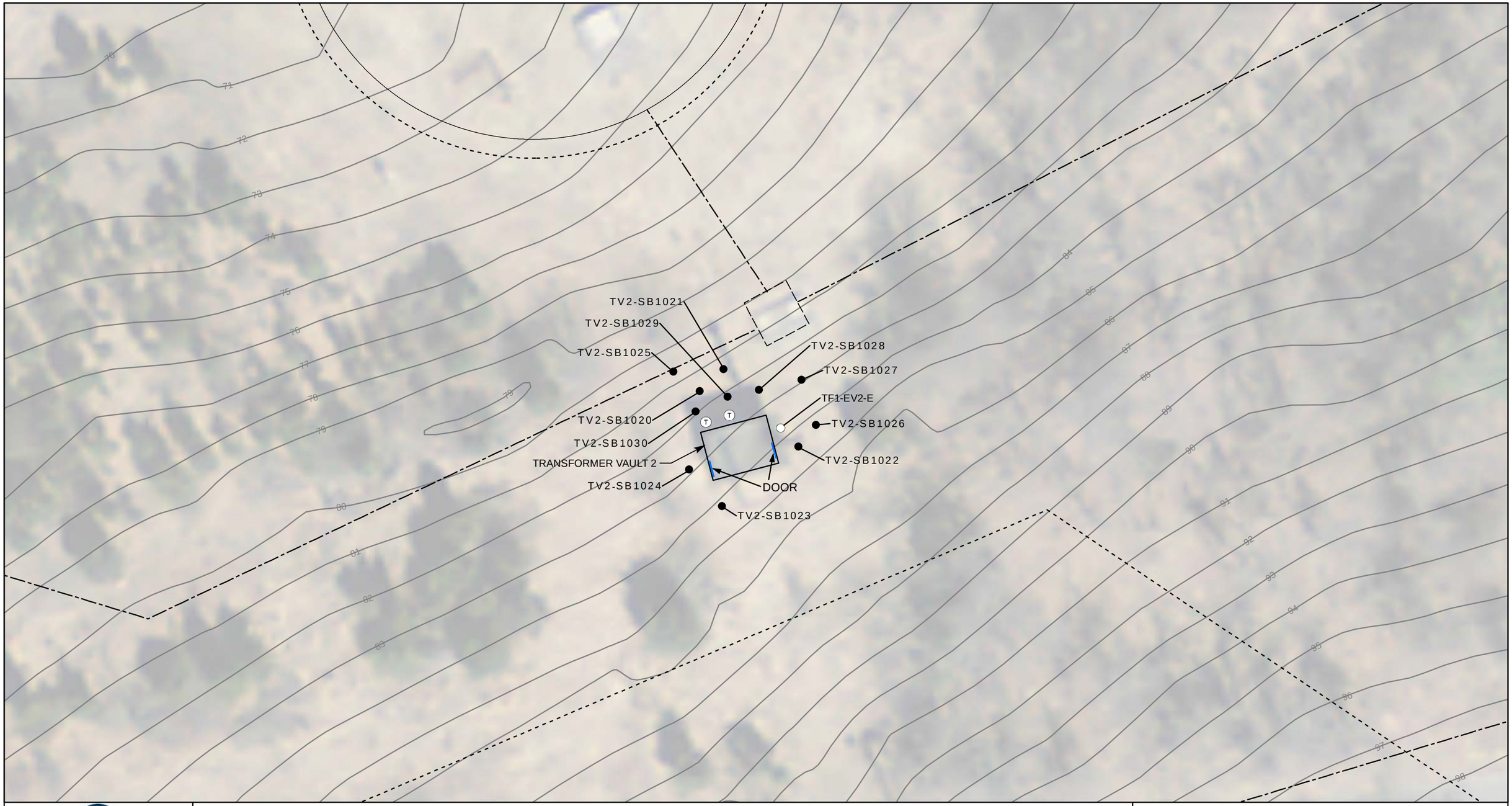
N

0 15 30
Scale in Feet

FIGURE 3
DECISION UNIT 1-1
SAMPLE LOCATION MAP

TANK FARM 1 - SITE 7
NAVSTA NEWPORT, RHODE ISLAND

Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\FS\MXD\Fig_3_Sample_Loc_Ethyl_Blending_Plant_DU_1_1.mxd



RESOLUTION CONSULTANTS

Drawn:	JB	12/03/2015
Approved:	NO	12/03/2015
Project #:	60268619	

Legend

- ● 2012-2013 Soil Boring
- ○ 2010 Site Investigation Soil Sample
- Ⓣ Transformer
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

N

0 10 20

Scale in Feet

FIGURE 4
DECISION UNIT 1-2
SAMPLE LOCATION MAP

TANK FARM 1 - SITE 7
NAVSTA NEWPORT, RHODE ISLAND

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RESOLUTION CONSULTANTS

Drawn:	JB	11/04/2015
Approved:	NO	11/04/2015
Project #:	60266436	

Legend

- 2010 Site Investigation Soil Sample
- 2012-2013 Soil Boring
- Rectifier
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

N

0 10 20
Scale in Feet

FIGURE 5
DECISION UNIT 1-3
SAMPLE LOCATION MAP

SITE 7 - TANK FARM 1
NAVSTA NEWPORT, RHODE ISLAND

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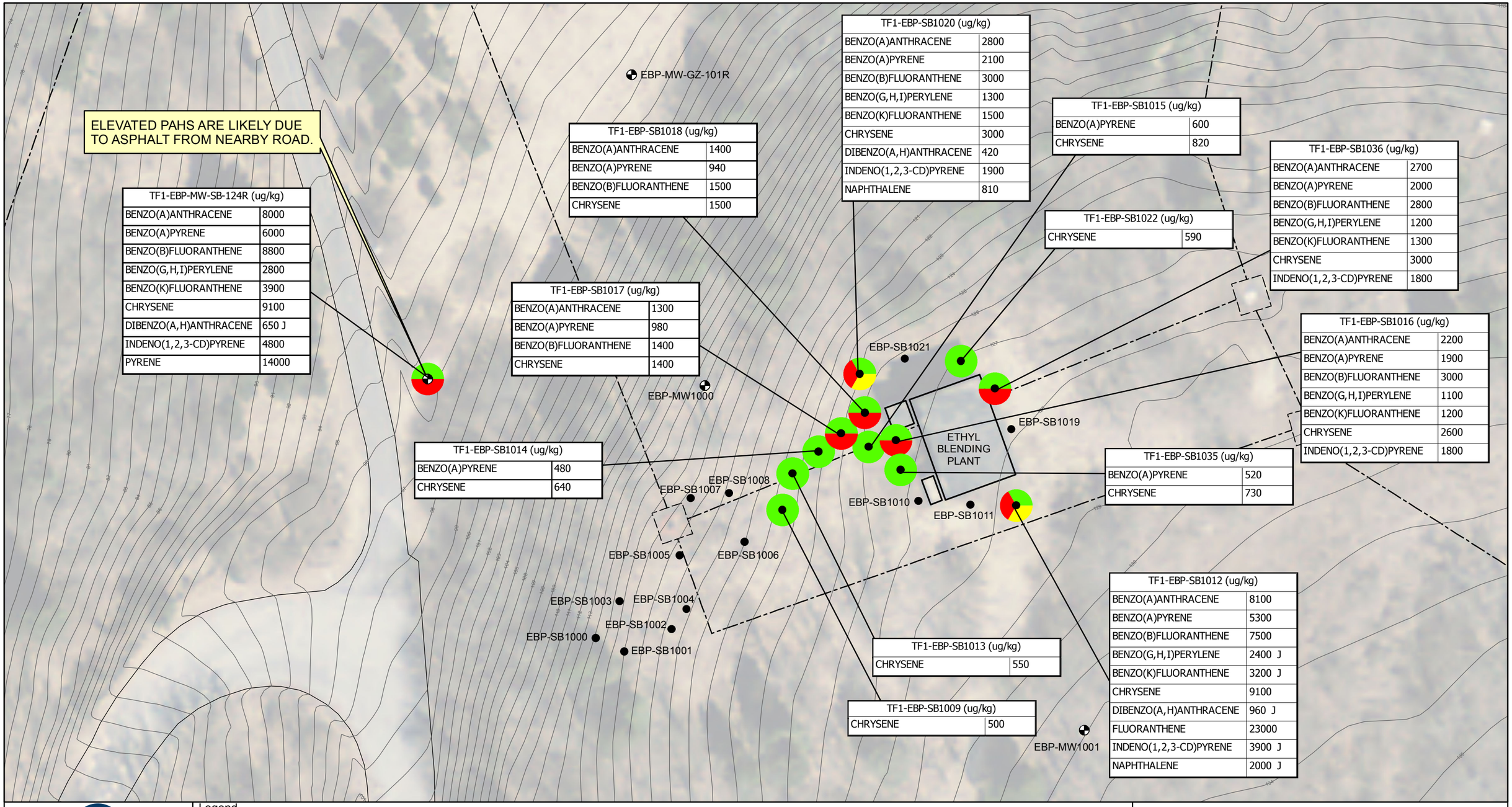


TF1-EBP-MW-SB-124R (ug/kg)	
BENZO(A)ANTHRACENE	8000
BENZO(A)PYRENE	6000
BENZO(B)FLUORANTHENE	8800
BENZO(G,H,I)PERYLENE	2800
BENZO(K)FLUORANTHENE	3900
CHRYSENE	9100
DIBENZO(A,H)ANTHRACENE	650 J
INDENO(1,2,3-CD)PYRENE	4800
PYRENE	14000

TF1-EBP-SB1018 (ug/kg)	
BENZO(A)ANTHRACENE	1400
BENZO(A)PYRENE	940
BENZO(B)FLUORANTHENE	1500
CHRYSENE	1500

TF1-EBP-SB1017 (ug/kg)	
BENZO(A)ANTHRACENE	1300
BENZO(A)PYRENE	980
BENZO(B)FLUORANTHENE	1400
CHRYSENE	1400

TF1-EBP-SB1014 (ug/kg)	
BENZO(A)PYRENE	480
CHRYSENE	640

TF1-EBP-SB1020 (ug/kg)	
BENZO(A)ANTHRACENE	2800
BENZO(A)PYRENE	2100
BENZO(B)FLUORANTHENE	3000
BENZO(G,H,I)PERYLENE	1300
BENZO(K)FLUORANTHENE	1500
CHRYSENE	3000
DIBENZO(A,H)ANTHRACENE	420
INDENO(1,2,3-CD)PYRENE	1900
NAPHTHALENE	810

TF1-EBP-SB1015 (ug/kg)	
BENZO(A)PYRENE	600
CHRYSENE	820

TF1-EBP-SB1022 (ug/kg)	
CHRYSENE	590

TF1-EBP-SB1036 (ug/kg)	
BENZO(A)ANTHRACENE	2700
BENZO(A)PYRENE	2000
BENZO(B)FLUORANTHENE	2800
BENZO(G,H,I)PERYLENE	1200
BENZO(K)FLUORANTHENE	1300
CHRYSENE	3000
INDENO(1,2,3-CD)PYRENE	1800

TF1-EBP-SB1016 (ug/kg)	
BENZO(A)ANTHRACENE	2200
BENZO(A)PYRENE	1900
BENZO(B)FLUORANTHENE	3000
BENZO(G,H,I)PERYLENE	1100
BENZO(K)FLUORANTHENE	1200
CHRYSENE	2600
INDENO(1,2,3-CD)PYRENE	1800

TF1-EBP-SB1035 (ug/kg)	
BENZO(A)PYRENE	520
CHRYSENE	730

TF1-EBP-SB1012 (ug/kg)	
BENZO(A)ANTHRACENE	8100
BENZO(A)PYRENE	5300
BENZO(B)FLUORANTHENE	7500
BENZO(G,H,I)PERYLENE	2400 J
BENZO(K)FLUORANTHENE	3200 J
CHRYSENE	9100
DIBENZO(A,H)ANTHRACENE	960 J
FLUORANTHENE	23000
INDENO(1,2,3-CD)PYRENE	3900 J
NAPHTHALENE	2000 J

TF1-EBP-SB1013 (ug/kg)	
CHRYSENE	550

TF1-EBP-SB1009 (ug/kg)	
CHRYSENE	500

RESOLUTION CONSULTANTS

Drawn:	JB	11/22/2015
Approved:	NO	11/22/2015
Project #:	60266436	

Legend

- Monitoring Well Location
- Soil Boring
- RIDEM RDEC Exceedance
- RIDEM I/C DEC Exceedance
- RIDEM GA LC Exceedance
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

PRG = Preliminary Remediation Goal
RIDEM = Rhode Island Dept. of Environmental Management
RDEC = Residential Direct Exposure Criteria
I/C DEC = Industrial/Commercial Direct Exposure Criteria
GA LC = GA Leachability Criteria
PAH = Polycyclic Aromatic Hydrocarbon

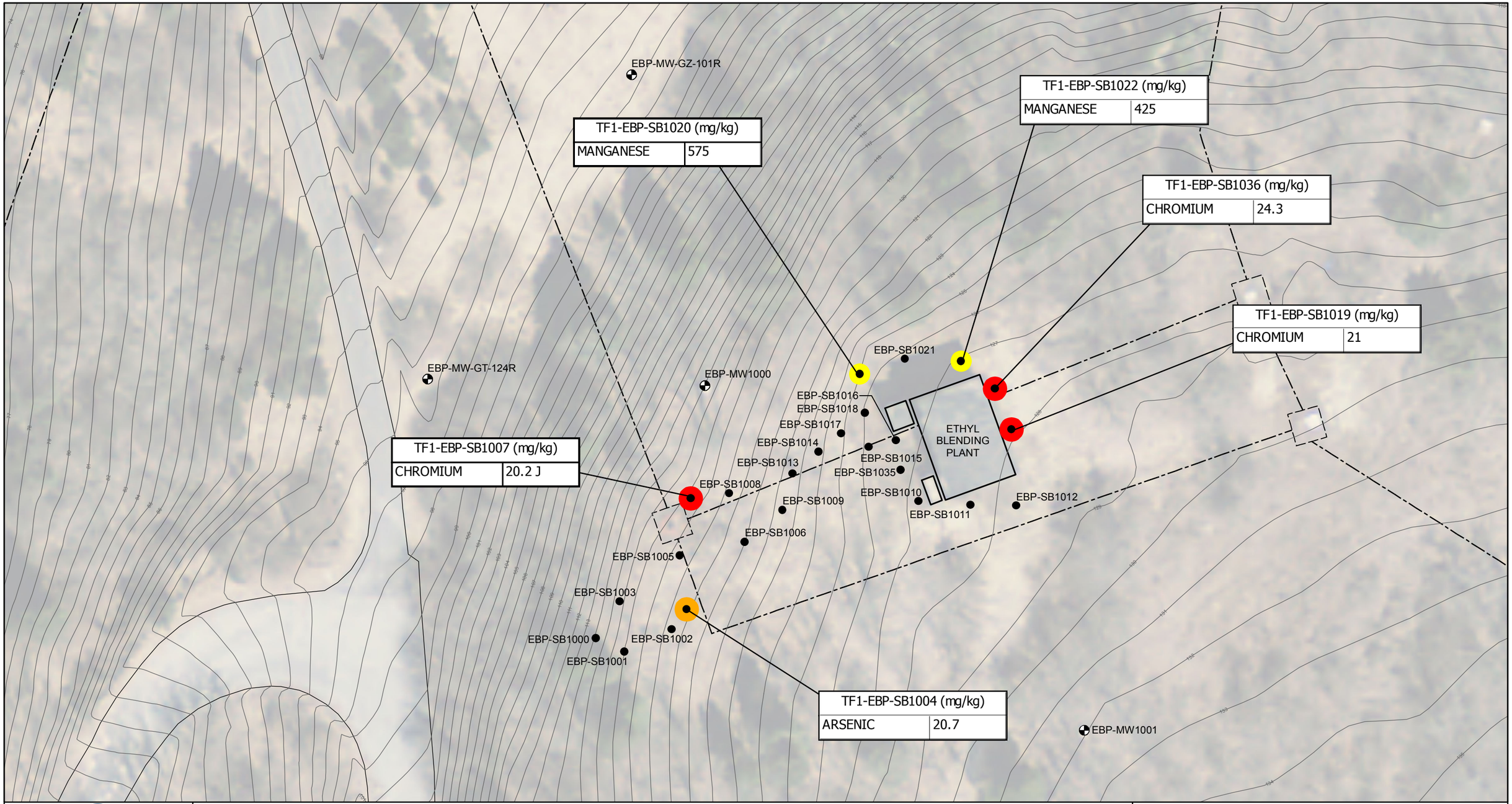
N

0 15 30
Scale in Feet

FIGURE 6
SURFACE SOILS EXCEEDING PRGs
FOR PAHs
DECISION UNIT 1-1

TANK FARM 1 (SITE 7)
NAVSTA NEWPORT, RHODE ISLAND

Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\FS\MXD\Fig_6_PAHs_DU_1_1.mxd



RESOLUTION CONSULTANTS

Drawn:	JB	11/22/2015
Approved:	NO	11/22/2015
Project #:	60266436	

Legend

- Monitoring Well Location
- Soil Boring
- PRG Exceedance for Arsenic (based on background)
- PRG Exceedance for Manganese (based on RIDEM RDEC)
- PRG Exceedance for Chromium (based on background)*
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

PRG = Preliminary Remediation Goal
RIDEM = Rhode Island Dept. of Environmental Management
RDEC = Residential Direct Exposure Criteria

I/C DEC = Industrial/Commercial Direct Exposure Criteria
COC = Contaminant of Concern
*Note: Chromium is a potential COC based on an assumption that detections are hexavalent chromium.

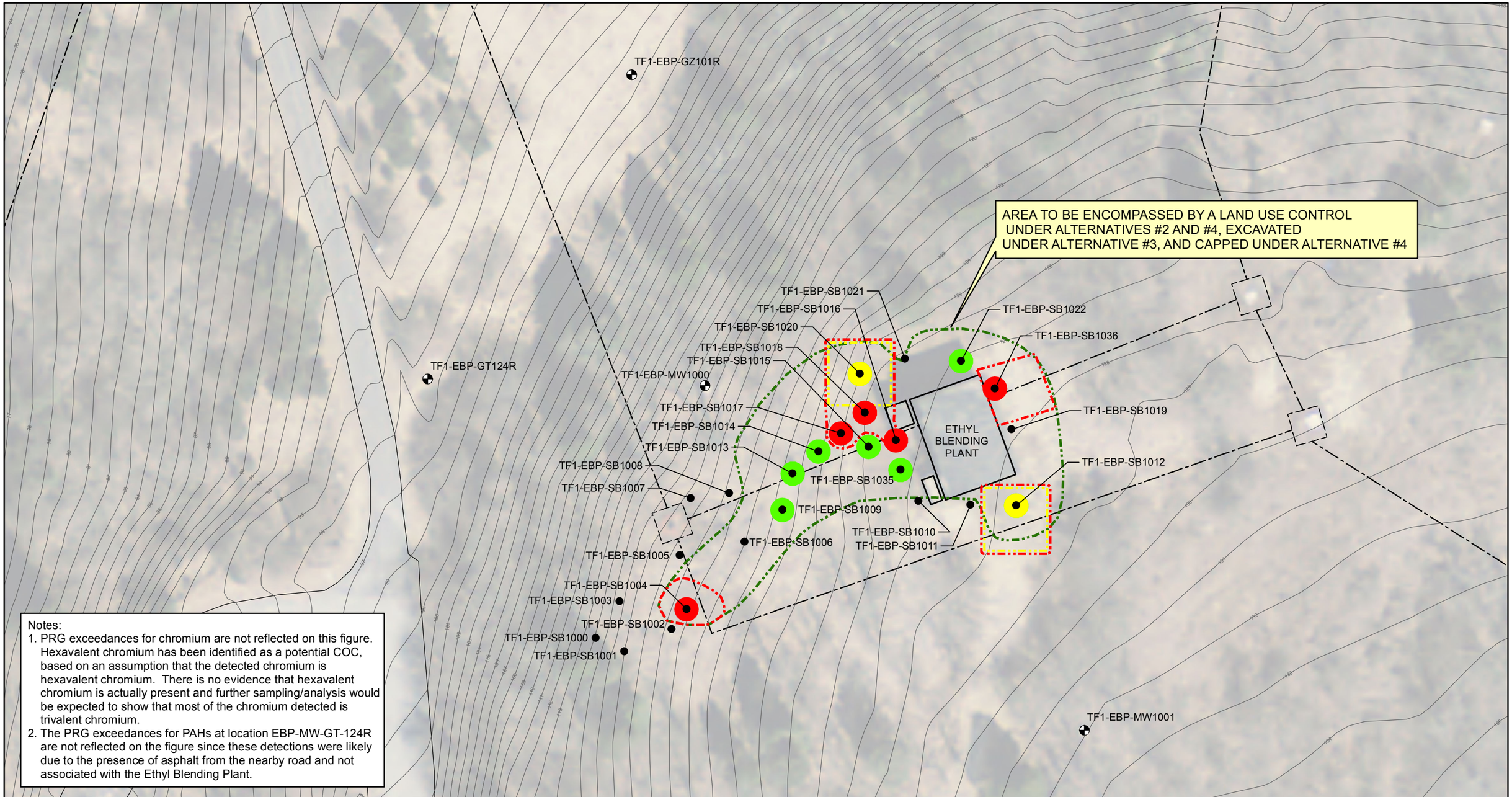
N

0 15 30
Scale in Feet

FIGURE 7
SURFACE SOILS EXCEEDING PRGs
FOR METALS
DECISION UNIT 1-1

TANK FARM 1 - SITE 7
NAVSTA NEWPORT, RHODE ISLAND

Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\FS\MXD\Fig_7_Metals_DU_1_1.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	12/03/2015
Approved:	NO	12/03/2015
Project #:	60266436	

Legend

- Monitoring Well Location
- Soil Boring
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

PRG = Preliminary Remediation Goal
GA LC = GA Leachability Criteria

- Exceeds Residential and Industrial PRGs (including GA LC)
- Exceeds Residential PRGs
- Exceeds Residential and Industrial PRGs

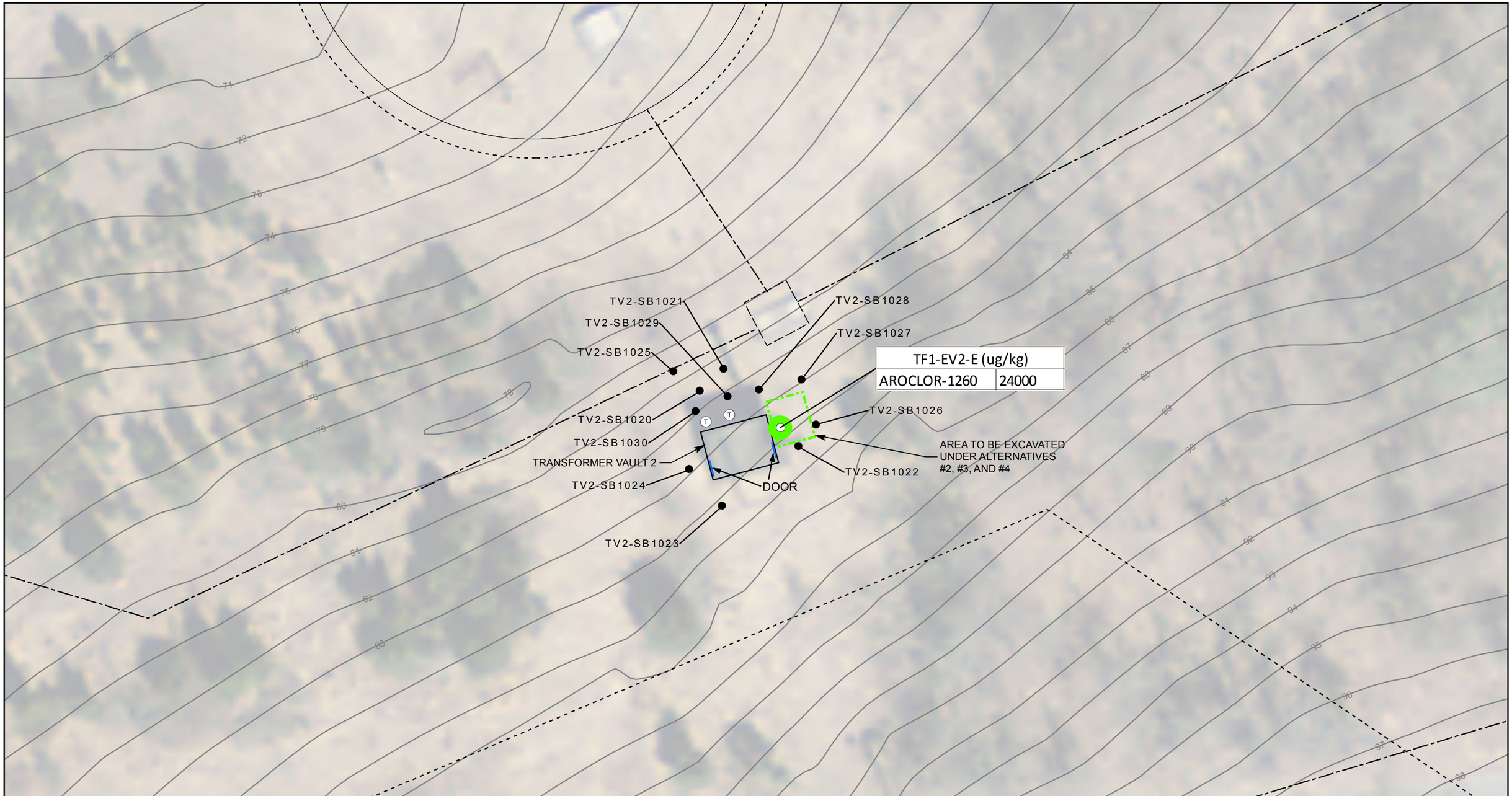
- Estimated Extent of Excavation under Alternative 4 (exceeds GA LC)
- Overall Estimated Extent of Surface Soil Impacts (Res and Ind PRG Exceedances)
- Estimated Extent of Excavation under Alternative 2 (based on Ind PRG Exceedances)

N

0 15 30
Scale in Feet

FIGURE 8
SUMMARY OF SURFACE SOILS EXCEEDING PRGs
DECISION UNIT 1-1

TANK FARM 1 (SITE 7)
NAVSTA NEWPORT, RHODE ISLAND



RESOLUTION CONSULTANTS

Drawn:	JB	12/03/2015
Approved:	NO	12/03/2015
Project #:	60268619	

Legend

- Monitoring Well Location
- 2012-2013 Soil Boring
- 2010 Site Investigation Soil Sample
- PRG Exceedance
- PRG = Preliminary Remediation Goal
- Estimated Extent of Surface Soil Impacts for Remedial Alternatives Analysis
- Transformer
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

N

0 10 20
Scale in Feet

FIGURE 9
SURFACE SOILS EXCEEDING PRGs
TRANSFORMER VAULT 2

TANK FARM 1 - SITE 7
NAVSTA NEWPORT, RHODE ISLAND

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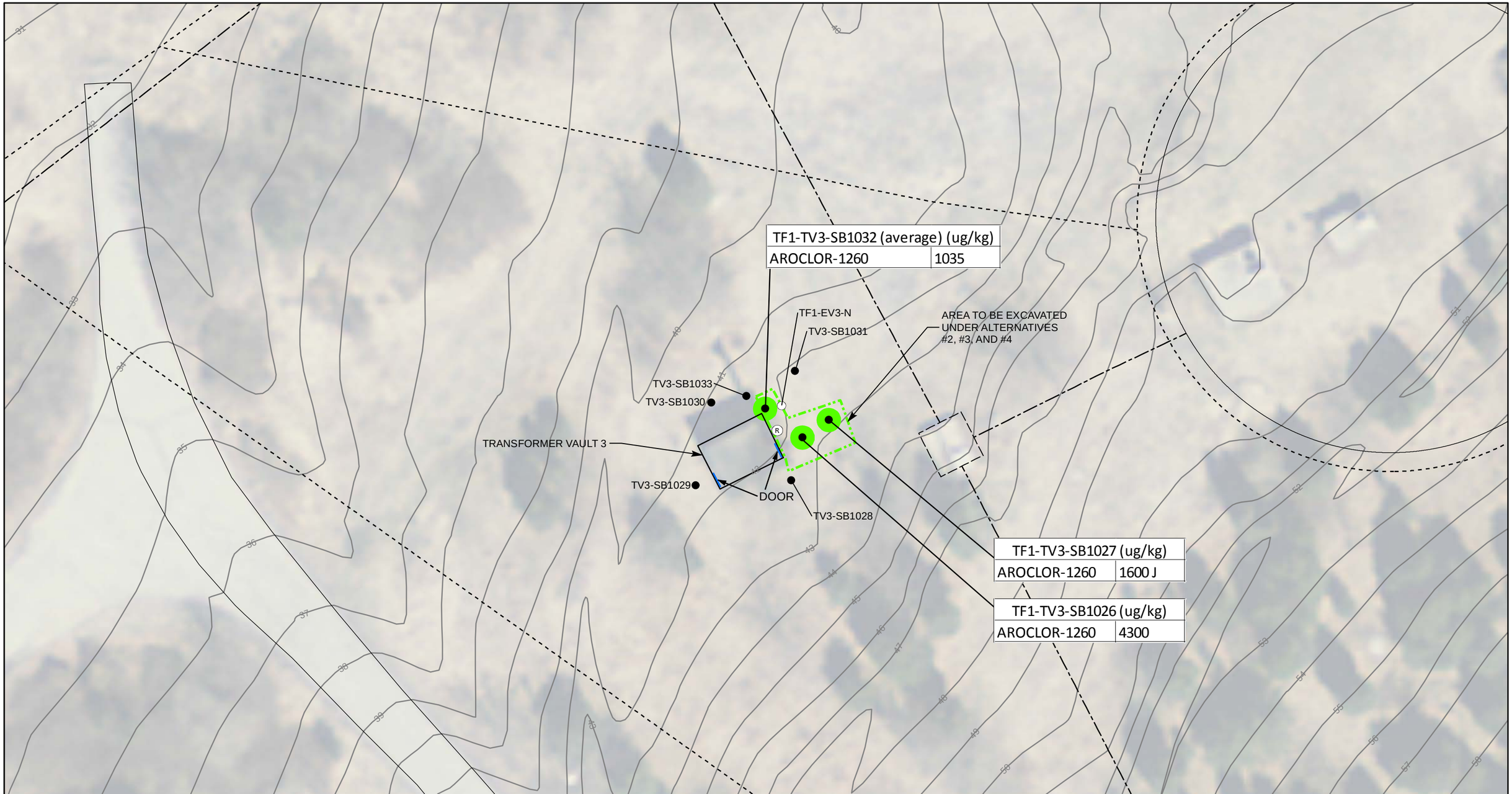

RESOLUTION CONSULTANTS

Drawn:	JB	11/04/2015
Approved:	NO	11/04/2015
Project #:	60266436	

Legend

- 2010 Site Investigation Soil Sample
- 2012-2013 Soil Boring
- Rectifier
- PRG Exceedance
- Estimated Extent of Surface Soil Impacts for Remedial Alternatives Analysis
- Petroleum Distribution (Remaining)
- Ring Drain/BSW Drainage (Remaining)

PRG = Preliminary Remediation Goal

N

0 10 20
Scale in Feet

FIGURE 10
SURFACE SOILS EXCEEDING PRGs
DECISION UNIT 1-3

SITE 7 - TANK FARM 1
NAVSTA NEWPORT, RHODE ISLAND

Document Path: P:\Govt\Projects\NavyCLEAN AECOM-EnSafe JV\Newport\GIS\Projects\Tank_Farm_1\FS\MXD\Fig_10_Surface_Soils_Exceeding_PRGs_TV3.mxd

Appendix A

Calculation of Preliminary Remediation Goals for DU 1-1, DU 1-2, & DU 1-3

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 $1x10^{-6}$ 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:

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

$$\frac{EF_{ressa\ 6\text{-}16}\left(\frac{350\ days}{year}\right)\times ED_{6\text{-}16}\ (yr)\times IRS_a\left(\frac{100\ mg}{day}\right)\times 3}{BW_a\ (80\ Kg)}+\frac{EF_{ressa\ 16\text{-}26}\left(\frac{350\ days}{year}\right)\times ED_{16\text{-}26}\ (yr)\times IRS_a\left(\frac{100\ mg}{day}\right)\times 1}{BW_a\ (80\ Kg)}$$

- 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

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

- 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**

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

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

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.

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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-day)$^{-1}$	key	IUR (ug/m^3)$^{-1}$	key	RfD_o (mg/kg-day)	key	RfC_i (mg/m^3)	key	voc	muta-gen	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	Maximum Detected	Units	Regulatory Criteria RIDEM Rem. Regs[2]			Residential Risk-Based Goals[3] ILCR				Additional Information		Selected		Selected	
	Surface Soil Concentration	Subsurface Soil Concentration		RDEC	Leachability - GA	Leachability - GB	10^{-6}	10^{-5}	10^{-4}	HQ = 1	Site-specific Background[4]	RI Background[5]	Residential PRG for Surface Soil	Basis	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]	
						ILCR				Site-specific Background[4]	RI Background[5]			Estimated ILCR	Estimated HQ
			Res. DEC	Leachability - GA	Leachability - GB	10^{-6}	10^{-5}	10^{-4}	HQ = 1						
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	Maximum Detected	Units	Regulatory Criteria RIDEM Rem. Regs[2]			Risk-Based Goals[3] ILCR				Additional Information Site-specific	RI	Selected		Selected	
	Surface Soil Concentration	Subsurface Soil Concentration		I/C DEC	Leachability - GA	Leachability - GB	10^{-6}	10^{-5}	10^{-4}	HQ = 1	Background[4]	Background[5]	Industrial PRG for Surface Soil	Basis	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

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

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)

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

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	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

	Site	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

	Site	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
Analyte	**Units**							
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

	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

	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								
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	B	C	D	E	F	G	H	I	J	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									

	A	B	C	D	E	F	G	H	I	J	K	L
65					95% UTL with 95% Coverage	14.8				90% Percentile (z)		9.029
66					95% UPL (t)	11.63				95% Percentile (z)		11.23
67					95% USL	23.7				99% Percentile (z)		16.92
68												
69					Nonparametric Distribution Free Background Statistics							
70					Data do not follow a Discernible Distribution (0.05)							
71												
72					Nonparametric Upper Limits for Background Threshold Values							
73					Order of Statistic, r	42				95% UTL with 95% Coverage		17.1
74					Approximate f	2.211				Confidence Coefficient (CC) achieved by UTL		0.884
75				95% Percentile Bootstrap UTL with	95% Coverage	16.97				95% BCA Bootstrap UTL with 95% Coverage		16.83
76					95% UPL	14.08				90% Percentile		9.32
77					90% Chebyshev UPL	15.73				95% Percentile		11.66
78					95% Chebyshev UPL	20.57				99% Percentile		16.03
79					95% USL	17.1						
80												
81					Note: The use of USL to estimate a BTV is recommended only when the data set represents a background							
82					data set free of outliers and consists of observations collected from clean unimpacted locations.							
83					The use of USL tends to provide a balance between false positives and false negatives provided the data							
84					represents a background data set and when many onsite observations need to be compared with the BTV.							
85												
86	CHROMIUM											
87												
88	General Statistics											
89					Total Number of Observations	22				Number of Distinct Observations		18
90					Minimum	6.3				First Quartile		7.3
91					Second Largest	17				Median		11.7
92					Maximum	17.1				Third Quartile		14.48
93					Mean	11.35				SD		3.948
94					Coefficient of Variation	0.348				Skewness		0.0465
95					Mean of logged Data	2.366				SD of logged Data		0.368
96												
97					Critical Values for Background Threshold Values (BTVs)							
98					Tolerance Factor K (For UTL)	2.349				d2max (for USL)		2.603
99												
100					Normal GOF Test							
101					Shapiro Wilk Test Statistic	0.885				Shapiro Wilk GOF Test		
102					5% Shapiro Wilk Critical Value	0.911				Data Not Normal at 5% Significance Level		
103					Lilliefors Test Statistic	0.189				Lilliefors GOF Test		
104					5% Lilliefors Critical Value	0.189				Data appear Normal at 5% Significance Level		
105					Data appear Approximate Normal at 5% Significance Level							
106												
107					Background Statistics Assuming Normal Distribution							
108					95% UTL with 95% Coverage	20.62				90% Percentile (z)		16.4
109					95% UPL (t)	18.29				95% Percentile (z)		17.84
110					95% USL	21.62				99% Percentile (z)		20.53
111												
112					Gamma GOF Test							
113					A-D Test Statistic	1.04				Anderson-Darling Gamma GOF Test		
114					5% A-D Critical Value	0.745				Data Not Gamma Distributed at 5% Significance Level		
115					K-S Test Statistic	0.176				Kolmogrov-Smirnoff Gamma GOF Test		
116					5% K-S Critical Value	0.186				etected data appear Gamma Distributed at 5% Significance Lev		
117					Detected data follow Appr. Gamma Distribution at 5% Significance Level							
118												
119					Gamma Statistics							
120					k hat (MLE)	8.176				k star (bias corrected MLE)		7.091
121					Theta hat (MLE)	1.388				Theta star (bias corrected MLE)		1.6
122					nu hat (MLE)	359.7				nu star (bias corrected)		312
123					MLE Mean (bias corrected)	11.35				MLE Sd (bias corrected)		4.26
124												
125					Background Statistics Assuming Gamma Distribution							
126				95% Wilson Hilferty (WH) Approx. Gamma UPL		19.44				90% Percentile		17.03
127				95% Hawkins Wixley (HW) Approx. Gamma UPL		19.65				95% Percentile		19.14
128				95% WH Approx. Gamma UTL with	95% Coverage	23.08				99% Percentile		23.52

	A	B	C	D	E	F	G	H	I	J	K	L
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							

	A	B	C	D	E	F	G	H	I	J	K	L
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 B

ARARs Tables

TABLE B-1
CHEMICAL-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-1: NO ACTION

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.	This alternative would not prevent exposure to soil contaminants at DU 1-1 which contribute to a calculated carcinogenic risk, developed using this guidance.
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.	This alternative would not prevent exposure to soil contaminants at DU 1-1 which contribute to a calculated non-carcinogenic risk, developed using this guidance.
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.	This alternative would not prevent exposure to soil contaminants at DU 1-1 which contribute to a calculated carcinogenic risk, developed using this guidance.
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.	This alternative would not prevent exposure to soil contaminants at DU 1-1 which contribute to a calculated carcinogenic risk to children, developed using this guidance.
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.	This alternative would not prevent exposure to PCB contamination in soil at DU 1-2 and DU 1-3 which exceeds the guidance value developed by EPA for PCBs in soil.
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.	This alternative would not prevent exposure to any soil contaminants at DU 1-1, 1-2, or 1-3 that exceed State soil standards that are more stringent than federal risk-based standards.

Notes:
With no action, there are no location- or action-specific ARARs.

TABLE B-2a
CHEMICAL-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
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 PRG for surface soil at DU 1-2 and 1-3 to be protective of unrestricted use by humans.
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 PRGs 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 will meet the remediation regulations through excavation of soil that exceeds the PRGs for industrial use and land use controls to restrict residential use. The action to be taken under this alternative for surface soil at DU 1-2 and 1-3 will meet the remediation regulations through excavation of soil that exceeds the selected PRG.

TABLE B-2b
ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
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 identified PCB cleanup levels at DU 1-2 and 1-3 will be excavated and disposed of off-site. 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 will include 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 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 Air Detrimental to Persons or Property	RIGL 23-23 *et seq.*; CRIR 12-31-07	Applicable	Prohibits emissions of contaminants which may be injurious to humans, plant or animal life, or cause damage to property, or which unreasonably interfere with the enjoyment of life and property.	Remediation activities may result in emissions. Appropriate measure would need to be taken to comply with these regulations.
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.

TABLE B-2b
ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
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
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.

TABLE B-3a
CHEMICAL-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-3: SOIL EXCAVATION (WITH SHORT-TERM LAND USE CONTROLS UNDER EBP, TV2, and TV3 BUILDINGS ONLY)

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 PRG for surface soil at DU 1-2 and 1-3 to be protective of unrestricted use by humans.
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 PRGs 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 will meet the remediation regulations through excavation of the full extent of soil that exceeds PRGs for residential and industrial use. Short-term land use controls (LUCs) will likely be needed until the Ethyl Blending Plant structure is demolished and the soil, if present, beneath the structure can be assessed. Short-term LUCs would prevent disturbance of the building foundation without approval of the Navy and regulatory agencies. The action to be taken under this alternative for surface soil at DU 1-2 and 1-3 will meet the remediation regulations through excavation of soil that exceeds the selected PRG.

TABLE B-3b
ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-3: SOIL EXCAVATION (WITH SHORT-TERM LAND USE CONTROLS UNDER EBP, TV2, and TV3 BUILDINGS ONLY)

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 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 identified PCB cleanup levels at the Transformer Vaults will be excavated and disposed of off-site. 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 will include 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 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 Air Detrimental to Persons or Property	RIGL 23-23 *et seq.*; CRIR 12-31-07	Applicable	Prohibits emissions of contaminants which may be injurious to humans, plant or animal life, or cause damage to property, or which unreasonably interfere with the enjoyment of life and property.	Remediation activities may result in emissions. Appropriate measure would need to be taken to comply with these regulations.
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	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.

TABLE B-3b
ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-3: SOIL EXCAVATION (WITH SHORT-TERM LAND USE CONTROLS UNDER EBP, TV2, and TV3 BUILDINGS ONLY)

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
Determination				
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.

TABLE B-4a
CHEMICAL-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-4: LIMITED SOIL EXCAVATION WITH SOIL COVER AND 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 PRG for surface soil at DU 1-2 and 1-3 to be protective of unrestricted use by humans.
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 and Leachability Criteria were used in the development of PRGs 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 will meet the remediation regulations through excavation of limited areas of soil that exceed the Leachability Criteria, placement of a soil cover over the full extent of soil that exceeds PRGs for residential and industrial use, and placement of land use controls to ensure that the soil cover remains intact. Similarly, the action to be taken under this alternative for surface soil at DU 1-2 and 1-3 will meet the remediation regulations through excavation of soil that exceeds the selected PRG.

TABLE B-4b
ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-4: LIMITED SOIL EXCAVATION WITH SOIL COVER AND 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 and the installation and maintenance of the cover at DU 1-1 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 identified PCB cleanup levels at DU 1-2 and 1-3 will be excavated and disposed of off-site. 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 will include 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 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 Air Detrimental to Persons or Property	RIGL 23-23 *et seq.*; CRIR 12-31-07	Applicable	Prohibits emissions of contaminants which may be injurious to humans, plant or animal life, or cause damage to property, or which unreasonably interfere with the enjoyment of life and property.	Remediation activities may result in emissions. Appropriate measure would need to be taken to comply with these regulations.
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.

TABLE B-4b
ACTION-SPECIFIC ARARs AND TBCs
DECISION UNITS 1-1, 1-2, and 1-3 AT TANK FARM 1 – SITE 7, FEASIBILITY STUDY
NAVSTA NEWPORT, PORTSMOUTH, RHODE ISLAND
ALTERNATIVE S-4: LIMITED SOIL EXCAVATION WITH SOIL COVER AND LAND USE CONTROLS

Requirement	Citation	Status	Requirement Synopsis	Action to Be Taken to Attain Requirement
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.
Rhode Island Solid Waste Regulations – Dust Control	DEM OWMSW0401, 1.7.10	Relevant and Appropriate	Requires dust control.	Dust will be controlled at the site during cover construction and during maintenance activities.
Rhode Island Solid Waste Regulations – Sedimentation and Erosion Control	DEM OWMSW0401, 2.1.04	Relevant and Appropriate	Requires development of a "Sedimentation and Erosion Control Plan."	Sedimentation and erosion controls will be implemented during intrusive activities.
Rhode Island Solid Waste Regulations – Vegetated Top Cover	DEM OWMSW0401, 2.2.12(d)(1) and 2.2.12(d)(2)(ii)(iii) and (v)	Relevant and Appropriate	Contains requirements for construction and maintenance of the vegetative cover final cover system.	The cover will include appropriate vegetation requirements of a soil cover in compliance with these standards.
Rhode Island Solid Waste Regulations – Cover Permeability	DEM OWM-SW0401, 2.3.04(2), (f)	Relevant and Appropriate	Outlines the requirements for the maintenance and permeability of cover material.	The substantive requirements of this section of the regulations will be met by maintaining a cover that has been determined to provide an adequate barrier for the contaminants remaining in the soil.
Rhode Island Solid Waste Regulations – Surface Water Drainage	DEM OWM-SW-0401, 2.3.10	Relevant and Appropriate	Contains requirements for surface water drainage.	The substantive requirements of this section of the regulations will be met through design of appropriate surface drainage considerations for the cover. The cover system would be designed to prevent erosion, sedimentation, and standing water on the cover. Minimum slope requirements for solid waste landfills have been determined not relevant or appropriate for a soil cover which is not intended to reduce infiltration.

Appendix C

Cost Estimates

Planning Cost Estimate Summary

Alternative: S-1 No Action

Site: DU 1-1, 1-2, & 1-3 at Tank Farm 1 - Site 7, NAVSTA Newport
Location: Portsmouth, Rhode Island
Phase: FS
Date: October 2015

Description: This alternative consists of no remedial action as a baseline comparison.

PERIODIC COSTS

Description	QTY	UNIT	UNIT COST	Total	Notes
No costs are estimated for this No Action alternative.					
SUBTOTAL				$0	
TOTAL PERIODIC ANNUAL COSTS				$0	

PRESENT VALUE ANALYSIS

Cost Type	Total Cost per Year	Discount Factor	Present Value	Notes
Capital Cost	0		$0	
O&M Cost	0		$0	
Periodic Cost	$0		$0	
Total Present Value of Alternative			$0	

Planning Cost Estimate Summary

Alternative: 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: October 2015

Description: This alternative consists of excavating the full extent of surface soil at DU 1-2 and 1-3 that exceeds the selected PRG (including GA Leachability Criteria). Additionally, this alternative includes limited surface soil excavation at DU 1-1 to meet 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		2050	SF	$1	$2,050	
					$9,650	
Excavation						
Excavate soil		150	CY	$15	$2,250	Based on 2 foot depth and areas shown on Figures 8 - 10
Dust control and air monitoring		1	LS	$500	$500	
Regrade excavation footprint		2050	SF	$1	$2,050	
Seeding		2050	SF	$5	$10,250	
					$15,050	
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		225	Ton	$75	$16,875	
					$17,705	
Post-Construction						
Contractor Completion Report		75	HR	$100	$7,500	
Remedial Action Completion Report		100	HR	$100	$10,000	
(2 iterations)					$17,500	
SUBTOTAL					$108,365	
Contingency	30%				$32,510	Scope (15%)+ Bid(15%)
SUBTOTAL					$140,875	
Project Management	6%				$8,452.47	
Remedial Design	4%				$5,634.98	
Construction Management	6%				$8,452.47	
TOTAL CAPITAL COSTS					$163,414	

Planning Cost Estimate Summary

Alternative: 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	$163,414	$163,414	1	$163,414	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					$238,235	

Planning Cost Estimate Summary

Alternative: S-3 Soil Excavation (with Short-Term Land Use Controls under EBP Building only)

Site: DU 1-1, 1-2, & 1-3 at Tank Farm 1 - Site 7, NAVSTA Newport
Location: Portsmouth, Rhode Island
Phase: FS
Date: October 2015

Description: This alternative consists of excavating the full extent of surface soils exceeding PRGs at DU 1-1, 1-2, and 1-3 with off-site disposal. Short-term LUCs may also be needed at the EBP Building and although the duration is not known (10 years assumed for costs).

CAPITAL COSTS

Description	QTY	UNIT	UNIT COST	Total	Notes
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	$5,000	$5,000	
HASP	1	LS	$2,500	$2,500	
Equipment mobilization	1	LS	$5,000	$5,000	
Temporary facilities	1	LS	$2,500	$2,500	
Erosion control measures	460	LF	$4	$1,840	
Clearing and grubbing	5450	SF	$1	$5,450	
				$22,290	
Excavation					
Excavate soil	420	CY	$15	$6,300	Based on 2 foot depth and area shown on Figures 8 -10
Dust control and air monitoring	1	LS	$2,500	$2,500	
Regrade excavation footprint	5450	SF	$1	$5,450	
Seeding	5450	SF	$5	$27,250	
				$41,500	
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	630	Ton	$65	$40,950	
				$40,950	
Post-Construction					
Contractor Completion Report	100	HR	$100	$10,000	
Remedial Action Completion Report	150	HR	$100	$15,000	
(2 iterations)				$25,000	
SUBTOTAL				$168,200	

Planning Cost Estimate Summary

Alternative: S-3 Soil Excavation (with Short-Term Land Use Controls under EBP Building only)

Contingency	30%				$50,460	Scope (15%)+ Bid(15%)
SUBTOTAL					$218,660	
Project Management	6%				$13,119.60	
Remedial Design	4%				$8,746.40	
Construction Management	6%				$13,119.60	
TOTAL CAPITAL COSTS					$253,646	

O&M COSTS

Description		QTY	UNIT	UNIT COST	Total	Notes
Annual LUC Site inspections (through year 10)		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 10)		2	each	$5,000	$10,000	Assume one component of base-wide 5-yr review
SUBTOTAL					$10,000	
TOTAL PERIODIC ANNUAL COSTS					$5,000	

PRESENT VALUE ANALYSIS

Cost Type	Year	Total Cost	Total Cost per Year	Discount Factor 1%	Present Value	Notes
Capital Cost	0	$253,646	$253,646	1	$253,646	Discount rate of 1% is based on the 30-Year Real Interest Rate in Appendix C of the White House Office of Management and Budget (OMB) Circular A-94, Revised December 2014.
O&M Cost	1 to 10	$21,450	$2,145	9.4713	$20,316	
Periodic Cost	5	$5,000	$5,000	0.9515	$4,758	
	10	$5,000	$5,000	0.9053	$4,527	
Total Present Value of Alternative					$283,246	

Planning Cost Estimate Summary

Alternative: 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
Location: Portsmouth, Rhode Island
Phase: FS
Date: October 2015

Description: This alternative consists of excavating the full extent of surface soil at DU 1-2 and 1-3 that exceeds the selected PRG (including the GA Leachability Criteria). Additionally, this alternative consists of limited surface soil excavation around 2 historic sample locations to address leachability criteria exceedances for naphthalene, installation of a cover system, land use controls, 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
Sample management and 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 Work Plan	1	LS	$10,000	$10,000	
HASP	1	LS	$2,500	$2,500	
Equipment mobilization	1	LS	$5,000	$5,000	
Temporary facilities	1	LS	$2,500	$2,500	
Erosion control measures	460	LF	$4	$1,840	
Clearing and grubbing	5450	SF	$1	$5,450	
				$27,290	
Excavate and Construct Soil Cover					
Excavate soil from TV2, TV3, and 2 areas at EBP	80	CY	$15	$1,200	Based on 4 areas. See Figures 8 - 10
Dust control and air monitoring	1	LS	$1,000	$1,000	
Regrade cap area	5450	SF	$1	$5,450	
Clean fill testing	2	EA	$830	$1,660	Estimate for VOCs, SVOCs, PCBs, pesticides, TPH, metals; 1 sample per fill type
Furnish common fill	360	CY	$15	$5,400	Cover assumed for costing to consist of a
Furnish topsoil	120	CY	$30	$3,600	2-ft clean soil cap with grass
Install clean fill	480	CY	$15	$7,200	
Seeding	5450	SF	$5	$27,250	
Survey to document final cover elevations	1	LS	$2,000	$2,000	
				$54,760	
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	120	Ton	$75	$9,000	
				$9,830	
Post-Construction					
Contractor Completion Report	75	HR	$100	$7,500	
Remedial Action Completion Report	100	HR	$100	$10,000	
(2 iterations)				$17,500	
SUBTOTAL				$157,840	

Planning Cost Estimate Summary

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

Contingency	30%			$47,352	Scope (15%)+ Bid(15%)
SUBTOTAL				$205,192	
Project Management	6%			$12,311.52	
Remedial Design	6%			$12,311.52	
Construction Management	6%			$12,311.52	
TOTAL CAPITAL COSTS				$242,127	

O&M COSTS

Description	QTY	UNIT	UNIT COST	Total	Notes
Maintain soil cover vegetation	2	each	$500	$1,000	Mow 2 times per year
Allowance for maintenance	1	each	$200	$200	Allowance for misc. needs
Annual LUC Site inspections (through year 30)	1	each	$1,950	$1,950	Estimated; See attached worksheet
SUBTOTAL				$3,150	
Contingency	0%			$0	
Project Management	10%			$315	
TOTAL O&M ANNUAL COSTS				$3,465	

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	$242,127	$242,127	1	$242,127	Discount rate of 2% is based on the
O&M Cost	1 to 30	$103,950	$3,465	24.0158	$83,215	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					$348,648	

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
Location: Portsmouth, Rhode Island
Phase: FS
Date: October 2015

Prepared By: CC
Date: 7/9/2014

Checked By: NT
Date: 7/16/2014

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.		

Planning Cost Backup Worksheet

Alternative:	S-3 Soil Excavation (with Short-Term Land Use Controls under EBP Building only)		
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