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RECORD OF DECISION

SITE 57 – BUILDING 292 TCE CONTAMINATION

for

Naval Support Facility, Indian Head

Indian Head, Maryland

September 2007

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ACRONYMS AND ABBREVIATIONS

µg/L	microgram per liter
ARAR	Applicable or Relevant and Appropriate Requirement
BOD	biochemical oxygen demand
bgs	below ground surface
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	CERCLA Information System
CFR	Code of Federal Regulations
COC	chemical of concern
COD	chemical oxygen demand
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	Conceptual Site Model
DNAPL	dense non-aqueous phase liquid
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
ESD	Explanation of Significant Differences
FS	Feasibility Study
GIS	Geographic Information System
gpm	gallon per minute
HEAST	Health Effects Assessment Summary Table
HI	hazard index
HQ	hazard quotient
HRC	hydrogen release compound
IR	Installation Restoration
IRIS	Integrated Risk Information System
IW40	Industrial Wastewater Outfall 40
IW80	Industrial Wastewater Outfall 80
LUC	land use control
MCL	Maximum Contaminant Level
MDE	Maryland Department of the Environment
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List

NSF-IH	Naval Support Facility, Indian Head
O&M	operation and maintenance
ORC	oxygen release compound
PCB	polychlorinated biphenyl
PRB	permeable reactive barrier
PRG	preliminary remediation goal
RAB	Restoration Advisory Board
RAO	remedial action objective
RBC	Risk-Based Concentration
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SF	slope factor
SVOC	semivolatile organic compound
TAL	Target Analyte List
TBC	to be considered
TCE	Trichloroethene
TCL	Target Compound List
TOC	total organic carbon
UCL	upper confidence limit
UIC	underground injection control
VOC	volatile organic compound

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Site 57 – Building 292 TCE Contamination
Naval Support Facility, Indian Head
Indian Head, Maryland
CERCLIS ID No. MD7170024684

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for Site 57 – Building 292 Trichloroethene (TCE) Contamination at the Naval Support Facility, Indian Head (NSF-IH) in Indian Head, Maryland. NSF-IH is part of Naval Support Activity South Potomac within the Naval District Washington Region. Until October 1, 2005, NSF-IH was referred to as Naval District Washington, Indian Head. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this site.

The Department of the Navy and United States Environmental Protection Agency (EPA) jointly selected the remedy, and the Maryland Department of the Environment (MDE) concurs with the Selected Remedy.

1.3 ASSESSMENT OF THE SITE

The response action selected in this Record of Decision (ROD) is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF SELECTED REMEDY

Site 57 is one of the Installation Restoration (IR) sites currently included in the NSF-IH IR Program. Separate investigations and assessments are being conducted for these sites in accordance with CERCLA. Therefore, this ROD only applies to Site 57.

The remedy addresses shallow groundwater contamination. The Selected Remedy for Site 57 includes in-situ bioremediation, natural attenuation, land use controls (LUCs), and monitoring.

1.5 STATUTORY DETERMINATIONS

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

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that will allow for unlimited use and unrestricted exposure, a statutory review will be conducted at least every 5 years after initiation of remedial action, as mandated by CERCLA and the NCP, to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD:

- Chemicals of concern (COCs) and their respective concentrations.
- Baseline risk represented by the COCs.
- Clean-up levels established for COCs and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonable anticipated future land use assumptions and current and beneficial uses of groundwater used in the baseline risk assessment and ROD.
- Potential land and groundwater use that will be available at the site because of the Selected Remedy.
- Estimated capital, annual operation and maintenance (O&M), and total present-worth costs, discount rates, and number of years over which the remedy cost estimates are projected.

- Key factor(s) that led to selection of the remedy (i.e., how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision).

Additional information can be found in the Administrative Record file for this site.

1.7 AUTHORIZING SIGNATURES

J L Smith

J. L. SMITH
Captain, U.S. Navy
Commanding Officer
Naval Support Activity South Potomac

21 Sept 2007

Date

James J Burke

JAMES J. BURKE, Director
Hazardous Site Cleanup Division
U.S. EPA Region 3

9/21/07

Date

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

NSF-IH is located in northwestern Charles County, Maryland, approximately 25 miles southwest of Washington, D.C. (Figure 2-1). The NSF-IH is a military facility consisting of the Main Area on the Cornwallis Neck Peninsula and the Annex on Stump Neck. The Main Area is bounded by the Potomac River to the northwest, west, and south; Mattawoman Creek to the south and east; and the Town of Indian Head to the northeast. Stump Neck Annex is located across Mattawoman Creek and is not contiguous with the Main Area. NSF-IH was placed on the National Priorities List (NPL) in September 1995. The facility is identified as Indian Head Naval Surface Warfare Center on the NPL. The EPA identification number for NSF-IH is MD7170024684.

The Navy is the lead agency for site activities at NSF-IH. EPA is the lead regulatory agency, and MDE is the support agency. Funding is provided by the Department of Defense.

Building 292 is located in a developed portion of NSF-IH in a valley that runs southeast for approximately 2,000 feet before it reaches Mattawoman Creek (Figures 2-2 and 2-3). The area around Building 292 is mostly covered with asphalt and gravel, with some grassy areas. Site 57 also includes Buildings 165 and 496, located approximately 150 feet southwest of Building 292, which were used to store ethyl ether (also known as diethyl ether).

2.2 SITE HISTORY AND ENFORCEMENT ACTIONS

2.2.1 Site History

At Building 292, TCE was used for vapor degreasing and general cleaning from the mid-1960s until 1989. During the 1970s and 1980s, spent TCE (EPA hazardous waste number F002) was transferred from a tank inside the building into drums through a pipe that passed through the wall near the southern corner of the building. The drums were reportedly stored on a grass-covered area near the building and near a storm sewer manhole, and releases from the drums are suspected to have occurred. Building 292 is still active; however, TCE has not been used at the building since 1989.

2.2.2 Previous Investigations and Removal Actions

In 1994, samples were collected from the storm sewer that runs southeast down the valley from Building 292 to Mattawoman Creek in response to a solvent odor.

A soil-gas survey was conducted in 1995 in and around the former drum storage area. Soil, groundwater, and sewer water samples were collected based on the results of the soil-gas survey.

A field-scale pilot study was conducted in 1997 to evaluate the removal of volatile organic compounds (VOCs) from soil using soil vapor extraction. The pilot study demonstrated that site conditions were not suitable for this treatment technology.

In 1998, the Navy completed a removal action to address infiltration of TCE-contaminated groundwater into the storm sewer. A video survey of the storm sewer was conducted, and approximately 700 feet of storm sewer were relined to inhibit migration of TCE.

A Remedial Investigation (RI) was performed in 1998 and 1999 and included installation of soil borings and shallow groundwater monitoring wells and collection and analysis of soil, groundwater, surface water, and sediment samples. Monitoring wells were screened in the upper and lower portions of the surficial aquifer. Human health and ecological risk assessments were conducted and included in the RI Report.

Additional activities were performed in 2001 to fill data gaps as part of the Feasibility Study (FS) preparation process. Field activities include installation of soil borings and temporary and permanent monitoring wells, soil and groundwater sampling, cone penetrometer testing, and aquifer testing.

A field-scale pilot study was conducted in 2003 to evaluate in-situ bioremediation of TCE and other VOCs detected in groundwater. The pilot study included installation of soil borings and groundwater monitoring wells in the pilot study area, injection of chemicals to enhance bioremediation, and collection and analysis of soil and groundwater samples. Groundwater samples were collected for 6 months to evaluate contaminant concentration trends.

Shallow groundwater sampling was conducted in 2004 and 2005 to further evaluate contaminant concentration trends and to collect comprehensive rounds of samples from all permanent monitoring wells to support the FS. Field activities included the installation of soil borings and temporary and permanent monitoring wells, collection and analysis of groundwater samples, field testing for dense non-aqueous phase liquid (DNAPL), aquifer testing, and a video survey of a section of storm sewer that was not relined in 1998.

A CERCLA non-time-critical removal action was completed in 2006 to address risks associated with contaminated soil. The removal action also addressed the likely source of TCE detected in shallow groundwater. An Engineering Evaluation/Cost Analysis (EE/CA) Report and Action Memorandum were prepared to support the removal action. The removal action alternative selected was excavation of soil

and transport to an off-site disposal facility. Confirmation sampling and analysis were conducted during the removal action to ensure that clean-up levels were achieved. Additional soil was removed, as necessary. The target clean-up levels were based on unrestricted residential exposure and migration of soil contaminants to groundwater. After the areas were excavated and verified clean, the area was restored to its original condition. Approximately 1,005 tons of soil were excavated and removed.

An FS was completed in 2006 to develop and evaluate remedial alternatives to address contaminated groundwater.

No other enforcement activities, removal actions, or remediation activities have been initiated at Site 57.

2.3 COMMUNITY PARTICIPATION

A Restoration Advisory Board (RAB) made up of community members and Navy, federal, and state officials meets several times a year. The RAB is designed to act as a focal point for the exchange of information between the Navy and the local community regarding restoration activities at NSF-IH.

The RI Report, FS Report, and Proposed Plan for Site 57 – Building 292 TCE Contamination at NSF-IH were made available to the public. The RI Report was made available in July 2000, the FS Report was made available in October 2006, and the Proposed Plan was made available in January 2007. These documents can be found in the Administrative Record file and the Information Repository maintained at the General Library, Naval Support Facility, Indian Head, 4163 North Jackson Road, Suite 104, Indian Head, Maryland 20640-5117 (formerly Building 620, 101 Strauss Avenue, Indian Head, Maryland). The notice of availability of these documents and a brief synopsis of the Proposed Plan was published in the *Maryland Independent* on February 2, 2007. A public comment period on the Proposed Plan, required by CERCLA Section 117(a)(2), was held from February 2 to March 9, 2007. In addition, a public meeting was held on February 21, 2007 to present the Proposed Plan to a broader community audience than those that had already been involved at the site. At this meeting, representatives of the Navy, EPA, and MDE answered questions about the site and the remedial alternatives. The Navy's responses to the significant comments received during this period are included in the Responsiveness Summary section of this ROD.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

Site 57 – Building 292 TCE Contamination is one of the IR sites currently included in the NSF-IH IR Program. The Selected Remedy is the final remedial action for Site 57 under CERCLA. The function of this remedy is to reduce risks to human health and the environment associated with exposure to shallow groundwater contamination. These potential risks were identified during the RI. Contaminated soil was

removed in 2006 under a non-time-critical removal action. As a result of the removal action, there are no longer any unacceptable risks to human health and the environment associated with exposure to contaminated soil.

The potential exposure to shallow groundwater contamination under a hypothetical future residential exposure scenario constitutes the principal risk to human health. There are no unacceptable risks to ecological receptors. Although shallow groundwater is contaminated, the contamination is not affecting public drinking water supplies or adjacent surface water. The purpose of the remedial action is to prevent future potential exposure to contaminated shallow groundwater, prevent or minimize further migration of the groundwater contaminant plume, and restore groundwater to its expected beneficial use.

This is the only ROD contemplated for Site 57. Separate investigations and assessments are being conducted for 17 other IR sites and 27 Munitions Response Program sites at NSF-IH in accordance with CERCLA. There are 44 other IR sites, solid waste management units, and areas of concern that have been closed out or remediated. Therefore, this ROD only applies to Site 57. Separate RODs or other CERCLA decision documents have been or will be prepared for the other sites.

2.5 SITE CHARACTERISTICS

2.5.1 Physical Setting

Site features are shown on Figure 2-3. Building 292 is located in a valley approximately 1,300 feet due north of Mattawoman Creek at an elevation of approximately 35 feet above mean sea level. The valley floor slopes approximately southeast toward Mattawoman Creek to approximately sea level. The valley side slopes are much steeper east, north, and west of the site. A storm drain from Building 292 approximately follows the valley and discharges to Mattawoman Creek at Industrial Wastewater Outfall 80 (IW80). An unnamed stream also flows through the valley before discharging to Mattawoman Creek at Industrial Wastewater Outfall 40 (IW40). The distance from Building 292 to Mattawoman Creek measured southeast down the valley is approximately 2,000 feet. A roadway and portions of an abandoned railroad track are located in the valley.

Subsurface materials at the site consist of fill, alluvium, and Marlboro Clay. The fill generally consists of reworked natural material including gravel, sand, silt, and clay and was encountered at depths ranging from 0 to 15 feet below ground surface (bgs). At some locations, the fill material contains minor amounts of asphalt, concrete, brick, terra cotta, and slag fragments. In areas of construction, the natural soil and alluvium are cut by, or supplemented with, the fill material. The alluvium is derived from erosion of adjacent upland areas, and the thickness ranges from approximately 10 to 25 feet. It generally consists of yellow-brown and gray, poorly sorted sand and gravel with minor amounts of silt and clay overlying a

greenish clayey, well-sorted, very fine-grained sand and silt. The green unit typically has a clayey upper surface, and the clay content generally decreases as depth increases. Based on field observations, the green unit is interpreted as an aquitard (upper aquitard) that is 0 to 20 feet thick. The green unit comes into contact with a distinct clay and silt unit that is interpreted to be the Marlboro Clay (lower aquitard). The Marlboro Clay is encountered at approximately 35 to 40 feet bgs. The thickness at Site 57 is unknown. Regionally, the unit is typically 10 to 20 feet thick.

Groundwater exists in the fill and alluvium. The surficial aquifer generally consists of yellow-brown sand and gravel and displays the characteristics of an unconfined system. The water table mimics the surface topography. The upper aquitard is expected to hinder the downward and lateral movement of groundwater within the surficial aquifer. However, it would provide less hindrance where the aquitard becomes sandier or thinner. The Marlboro Clay (lower aquitard) is expected to significantly limit migration between the shallow aquifer and deeper aquifers. The shallow groundwater in the upper and lower portions of the surficial aquifer generally flows southeast down the valley toward Mattawoman Creek. The upper surficial groundwater may be discharging to both the unnamed stream and Mattawoman Creek. The deeper groundwater in the surficial aquifer is most likely discharging to Mattawoman Creek. The depth to groundwater ranges from 3 to 7 feet bgs. Groundwater from the surficial aquifer is not currently used as a potable water supply. Drinking water is obtained from deeper aquifers (more than 190 feet deep). There is no known hydrogeologic connection or communication between the shallow water-table aquifer and the deeper aquifers used for drinking water.

The buildings located in the valley of Site 57 are all part of the Naval Powder Facility Historic District and are eligible for the National Historic Registry. In addition, there are three archeological sites located in the valley area. The historic structures and archeological sites are not affected by the contaminated shallow groundwater from Site 57.

2.5.2 Conceptual Site Model

Figure 2-4 is the Conceptual Site Model (CSM) for human receptors, and Figure 2-5 is the CSM for ecological receptors. Each CSM graphically integrates information regarding the physical characteristics of the site, exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential exposure routes and receptors evaluated in the risk assessments. A well-defined CSM allows for a better understanding of the risks at a site and aids in the identification of the potential need for remediation.

2.5.3 Sampling Strategy

Drum filling and spillage of spent TCE onto soil are the likely sources of contamination. The suspected source of diethyl ether is the former ether vaults and associated underground piping.

In 1994, samples from the storm sewer were collected in response to a solvent odor detected by an MDE inspector at a manhole near Building 292. TCE was detected in samples from manholes located near Building 292 and approximately 1,300 feet downstream of the building but was not detected upstream of the building.

In 1995, a soil-gas survey was conducted in and around the former drum storage area. High concentrations of TCE (1,100 to 9,600 µg/L) were detected near where the drums were filled and stored. As a result, nine subsurface soil samples were collected from four soil borings, groundwater samples were collected from two temporary monitoring wells, and two samples were collected from the storm sewer. These samples were analyzed for Target Compound List (TCL) VOCs.

An RI was conducted in 1998 and 1999 to determine the extent of contamination. Thirteen permanent and three temporary groundwater monitoring wells were installed, and aquifer testing was conducted. Monitoring wells were installed in the upper portion (near the water table) and lower portion (above the upper aquitard or lower aquitard) of the surficial aquifer. Surface soil samples were collected from 10 locations. All surface soil samples were analyzed for TCL VOCs and diethyl ether. Samples from four locations were also analyzed for TCL semivolatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals, and explosives. Thirty-eight subsurface soil samples were collected at various depths from 16 soil borings. Thirty-four samples were analyzed for TCL VOCs and diethyl ether. Nine samples were also analyzed for TCL SVOCs and pesticides/PCBs, TAL metals, and explosives. Four samples were analyzed for geochemical parameters. Groundwater samples were collected from all permanent and temporary monitoring wells and analyzed for TCL VOCs and diethyl ether. Six groundwater samples were also analyzed for TCL SVOCs and pesticides/PCBs, TAL metals, explosives, and miscellaneous water quality parameters. Surface water samples were collected from 15 locations in the unnamed stream and storm sewer and analyzed for TCL VOCs and diethyl ether. Seven samples were also analyzed for TCL SVOCs and pesticides/PCBs, TAL metals, and explosives. Sediment samples were collected from eight locations in the unnamed stream and storm sewer and analyzed for TCL VOCs and diethyl ether. Three samples were also analyzed for TCL SVOCs and pesticides/PCBs, TAL metals, and explosives. The RI indicated that chlorinated solvents, diethyl ether, and arsenic were the main contaminants at the site.

A field investigation was conducted in 2001 to fill data gaps, to refine the nature and extent of contamination, and to provide additional information on subsurface physical characteristics. Field

activities included installation of soil borings and temporary and permanent monitoring wells, soil and groundwater sampling, cone penetrometer testing, and aquifer testing. Eighteen soil borings were installed to collect 13 surface soil and 58 subsurface soil samples to refine the extent of soil contaminated with chlorinated solvents and arsenic. Most soil samples were analyzed for TCL VOCs and diethyl ether, and many were analyzed for arsenic. Several of the subsurface soil samples were analyzed for engineering parameters. Ten new monitoring wells (three permanent and seven temporary) were installed in the upper and lower portions of the surficial aquifer to better define the extent of groundwater contamination and to gather information for an evaluation of natural attenuation processes that may be occurring. Samples were collected from the new monitoring wells and existing permanent monitoring wells and analyzed for TCL VOCs and diethyl ether. Many of the samples were also analyzed for water chemistry and natural attenuation parameters.

Soil and groundwater samples were collected during the 2003 in-situ bioremediation pilot study where chemicals were injected to stimulate biological activity. The pilot study was conducted near the former drum storage area. Subsurface soil samples were collected from four depths at each of two soil boring locations and analyzed for chlorinated VOCs, diethyl ether, and arsenic. Two new permanent monitoring wells were installed downgradient of the pilot study area. Groundwater samples were collected from these wells and three existing wells prior to the pilot study and analyzed for chlorinated VOCs, diethyl ether, and bioremediation indicator parameters. Groundwater samples were collected from the same locations at 1, 2, 4, and 6 months after chemical injection and analyzed for the same parameters.

Groundwater sampling was conducted in 2004 and 2005 to further evaluate contaminant concentration trends. Another purpose was to collect comprehensive rounds of samples from all permanent monitoring wells to support the FS. The previous comprehensive sampling was conducted in 2001, and conditions could have changed as a result of the 2003 pilot study. Ten soil borings were installed in 2005 to investigation the confining unit (upper aquitard). At four boring locations, ribbon samplers were installed to determine whether DNAPL was present. DNAPL was not detected; therefore, soil samples were not collected. No new wells were installed during the 2004 sampling event. Groundwater samples were collected from the 17 permanent monitoring wells in existence at Site 57 at that time and analyzed for TCL VOCs, diethyl ether, TAL metals, and miscellaneous water quality parameters. Twelve permanent and three temporary monitoring wells were installed during the 2005 sampling event. Groundwater samples were collected from these wells and all other permanent monitoring wells previously installed at Site 57. Samples were also collected from three monitoring wells from UXO 32 (also known as Site 41), which is adjacent to Mattawoman Creek, to confirm that UXO 32 was not contributing to groundwater contamination detected downgradient of Site 57 near Mattawoman Creek. All groundwater samples collected in 2005 were analyzed for TCL VOCs and diethyl ether.

2.5.4 Nature and Extent of Contamination

COCs were identified based on the analytical data, risk drivers from the human health and ecological risk assessments (discussed in Section 2.7), and exceedances of regulatory standards and criteria. The concentrations of the COCs are provided in Table 2-1. There are no longer any COCs for soil; all contaminated soil was addressed under the non-time-critical removal action completed in 2006. Clean-up goals for the removal action were based on residential exposure and migration of soil contaminants to shallow groundwater. Additional details on development and attainment of soil clean-up goals are contained in the EE/CA Report (TtNUS, 2005).

No COCs have been identified for surface water or sediment. The remainder of this section discusses the nature and extent of groundwater contamination.

Three areas of groundwater contamination have been defined at Site 57 that have different COCs and/or different concentration ranges (see Figure 2-6). This discussion will focus on TCE and its degradation products (i.e., cis-1,2-dichloroethene and vinyl chloride) because these are the COCs detected most often and at the greatest concentrations. The following evaluation is based on the most recent sampling event in 2005.

The source area plume is near Building 292 and exhibits the greatest contaminant concentrations. This is the area where contaminated soil was removed. The length of the plume in this area is approximately 300 feet. Monitoring wells are screened across the water table in the upper portion of the surficial aquifer and above the confining unit in the lower portion of the aquifer. The principal COCs are TCE and its degradation products cis-1,2-dichloroethene and vinyl chloride. Chemical concentrations are greater in the upper portion of the aquifer. The average concentrations of TCE are greater than 7,000 micrograms per liter (µg/L) in the upper portion and less than 60 µg/L in the lower portion. The average concentrations of cis-1,2-dichloroethene are greater than 10,000 µg/L in the upper portion and approximately 10 µg/L in the lower portion. The average concentrations of vinyl chloride are greater than 5,000 µg/L in the upper portion and less than 1 µg/L in the lower portion. The concentrations of TCE, cis-1,2-dichloroethene, and vinyl chloride were affected by the pilot study, which reduced the concentrations of TCE but resulted in greater concentrations of TCE degradation products. Although field testing did not identify the presence of DNAPL in soil and groundwater samples, TCE concentrations in a few soil and groundwater samples from this area were great enough to infer that DNAPL may be or may have been present in the source area near the building where drums were stored. The amount of potential DNAPL that may be present is not known, partly because this is the area where contaminated soil, which may have contained DNAPL, was removed in 2006.

The next downgradient area (mid-plume area) of groundwater contamination is approximately halfway between Building 292 and Mattawoman Creek. The principal COC is TCE. Chemical concentrations are much lower than in the source area plume discussed above and do not change significantly between the upper and lower portions of the aquifer. The average concentrations of TCE are approximately 200 µg/L in the upper portion and approximately 150 µg/L in the lower portion. The average concentrations of cis-1,2-dichoroethene are approximately 50 µg/L in the upper portion and approximately 25 µg/L in the lower portion. The average concentration of vinyl chloride is less than 5 µg/L in the upper portion, and vinyl chloride was not detected in the lower portion.

The other area of groundwater contamination is near Mattawoman Creek. There is a relatively large area (approximately 700 feet) of uncontaminated groundwater between this downgradient plume area and the mid-plume area discussed above. The principal COCs in the downgradient plume area are cis-1,2-dichloroethene and vinyl chloride. The concentrations of these chemicals are decreasing over time at the only permanent monitoring well in this area where COCs were detected. The concentrations of cis-1,2-dichloroethene were 1,400 µg/L in 2001 and 210 µg/L in 2005. The concentrations of vinyl chloride were 1,500 µg/L in 2001 and 400 µg/L in 2005.

Additional details on the spatial distribution and concentrations of chemicals detected in all site media and site investigations conducted to date are contained in the RI Report (TtNUS, 2000) and the FS Report (TtNUS, 2006).

2.6 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

Building 292 is currently in active industrial use. Reasonable potential future land uses include industrial and maintenance activities within and around the building, minor construction, and limited development. There are no plans for residential development of the site. Shallow groundwater is not used for any purpose, and the Navy has no plans to develop this resource in the future. The shallow unconfined groundwater at the site is not hydraulically connected to deeper aquifers that are the principal source of water for domestic use at NSF-IH.

2.7 SUMMARY OF SITE RISKS

2.7.1 Summary of Human Health Risk Assessment

The baseline human health risk assessment estimates the risks that the site poses if no further action is taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment that was conducted for the RI Report. The primary focus of this summary is on

those exposure pathways and chemicals found to pose actual or potential risks to human health. The risk assessment in the RI Report contains an evaluation of all chemicals of potential concern (COPCs) and exposure pathways, including those that do not pose unacceptable risks to human health. COPCs are those chemicals that are identified as potential threats to human health and are evaluated further in the baseline risk assessment. COCs are a subset of COPCs that are identified in the RI/FS as needing to be addressed by the response action selected in the ROD.

The baseline risk assessment was completed for the RI Report that was published in 2000. Some of the COCs and concentrations detected have changed based on more recent groundwater sampling conducted in 2005. However, the key COCs (TCE, cis-1,2-dichloroethene, and vinyl chloride) have not changed, and exposure to contaminated shallow groundwater still poses unacceptable risks under a hypothetical future residential exposure scenario.

2.7.1.1 Identification of Chemicals of Concern

Table 2-1 presents the COCs and exposure point concentrations for each of the COCs detected in upgradient and downgradient shallow groundwater based on the risk assessment in the RI Report. There are no COCs for soil, surface water, or sediment. COCs either result in an unacceptable risk or exceed a regulatory standard. The exposure point concentration is the concentration that was used to estimate the exposure and risk from each COC. Table 2-1 contains the concentration range of each COC in shallow groundwater, the frequency of detection, the exposure point concentration, and how the exposure point concentration was derived.

The only upgradient shallow groundwater COC based on unacceptable risks to human health is 1,1-dichloroethene. Downgradient shallow groundwater COCs based on unacceptable risks to human health are 1,1-dichloroethene, cis-1,2-dichloroethene, diethyl ether, TCE, and vinyl chloride. An additional COC from the RI Report based on an exceedance of federal and state Maximum Contaminant Levels (MCLs) was tetrachloroethene; however, this chemical was only detected at one location. Based on the most recent data, the concentrations of tetrachloroethene are now less than the MCL, and this chemical is no longer a COC. Although trans-1,2-dichloroethene was not a COPC for the RI Report, one sample collected in 2005 had a concentration greater than the MCL. Therefore, trans-1,2-dichloroethene is now considered a COC for downgradient groundwater.

2.7.1.2 Exposure Assessment

This section presents a summary of the exposure assessment detailed in the RI Report. The exposure assessment defines and evaluates the type and magnitude of human exposure to the chemicals present at or migrating from a site. The exposure assessment is designed to depict the physical setting of the

site, to identify potentially exposed populations, and to estimate chemical intakes under the identified exposure scenarios. Actual or potential exposures are based on the most likely pathways of contaminant release and transport, as well as human activity patterns. A complete exposure pathway has the following three components: a source of chemicals that can be released into the environment, a route of contaminant transport through an environmental medium, and an exposure or contact point for a human receptor.

The compilation of contaminant sources, likely exposure pathways, and receptors at Site 57 is depicted in the human health CSM (Figure 2-4). Potential receptors include current and future full-time employees, future construction workers, and hypothetical future residents. At present, no outdoor activities are conducted at Site 57 except for routine maintenance. Military personnel and civilian workers may work inside Building 292. Future residential use is not a reasonably anticipated land use but was evaluated to identify whether unrestricted land use could be permitted.

Major assumptions about exposure frequency (days per year), exposure duration (years), and other exposure factors (e.g., body surface area for dermal exposure, ingestion rates) that were included in the exposure assessment can be found in the RI Report (TtNUS, 2000).

2.7.1.3 Toxicity Assessment

Table 2-2 provides carcinogenic risk information for COCs in both upgradient and downgradient shallow groundwater. Cis-1,2-dichloroethene and diethyl ether are not classifiable as human carcinogens, and there are no cancer toxicity data available.

Table 2-3 provides noncarcinogenic risk information for COCs in both upgradient and downgradient shallow groundwater. Five of the COCs (1,1-dichloroethene, cis-1,2-dichloroethene, diethyl ether, tetrachloroethene, and TCE) have toxicity data indicating their potential for adverse noncarcinogenic effects in humans. Chronic toxicity data are not available for vinyl chloride. At this time, inhalation reference concentrations are only available for tetrachloroethene.

2.7.1.4 Risk Characterization

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

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

Where: Risk = a probability (e.g., 2.0E-05) of an individual developing cancer (unitless)
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor (cancer potency factor), expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are usually expressed in scientific notation (e.g., 1.0E-06). An excess lifetime cancer risk of 1.0E-06 indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an “excess lifetime cancer risk” because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three (33 percent) for women and one in two (50 percent) for men. The EPA's generally acceptable risk range for site-related exposure is 1.0E-04 to 1.0E-06, or an excess lifetime cancer risk of 1 in 10,000 to 1 in 1,000,000.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ less than one indicates that a receptor’s dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from that chemical are unlikely. The hazard index (HI) is generated by adding the HQs for all COCs. An HI less than one indicates that, based on the sum of all HQs from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI greater than one indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows:

$$\text{Noncancer HQ} = CDI/RfD$$

Where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short term).

Carcinogenic Risks

The only unacceptable carcinogenic risks were for the future child resident and future adult resident. These are hypothetical exposure scenarios. Carcinogenic risks for all other evaluated receptors were within or less than the EPA acceptable risk range (1.0E-04 to 1.0E-06).

Tables 2-4 provides risk estimates for the hypothetical future child resident for exposure to upgradient and downgradient shallow groundwater. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's exposure to shallow groundwater through ingestion and dermal contact. Children (ages 0 to 6) are assumed to take baths rather than showers and are not considered to be exposed through inhalation of volatiles while showering. The risk estimates are based on the toxicity of the COCs (1,1-dichloroethene, tetrachloroethene, TCE, and vinyl chloride). There is no cancer toxicity information available for exposure to cis-1,2-dichloroethene or diethyl ether. The total risk from direct exposure to upgradient groundwater at Site 57 for a future child resident is estimated to be 3.3E-04. The only COC contributing to this risk level is 1,1-dichloroethene. This risk level indicates that, if no clean-up action is taken, an individual child resident would have an increased probability of about 3 in 10,000 of developing cancer as a result of site-related exposure to the COC in upgradient groundwater. The total risk from direct exposure to downgradient groundwater at Site 57 for a future child resident is estimated to be 1.2E-03. The COC contributing most to this risk level is vinyl chloride. This risk level indicates that an individual child resident would have an increased probability of about 1 in 1,000 of developing cancer as a result of site-related exposure to the COCs in downgradient groundwater.

Table 2-5 provides risk estimates for the hypothetical future adult resident for exposure to upgradient and downgradient shallow groundwater. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult's exposure to shallow groundwater through ingestion, dermal contact, and inhalation of volatiles while showering. The risk estimates are based on the toxicity of the COCs (1,1-dichloroethene, tetrachloroethene, TCE, and vinyl chloride). There is no cancer toxicity information available for exposure to cis-1,2-dichloroethene or diethyl ether. The total risk from direct exposure to upgradient groundwater at Site 57 for a future adult resident is estimated to be 6.6E-04. The COC contributing to this risk level is 1,1-dichloroethene. This risk level indicates that, if no clean-up action is taken, an individual adult would have an increased probability of approximately 7 in 10,000 of developing cancer as a result of site-related exposure to the COC in upgradient groundwater. The total risk from direct exposure to downgradient groundwater at Site 57 for a future adult resident is estimated to be 2.3E-03. The COC contributing most to this risk level is vinyl chloride. This risk level indicates that an individual adult resident would have an increased probability of about 2 in 1,000 of developing cancer as a result of site-related exposure to the COCs in downgradient groundwater.

Noncarcinogenic Risks

The only unacceptable noncarcinogenic risks were for the future child resident and future adult resident. Noncarcinogenic risks for all other evaluated receptors have an HI less than one.

Table 2-6 provides the HQs for the hypothetical child resident for exposure to upgradient and downgradient shallow groundwater and the HI for all COCs. The estimated HI of 0.6 for upgradient groundwater indicates that noncarcinogenic health effects would not be expected. The estimated HI of 12.5 for downgradient groundwater indicates the potential for adverse noncarcinogenic health effects from exposure. The COCs contributing most to the downgradient groundwater HI are cis-1,2-dichloroethene and TCE. The contributing HQ for each of the COCs is greater than 1.0.

Table 2-7 provides the HQs for the hypothetical adult resident for exposure to upgradient and downgradient shallow groundwater and the HI for all COCs. The estimated HI of 0.3 for upgradient groundwater indicates that noncarcinogenic health effects would not be expected. The estimated HI of 5.5 for downgradient groundwater indicates the potential for adverse noncarcinogenic health effects from exposure. The COCs contributing most to the downgradient groundwater HI are cis-1,2-dichloroethene and TCE. The contributing HQ for each of the COCs is greater than 1.0.

Uncertainty Analysis

At Site 57, TCE is a major contributor to the noncarcinogenic risks for the groundwater pathway for the hypothetical future resident. The oral RfD for TCE is not derived from the EPA Integrated Risk Information System (IRIS) or in the EPA Health Effects Assessment Summary Table (HEAST). The EPA Region 3 Risk-Based Concentration (RBC) table lists an oral RfD for TCE which is provided as a provisional value and references the EPA National Center for Environmental Assessment (NCEA). A provisional value is recommended for the toxicity value in the absence of IRIS or HEAST toxicity values; however, the provisional value adds to the uncertainty associated with the noncancer risks attributable to TCE. There is lower confidence in the provisional value compared to toxicity values derived from IRIS or HEAST, and the provisional value could change if additional toxicity data becomes available.

2.7.2 Summary of Ecological Risk Assessment

The ecological risk assessment (ERA) was performed to characterize potential risks to ecological receptors from site-related contaminants. The primary focus of this summary of the results of the ERA is on exposure pathways and chemicals found to potentially pose threats to ecological receptors. Details

may be found in the RI Report (TtNUS, 2000). The ERA for Site 57 included the following steps of the eight-step EPA process:

- Step 1 – Preliminary Problem Formulation and Ecological Effects Evaluation
- Step 2 – Preliminary Exposure Assessment and Risk Calculation
- Step 3A – Refined of COPCs
- Step 8 – Risk Management

The areas around Building 292 that could have received surface contamination are mainly comprised of asphalt and gravel, providing no terrestrial habitat. The only potentially impacted area of ecological concern near Building 292 is a grassy area approximately 100 feet long by 30 feet wide surrounded by concrete. For these reasons, the potential for ecological risks on and near the site proper (surface soil and terrestrial receptors) is negligible. In addition, this is the area where contaminated soil was removed in 2006.

There were no unacceptable risks to ecological receptors from exposure to surface water or sediment. Mattawoman Creek has not been affected by releases from the site.

2.7.3 Risk Assessment Conclusions

The only remaining unacceptable risks to human health are for hypothetical child and adult residents that use shallow groundwater as a source of potable water. Risks associated with exposure to soil contaminants were addressed during the 2006 non-time-critical removal action. There are no unacceptable risks to other human receptors under current land use and reasonably anticipated future land use scenarios. The main risk drivers for groundwater are 1,1-dichloroethene, cis-1,2-dichloroethene, TCE, and vinyl chloride.

There are no unacceptable risks to ecological receptors.

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment.

2.8 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) provide a general description of what the cleanup will accomplish. These goals typically serve as the design basis for many of the remedial alternatives that are discussed in

the next section. The RAOs provide the basis for evaluating clean-up options for the site and an understanding of how the risks identified in the previous section will be addressed by the response action.

Based on the recommendations in the RI Report and the 2006 soil removal action, the only remaining medium of concern at Site 57 is shallow groundwater.

The RAOs for remedial action at Site 57 are summarized as follows:

- Prevent exposure to groundwater contaminated at concentrations greater than preliminary remediation goals (PRGs).
- Prevent or minimize further migration of the groundwater contaminant plume (plume containment).
- Restore groundwater to its expected beneficial use (aquifer restoration).

RAOs were not developed for soil, surface water, or sediment. There are no unacceptable risks to human health from exposure to these media under residential land use scenarios, and there are no unacceptable risks to terrestrial or aquatic ecological receptors from exposure to these media.

2.9 DESCRIPTION OF ALTERNATIVES

Remedial alternatives evaluated for Site 57 are presented below. More detailed descriptions of the alternatives can be found in the FS Report (TtNUS, 2006).

2.9.1 Description of Remedy Components

This section provides a list of the major components of each alternative as they occur in the remediation process. The lists include treatment components and the materials they will address, LUCs, O&M activities required to maintain the integrity of the remedy, and monitoring requirements.

2.9.1.1 Alternative 1 – No Action

There are no remedy components for the no-action alternative. This alternative is required under CERCLA to establish the basis for comparison with other alternatives. No remedial actions would be implemented, and the shallow groundwater would be available for unrestricted use because no LUCs would be implemented.

2.9.1.2 Alternative 2 – Monitored Natural Attenuation

Alternative 2 consists of the following major components: natural attenuation, LUCs, monitoring, and site reviews.

Natural Attenuation

Natural attenuation refers to inherent processes that affect the rates of migration and concentrations of contaminants in groundwater. A screening evaluation included in the FS Report concluded that, with the exception of the downgradient plume area, conditions at Site 57 are not favorable or show limited possibilities for the natural attenuation of chlorinated VOCs. However, the presence of TCE degradation products (i.e., dichloroethenes and vinyl chloride) indicates that some biodegradation is occurring. Also, groundwater COC concentrations have generally decreased over time.

Land Use Controls, Monitoring, and Site Reviews

LUCs would consist of maintaining records of the restrictions in the NSF-IH Geographic Information System (GIS). Use of shallow groundwater as a source of potable water would not be permitted until PRGs are achieved. A LUC Remedial Design would need to be prepared to document the restrictions.

Shallow groundwater samples from existing monitoring wells would be collected on a regular basis. It was assumed that the samples would be analyzed for TCL VOCs, diethyl ether, and natural attenuation indicator parameters [ferrous iron, total organic carbon (TOC), alkalinity, nitrate, nitrite, sulfate, sulfide, carbon dioxide, methane, ethane, and ethene]. A long-term monitoring plan would need to be developed, with EPA and MDE concurrence, as part of the remedial design.

At least every 5 years, a site review would be conducted to evaluate the site status and determine whether further action (including the need for additional 5-year reviews) is necessary.

2.9.1.3 Alternative 3 – In-Situ Bioremediation

Alternative 3 consists of the following major components: in-situ bioremediation, natural attenuation, LUCs, monitoring, and site reviews.

In-Situ Bioremediation and Natural Attenuation

Under this alternative, a hydrogen release compound (HRC) (electron donor) would be injected to treat the most contaminated portion of the TCE plume (source area plume) near Building 292 where DNAPL may be present. Injection of this chemical would promote anaerobic conditions suitable for the reductive dechlorination of TCE to cis-1,2-dichlroethene, vinyl chloride, and nontoxic byproducts. HRC would be injected in rows of delivery points to form a treatment barrier across the entire width of the plume, thereby creating an anaerobic treatment zone oriented to intercept the downgradient migration of contaminants. A series of treatment barriers would be installed perpendicular to the groundwater flow direction at regular

intervals throughout the entire length of the source area plume. The spacing between each treatment barrier was based on a 1-year groundwater travel time. The screening evaluation for in-situ biological treatment conducted for the FS concluded that site conditions may be favorable for treatment of chlorinated VOCs. The presence of TCE degradation products (i.e., dichloroethenes and vinyl chloride) indicates that some natural biodegradation is occurring. A portion of this plume area was already treated during the 2003 pilot study; however, subsequent applications are needed to attain PRGs. It was assumed two applications of HRC would be needed.

Natural attenuation would be used for the remaining portion of the TCE plume (mid-plume area). A screening evaluation included in the FS Report concluded that conditions in the mid-plume area are not favorable or show limited possibilities for the natural attenuation of chlorinated VOCs. However, the presence of TCE degradation products (i.e., dichloroethenes and vinyl chloride) indicates that some biodegradation is occurring. Chemical concentrations in this area are much lower than in the source area plume and have continued to decline with time and downgradient distance.

Under this alternative, an oxygen release compound (ORC) (electron acceptor) would be injected to treat the downgradient plume area near Mattawoman Creek where cis-1,2-dichloroethene and vinyl chloride are the COCs. Injection of ORC would promote in-situ aerobic (or oxidative) biodegradation suitable for removal of these COCs. It was assumed that one application of ORC injected in a grid pattern would be needed to reduce contaminant levels to PRGs.

The use of other bioremediation chemicals (i.e., hydrogen and oxygen sources, electron donor and receptor) or methods may be feasible. This would be determined during the remedial design.

Land Use Controls, Monitoring, and Site Reviews

LUCs would consist of maintaining records of the restrictions in the NSF-IH GIS. Use of shallow groundwater as a source of potable water would not be permitted until PRGs are achieved. A LUC Remedial Design would need to be prepared to document the restrictions.

New monitoring wells would be installed upgradient and downgradient of each HRC treatment barrier in the source area plume and the ORC grid in the downgradient plume area. Shallow groundwater samples would be collected from new and existing wells and analyzed for TCL VOCs and diethyl ether. Samples from wells in the HRC treatment area (source area plume) would also be analyzed for anaerobic biodegradation indicator parameters (ferrous iron, dissolved iron, dissolved manganese, TOC, alkalinity, nitrate, nitrite, sulfate, sulfide, chloride, carbon dioxide, methane, ethane, ethene, and metabolic acids). Samples from wells in the ORC treatment area (downgradient plume area) would also be analyzed for aerobic biodegradation indicator parameters [ferrous iron, biochemical oxygen demand (BOD), and

chemical oxygen demand (COD)]. Samples from wells in the mid-plume area would also be analyzed for natural attenuation indicator parameters (ferrous iron, TOC, alkalinity, nitrate, nitrite, sulfate, sulfide, chloride, carbon dioxide, methane, ethane, and ethene). A long-term monitoring plan would need to be developed, with EPA and MDE concurrence, as part of the remedial design.

At least every 5 years, a site review would be conducted to evaluate the site status and determine whether further action (including the need for additional 5-year reviews) is necessary.

2.9.1.4 Alternative 4 – Permeable Reactive Barrier

Alternative 4 includes the following major components: a permeable reactive barrier (PRB), natural attenuation, LUCs, monitoring, and site reviews.

Permeable Reactive Barrier

Under this alternative, a PRB would be installed across the width of the contaminant plume in the downgradient portion of the mid-plume area. The PRB would address contamination in the source area plume and mid-plume area. The PRB would consist of a zone of reactive material installed in the path of the TCE plume. The FS assumed that zero-valent granular iron would be used; however, other materials may also be effective. As groundwater flows through the reactive zone, COCs would come in contact with the reactive medium and would be degraded to potentially nontoxic dehalogenated organic compounds and inorganic chloride. As the zero-valent metal in the reactive cell corrodes, the resulting electron activity would cause the reduction of chlorinated compounds. It was assumed that the reactive medium would need to be replaced after 15 years of operation.

Natural Attenuation

Groundwater contaminated with cis-1,2-dichloroethene and vinyl chloride in the downgradient plume area near Mattawoman Creek would be allowed to naturally attenuate. The screening evaluation for monitored natural attenuation conducted for the FS indicated that conditions in this area are favorable for natural attenuation of chlorinated VOCs. COC concentrations in this area continue to decrease over time. This alternative was conceptually designed as a relatively long-term action as it would take many years for all of the contaminated shallow groundwater in the source area plume and mid-plume area to flow through the PRB. It is assumed by the time all contaminated shallow groundwater had flowed through the PRB, the contamination in the downgradient plume area would have had adequate time to naturally attenuate.

Land Use Controls, Monitoring, and Site Reviews

LUCs would consist of maintaining records of the restrictions in the NSF-IH GIS. Use of shallow groundwater as a source of potable water would not be permitted until PRGs are achieved. A LUC Remedial Design would need to be prepared to document the restrictions.

Shallow groundwater samples from existing monitoring wells would be collected on a regular basis. The samples would be analyzed for TCL VOCs and diethyl ether. A long-term monitoring plan would need to be developed, with EPA and MDE concurrence, as part of the remedial design.

At least every 5 years, a site review would be conducted to evaluate the site status and determine whether further action (including the need for additional 5-year reviews) is necessary.

2.9.1.5 Alternative 5 – Extraction and Treatment

Alternative 5 consists of the following major components: groundwater extraction, treatment, and discharge, LUCs, monitoring, and site reviews.

Groundwater Extraction, Treatment, and Discharge

Based on modeling conducted for the FS, a total of six groundwater extraction wells would be installed in the surficial aquifer. Five wells would be installed in the TCE plume (source area plume and mid-plume area), and one well would be installed in the downgradient plume area near Mattawoman Creek. The individual extraction rates range from 5 to 20 gallons per minute (gpm), with a combined pumping rate of approximately 75 gpm. The combined flows from the extraction wells would be treated using air stripping to remove VOCs. Based on the anticipated influent concentrations and flow rate, the VOC concentrations in the air emissions from the air stripper would be low enough that treatment would not be required. The treated groundwater would be discharged to Mattawoman Creek.

Land Use Controls, Monitoring, and Site Reviews

LUCs would consist of maintaining records of the restrictions in the NSF-IH GIS. Use of shallow groundwater as a source of potable water would not be permitted until PRGs are achieved. A LUC Remedial Design would need to be prepared to document the restrictions.

Shallow groundwater samples from existing monitoring wells would be collected on a regular basis. The samples would be analyzed for TCL VOCs and diethyl ether. The influent and effluent from the air stripper would be sampled monthly and analyzed for TCL VOCs. A long-term monitoring plan would be developed, with EPA and MDE concurrence, as part of the remedial design.

At least every 5 years, a site review would be conducted to evaluated the site status and determine whether further action (including the need for additional 5-year reviews) is necessary.

2.9.2 Common Elements and Distinguishing Features of Each Alternative

No response actions would be implemented under Alternative 1, the no-action alternative.

Alternatives 2, 3, 4, and 5 include various forms of passive and active treatment to reduce COC concentrations in shallow groundwater. Alternative 2 includes natural attenuation of the source area plume, mid-plume area, and downgradient plume area. Alternative 3 includes in-situ bioremediation of the source area plume and downgradient plume area and natural attenuation of the mid-plume area. Alternative 4 includes using a PRB to treat the source area plume and mid-plume area and natural attenuation of the downgradient plume area. Alternative 5 includes extraction of groundwater from the source area plume, mid-plume area, and downgradient plume area, air stripping, and discharge of treated groundwater to Mattawoman Creek.

LUCs that would be maintained by the Navy are a component of Alternatives 2, 3, 4, and 5. Use of shallow groundwater as a source of potable water would not be permitted until PRGs are achieved.

Alternatives 2, 3, 4, and 5 include collection of shallow groundwater samples on a regular basis, with analysis for TCL VOCs and diethyl ether. Additional analytes would be included for monitoring the natural attenuation and in-situ bioremediation components of Alternatives 2, 3, and 4. For Alternative 5, monitoring of the air stripper influent and effluent would be included.

Five-year reviews would be required for Alternatives 2, 3, 4, and 5 until PRGs are attained. Such reviews are required by CERCLA Section 121(c) because these alternatives would result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure.

It was estimated that Alternative 2 would take approximately 1 month to implement and 70 years to attain RAOs. Alternative 3 would take approximately 2 months to implement and up to 30 years to attain RAOs. Alternative 4 would take approximately 3 months to implement and up to 30 years to attain RAOs. Alternative 5 would take approximately 5 months to implement and 19 years to attain RAOs.

The present-worth cost for Alternatives 2, 3, and 4 is based on 30 years of annual costs and a 7 percent annual discount factor. The present-worth cost for Alternative 5 is based on 19 years of annual cost and the same discount factor. The estimated present-worth costs are as follows:

- Alternative 1: $0
- Alternative 2: $604,000
- Alternative 3: $1,358,000
- Alternative 4: $1,326,000
- Alternative 5: $1,308,000

2.9.3 Expected Outcome of Each Alternative

Under Alternative 1 (no action), the site could be released for unrestricted use because no LUCs would be implemented, but this alternative could result in unacceptable risks to human health and the environment.

Under Alternatives 2, 3, 4, and 5, the use of shallow groundwater as a source of potable water would not be permitted until PRGs are achieved.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The objective of the comparative analysis of alternatives is to evaluate the relative performance of the alternatives with respect to the nine evaluation criteria established in the NCP so that the advantages and disadvantages of each are clearly understood. The first two evaluation criteria, Overall Protection of Human Health and the Environment and Compliance with Applicable or Relevant and Appropriate Requirements (ARARs), are threshold criteria that must be satisfied by any remedial alternative chosen for a site. Table 2-8 contains a summary of the comparative analysis of alternatives.

2.10.1 Overall Protection of Human Health and the Environment

All the alternatives, except the no-action alternative, protect human health and the environment by eliminating, reducing, or controlling risks posed by the site through removal of contaminants and institutional controls. Therefore, the no-action alternative will not be considered further in this analysis because it does not satisfy this threshold criterion.

Alternative 3 (In-Situ Bioremediation) and Alternative 4 (PRB) would protect human health by treating certain areas of the contaminated groundwater in situ and allowing other areas to naturally attenuate. Alternative 5 (Extraction and Treatment) would protect human health by removing and treating contaminated groundwater. Groundwater contamination would be allowed to naturally attenuate under Alternative 2. Restrictions on the use of shallow groundwater as a source of potable water would be imposed for these alternatives until PRGs are attained.

Alternatives 2, 3, 4, and 5 would include groundwater monitoring to ensure protection of the environment.

2.10.2 Compliance with ARARs

Alternatives 2, 3, 4, and 5 have common chemical-specific ARARs for shallow groundwater. These include MCLs for chlorinated VOCs. These alternatives would eventually comply with these ARARs.

There are no location-specific ARARs associated with Alternatives 2, 3, 4, and 5.

There are no action-specific ARARs associated with Alternative 2. For Alternatives 3 and 5, installation of monitoring wells and extraction wells would comply with state well construction regulations. For Alternative 3, injection of bioremediation chemicals would comply with underground injection control (UIC) regulations. For Alternative 5, the discharge of treated groundwater to Mattawoman Creek would comply with state water pollution permit regulations and surface water quality standards. The discharge to the atmosphere from the air stripper would comply with state air pollution control regulations.

2.10.3 Long-Term Effectiveness and Permanence

Because Alternatives 2, 3, 4, and 5 involve some form of active or passive groundwater remediation, they are expected to be effective at decreasing groundwater contaminant concentrations over the long term. The recent removal of contaminated soil that was an ongoing source of groundwater contamination would be expected to enhance the effectiveness of all alternatives. This soil removal action may have also removed some DNAPL. Residual DNAPL, if present, could act as a continuing source of groundwater contamination.

The 2003 pilot study results indicated large reductions in TCE concentrations; however, TCE and its degradation products cis-1,2-dichloroethene and vinyl chloride remain at concentrations greater than PRGs. It is anticipated that implementation of Alternative 3 would remove the remaining TCE and possibly TCE degradation products. The addition of the proper bacteria to enhance the removal of cis-1,2-dichloroethene and vinyl chloride could enhance the effectiveness of this alternative.

A treatability study would be needed for Alternative 4 to confirm long-term effectiveness with respect to the COCs detected in shallow groundwater.

For Alternative 5, there may be a point at which COC concentrations approach a constant value and contamination is no longer being removed at a significant rate. If a point of ineffectiveness is reached before PRGs are attained, another remedial approach may be required.

Based on the above discussion, Alternative 3 would be the most effective over the long term. The uncertainties associated with Alternatives 4 and 5 would make them less effective.

For Alternatives 2, 3, 4, and 5, monitoring would be effective in determining the effectiveness of treatment, the rate of contaminant removal, and whether future action is required. These alternatives would rely on LUCs to control exposure to contaminated groundwater until PRGs are attained.

Reviews at least every 5 years, as required, would be necessary to evaluate the effectiveness of any of these alternatives as long as hazardous substances remain in shallow groundwater at concentrations greater than health-based levels that allow for unlimited use and unrestricted exposure.

2.10.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 3 and 4 include in-situ biological treatment and a PRB, respectively, to reduce the toxicity of hazardous substances and the volume of contaminated shallow groundwater. Alternative 5 includes extraction and air stripping to reduce the toxicity of hazardous substances in shallow groundwater prior to discharge to surface water. All of the treatment technologies are expected to reduce the concentrations of COCs to PRGs. None of the alternatives would reduce contaminant mobility.

Alternative 2 does not include treatment to reduce the toxicity, mobility, or volume of hazardous substances in shallow groundwater. Alternatives 3, 4, and 5 may be equally effective in reducing toxicity, mobility, and volume.

2.10.5 Short-Term Effectiveness

No risks to the community, on-site workers, or the environment are anticipated for Alternatives 2, 3, 4, and 5. However, activities associated with injection of bioremediation chemicals (Alternative 3), construction of the PRB (Alternative 4), and installation of groundwater extraction wells and associated piping (Alternative 5) would have short-term impacts on local traffic near the site.

Alternative 2 could be implemented within 1 month. The estimated construction durations of Alternatives 3, 4, and 5 are 2 months, 3 months, and 5 months, respectively.

For Alternative 2, groundwater modeling indicated that TCE concentrations could be reduced to PRGs in approximately 70 years. For Alternative 3, bioremediation chemicals would be injected in the source area plume at Year 0 and Year 3, and it could take several years following the second application to attain PRGs in this area. The addition of bacteria to enhance biodegradation could decrease the time to attain

PRGs in the source area plume and downgradient plume area. It may take up to 30 years to attain PRGs in the mid-plume area via natural attenuation. The time to attain PRGs under Alternative 4 cannot be estimated without additional studies; however, 30 years was assumed for estimating the net present worth. For Alternative 5, groundwater modeling indicated that TCE concentrations would be reduced to PRGs in approximately 19 years. Although the overall time to achieve PRGs in all portions of the aquifer would be the shortest under Alternative 5, Alternative 3 would be expected to attain PRGs in less time than the other alternatives in the most contaminated portion of the site (source area plume). For all alternatives, any DNAPL potentially present following the 2006 soil removal action would be an ongoing source of groundwater contamination that could affect the time needed to attain PRGs.

2.10.6 Implementability

All of the remedial alternatives are implementable. Equipment and services needed to implement the alternatives are available. The groundwater use restrictions under Alternatives 2, 3, 4, and 5 can be strictly enforced because the site is located within a military facility.

A pilot study would be needed to confirm the effectiveness of and determine design requirements for Alternative 4. A pilot study has already been conducted for Alternative 3.

Care would need to be taken during implementation of Alternatives 3, 4, and 5 because there are underground utilities present, especially near Building 292.

For Alternative 5, the state would need to develop contaminant concentration limits for the discharge of treated groundwater to Mattawoman Creek.

2.10.7 Cost

The estimated present-worth costs for Alternatives 2, 3, 4, and 5 range from approximately $0.6 million for Alternative 2 to approximately $1.4 million for Alternative 3. Capital, annual O&M, and present-worth costs are provided in Table 2-8. Present-worth costs are listed below:

- Alternative 2: $604,000
- Alternative 3: $1,358,000
- Alternative 4: $1,326,000
- Alternative 5: $1,308,000

2.10.8 State Acceptance

The state has expressed their acceptance of Alternatives 2, 3, 4, and 5. In addition, MDE supports the remedy selected by the Navy and EPA.

2.10.9 Community Acceptance

Based on comments expressed at the public meeting and receipt of written comments during the public comment period, it appears that the community agrees with the Selected Remedy because no negative comments were received. Specific responses to issues raised by the community can be found in the Responsiveness Summary section of this ROD.

2.11 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable [40 Code of Federal Regulations (CFR) 300.430(a)(1)(iii)(A)]. Based on the results of the investigations, studies, and sampling conducted during the RI and FS, the contaminated groundwater at Site 57 does not constitute a principal threat waste as defined by the NCP. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

2.12 SELECTED REMEDY

2.12.1 Summary of Rationale for the Selected Remedy

The Selected Remedy for Site 57 – Building 292 TCE Contamination is Alternative 3 – In-Situ Biodegradation. This alternative meets the RAOs, provides adequate protection of human health and the environment, attains ARARs, and provides the best balance of tradeoffs with respect to the balancing and modifying criteria. The 2003 pilot study showed that injecting chemicals to stimulate in-situ bioremediation was effective in significantly reducing TCE concentrations. The addition of the proper bacteria and nutrients and/or treatment of areas, if any, where DNAPL is present could readily be added as a remedy component that could enhance the effectiveness of Alternative 3. The need for these additional actions will be based on a review of the long-term monitoring results during the 5-year review. LUCs will be implemented to prohibit the use of contaminated shallow groundwater as a source of potable water until the PRGs are attained and the site is suitable for unlimited use and unrestricted exposure.

Alternative 3 would be expected to attain PRGs in less time than the other alternatives in the most contaminated portion of the site (source area plume).

A pilot study would be needed to confirm the effectiveness of Alternative 4, and Alternative 5 includes conventional extraction and treatment. Compared to Alternative 3, there are few options to enhance the effectiveness of these alternatives after they are implemented.

2.12.2 Description of Selected Remedy

2.12.2.1 In-Situ Bioremediation

An HRC (electron donor) will be injected into the surficial aquifer in the source area plume to create an anaerobic treatment zone suitable for reductive dechlorination of TCE and its degradation products cis-1,2-dichloroethene and vinyl chloride. The HRC will be injected in rows of delivery points to form treatment barriers across the width of the plume. The length of each treatment barrier was estimated to be 160 feet, which is the approximate width of the valley in this area. Each treatment barrier will contain two rows of injection points on 10-foot centers. The spacing between each row will be 5 feet. Based on the estimated length of the plume and the average groundwater flow velocity, two treatment barriers will be installed in the source area plume. The conceptual design assumed that at least two injection events will be needed. The proper bacteria and/or nutrients could also be injected to enhance the removal of TCE degradation products.

An ORC (electron acceptor) will be injected into the surficial aquifer in the downgradient plume area near Mattawoman Creek to create an aerobic treatment zone suitable for oxidative biodegradation of cis-1,2-dichloroethene and vinyl chloride. The ORC will be injected in a grid pattern over an area of approximately 100 by 100 feet. The spacing between injection points will be 10 feet. The conceptual design assumed that one injection event will be needed.

2.12.2.2 Monitored Natural Attenuation

The mid-plume area between the source area plume and downgradient plume will be allowed to naturally attenuate. The COC concentrations in the mid-plume area are much less than those in the source area plume.

2.12.2.3 Land Use Controls

The LUCs for Site 57 will meet the following objectives:

- No use of shallow groundwater as a potable water supply.
- All other uses of groundwater require Navy approval. The acceptability of such use will be evaluated based on the chemical concentrations present in the groundwater at the time of such use.

- Maintain the integrity of any current or future monitoring system.

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

A LUC Remedial Design will be prepared as the land use component of the Remedial Design. Within 90 days of ROD signature, the Navy shall prepare and submit to EPA for approval a LUC Remedial Design that shall contain implementation and maintenance actions, including periodic inspections. The Navy will implement, maintain, monitor, report on, and enforce the LUCs in accordance with the LUC Remedial Design.

2.12.2.4 Long-Term Monitoring

Long-term monitoring will involve shallow groundwater sampling as described in Section 2.9.1.3. A long-term monitoring plan will be developed, with EPA and MDE concurrence, as part of the remedial design. The plan will detail the frequency, analysis, and locations of the long-term monitoring samples and the exit criteria for cessation of monitoring.

2.12.2.5 Site Review

Within 5 years, a site review will be conducted to evaluate the site status and determine whether further action is necessary (including the need for additional 5-year reviews). The site review is required because the Selected Remedy will allow contaminants to remain at concentrations greater than those suitable for unlimited use and unrestricted exposure.

2.12.3 Summary of the Estimated Remedy Costs

Cost estimate summaries for the Selected Remedy are provided in Table 2-9 (capital cost), Table 2-10 (annual costs), and Table 2-11 (present-worth analysis). The information in these cost estimate summary tables is based on the best available information regarding the anticipated scope of the remedial alternative. The estimated present-worth cost is $1,358,000. Changes in the cost elements may occur because of new information or data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences (ESD), or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost. These estimates are refined as the remedy is designed and implemented. Even after the remedial action is constructed, the total project cost is still reported as estimated because of the uncertainty associated with annual O&M expenditures.

2.12.4 Expected Outcomes of the Selected Remedy

After the Selected Remedy has been implemented, the use of shallow groundwater as a source of potable water at Site 57 will be prohibited until PRGs are attained. The groundwater can possibly be used for non-potable uses depending on contaminant concentrations at the time of the proposed use. The estimated times to achieve PRGs for various plume areas are as follows: source area plume – 6 years, mid-plume area – 30 years, and downgradient plume area – 2 years. The PRGs for the COCs are as follows:

- cis-1,2-Dichloroethene – 70 µg/L (MCL)
- 1,1-Dichloroethene – 7 µg/L (MCL)
- Diethyl ether – 1,246 µg/L (noncancer risk-based)
- trans-1,2-Dichloroethene – 100 µg/L (MCL)
- TCE – 5 µg/L (MCL)
- Vinyl chloride – 2 µg/L (MCL)

During the human health risk assessment for the RI Report, tetrachloroethene was identified as a COC because the exposure point concentration based on the RI data was greater than the MCL; however, there were no unacceptable carcinogenic or noncarcinogenic risks from exposure to tetrachloroethene. Based on 2005 data, the maximum concentration is less than the MCL; therefore, tetrachloroethene is no longer a COC.

Also, trans-1,2-dichloroethene was not identified as a COPC during the RI risk assessment because the exposure point concentration was less than the COPC screening level and the MCL. However, based on 2005 data, the maximum concentration is greater than the MCL, and trans-1,2-dichloroethene is now a COC.

Since the RI risk assessment was prepared the exposure point concentrations of the COCs have changed as a result of the following: (1) natural processes; (2) the removal of contaminated soil that was the assumed source of contamination in June 2006; (3) the effects of the 2003 pilot study; and (4) the collection of additional data within the source area where TCE was released. The risk calculations and statistical analysis used to determine the exposure point concentrations were not repeated after the 2001, 2003, 2004, and 2005 sampling rounds because an obvious risk was still present from use of groundwater as a source of potable water. The PRGs developed in the FS and presented in this section were sufficient to develop conceptual designs and to evaluate remedial alternatives. However, for the

reasons stated above, the COCs, exposure point concentrations, and PRGs may need to be re-evaluated based on the most recent data before final design of the Selected Remedy.

2.13 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of contaminants as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

2.13.1 Protection of Human Health and the Environment

The Selected Remedy, Alternative 3, will protect human health and the environment by using a combination of in-situ bioremediation and natural attenuation to reduce COC concentrations in shallow groundwater and LUCs to prohibit use of contaminated shallow groundwater as a source of potable water until PRGs are attained and the site is suitable for unlimited use and unrestricted exposure. The discharge of groundwater has not affected surface water quality.

There are no short-term threats associated with the Selected Remedy that cannot be readily controlled. In addition, no cross-media impacts are expected from the Selected Remedy. Long-term monitoring will be conducted to ensure that shallow groundwater contaminants are not migrating off site at unacceptable concentrations.

2.13.2 Compliance with ARARs

The Selected Remedy will meet all identified ARARs. Federal and state chemical- and action-specific ARARs for the Selected Remedy are summarized in Tables 2-12 and 2-13, respectively. There are no location-specific ARARs associated with the Selected Remedy.

2.13.3 Cost Effectiveness

In the Navy's judgment, the Selected Remedy is cost effective. In making this determination, the following definition was used [40 CFR 300.430(f)(1)(ii)(D)]: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." The analysis of the cost effectiveness of the alternatives was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and complied with ARARs).

Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness). The overall effectiveness of all the alternatives was considered and then compared to each of their costs.

The estimated present-worth cost of the Selected Remedy (Alternative 3) is $1,358,000. Although Alternative 2 (Monitored Natural Attenuation) is more than 50 percent less expensive, it does not include treatment and is expected to take much longer to attain PRGs. The estimated present-worth costs for Alternative 4 (PRB) and Alternative 5 (Extraction and Treatment) are slightly less (approximately 4 percent) than for Alternative 3, and these alternatives would provide a similar level of protection. However, Alternative 3 would be expected to attain PRGs in less time in the most contaminated portion of the site (source area plume). Therefore, Alternative 3 is cost effective.

2.13.4 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

The Navy and EPA, with state concurrence, have determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the Navy and EPA have determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria. The Navy and EPA also considered the statutory preference for treatment as a principal element and state and community acceptance.

The Selected Remedy uses treatment to remove COCs from the most contaminated portion of the aquifer (source area plume) and the downgradient plume area where contaminants would be most likely to migrate to Mattawoman Creek. The mid-plume area would be allowed to naturally attenuate; however, COC concentrations are significantly lower in this area than in the source area, and this portion of the plume is not migrating to downgradient areas. The discharge of shallow groundwater to surface water is not adversely affecting water quality in the adjacent streams, and there is no known hydrogeologic connection between the shallow water-table aquifer and the deeper aquifer used for drinking water. The Selected Remedy does not present short-term risks different than the other treatment alternatives. There are no special implementability issues that set the Selected Remedy apart from any of the other alternatives evaluated.

2.13.5 Preference for Treatment as a Principal Element

By treating groundwater in the most contaminated portion of the shallow groundwater (source area plume) and in the downgradient plume area where COCs could migrate to Mattawoman Creek, the

Selected Remedy addresses unacceptable risks posed by the site through the use of treatment technologies. By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

2.13.6 Five-Year Review Requirement

Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted at least every 5 years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for Site 57 – Building 292 TCE Contamination at NSF-IH, Indian Head, Maryland was released for public comment in January 2007. The Proposed Plan identified Alternative 3, In-Situ Bioremediation, as the preferred alternative. The Navy reviewed all written and oral comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate based on public comments.

TABLE 2-1

SUMMARY OF CHEMICALS OF CONCERN AND EXPOSURE POINT CONCENTRATIONS FOR HUMAN RECEPTORS
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Exposure Point	Chemical of Concern	Concentration Detected (µg/L)	Frequency of Detection	Exposure Point Concentration (µg/L)	Statistical Measure	MCL (µg/L)
Upgradient groundwater – ingestion, dermal contact, inhalation	1,1-Dichloroethene	1.8 – 77.5	2/2	77.5	Maximum	7
Downgradient groundwater – ingestion, dermal contact, inhalation	1,1-Dichloroethene	2.9 – 29	7/14	29	Maximum	7
	cis-1,2-Dichloroethene	0.5 – 528	12/14	528	Maximum	70
	Diethyl ether	1 – 3,950	9/12	3,950	Maximum	NA
	Tetrachloroethene	9.5	1/14	5.41	95% UCL	5
	Trichloroethene	2.2 – 612	11/14	612	Maximum	5
	Vinyl chloride	2.9 – 85	6/14	85	Maximum	2

MCL: Maximum Contaminant Level.
NA: Not available.
UCL: Upper confidence limit.

This table presents the chemicals of concern (COCs) and exposure point concentrations (i.e., the concentration that will be used to estimate the exposure and risk) for each of the COCs detected in upgradient and downgradient groundwater based on the risk assessment in the RI Report (TtNUS, 2000). The 95% UCL on the arithmetic mean was used as the exposure point concentration for tetrachloroethene in downgradient groundwater. For the other COCs, the maximum concentration was used as the exposure point concentration because of the limited amount of sample data available (upgradient groundwater) or because the 95% UCL was greater than the maximum concentration (downgradient groundwater).

TABLE 2-2

CANCER TOXICITY DATA SUMMARY
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence	Source	Date
1,1-Dichloroethene	6.0E-01	6.0E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	06/01/99
cis-1,2-Dichloroethene	--	--	--	D	IRIS	06/01/99
Diethyl ether	--	--	--	--	IRIS	06/01/99
Tetrachloroethene	5.2E-02	5.2E-02	$(mg/kg\text{-}day)^{-1}$	--	EPA3	04/12/99
Trichloroethene	1.1E-02	1.1E-02	$(mg/kg\text{-}day)^{-1}$	--	EPA3	04/12/99
Vinyl chloride	1.9E+00	1.9E+00	$(mg/k\text{-}/day)^{-1}$	A	HEAST	07/97

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence	Source	Date
1,1-Dichloroethene	5.0E-05	$(\mu g/m^3)^{-1}$	1.8E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	06/01/99
cis-1,2-Dichloroethene	--	--	--	--	D	--	--
Diethyl ether	--	--	--	--	--	--	--
Tetrachloroethene	--	--	2.0E-03	$(mg/kg\text{-}day)^{-1}$	--	EPA3	04/12/99
Trichloroethene	--	--	6.0E-03	$(mg/kg\text{-}day)^{-1}$	--	EPA3	04/12/99
Vinyl chloride	8.4E-05	$(\mu g/m^3)^{-1}$	3.0E-01	$(mg/kg\text{-}day)^{-1}$	A	HEAST	07/97

--: No information available.
EPA3: United States Environmental Protection Agency Region 3 Risk-Based Concentration Table.
HEAST: Health Effects Assessment Summary Table.
IRIS: Integrated Risk Information System.

TABLE 2-2

CANCER TOXICITY DATA SUMMARY
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Weight of Evidence
A: Human carcinogen.
C: Possible human carcinogen.
D: Not classifiable as a human carcinogen.

Cancer slope factors are not available for the dermal route of exposure; the dermal slope factors used in the assessment have been extrapolated from oral values. An adjustment factor is applied and is dependent on how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50 percent absorption via the ingestion route. However, no adjustments were necessary.

Four of the COCs (1,1-dichloroethene, tetrachloroethene, trichloroethene, and vinyl chloride) are also considered carcinogenic via the inhalation route of exposure. Cis-1,2-dichloroethene and diethyl ether lack sufficient toxicity via the inhalation route to support the development of specific inhalation carcinogenic toxicity criteria.

TABLE 2-3

NONCANCER TOXICITY DATA SUMMARY
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD	Dermal RfD	Units	Target Organ(s)	Uncertainty Factor	Source	Date
1,1-Dichloroethene	Chronic	9.0E-03	9.0E-03	mg/kg-day	Liver	3,000	IRIS	06/01/99
cis-1,2-Dichloroethene	Chronic	1.0E-02	1.0E-02	mg/kg-day	Blood	3,000	HEAST	07/97
Diethyl ether	Chronic	2.0E-01	2.0E-01	mg/kg-day	--	3,000	IRIS	06/01/99
Tetrachloroethene	Chronic	1.0E-02	1.0E-02	mg/kg-day	Liver	--	IRIS	06/06/99
Trichloroethene	Chronic	6.0E-03	6.0E-03	mg/kg-day	--	--	EPA3	04/12/99
Vinyl chloride	--	--	--	--	--	--	--	--

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Units	Inhalation RfD	Units	Primary Target Organ	Uncertainty Factor	Source	Date
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--
Diethyl ether	--	--	--	--	--	--	--	--	--
Tetrachloroethene	Chronic	---	---	1.4E-01	mg/kg-day	--	--	EPA3	04/12/99
Trichloroethene	--	--	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--	--	--

--: No information available.
EPA3: United States Environmental Protection Agency Region 3 Risk-Based Concentration Table.
HEAST: Health Effects Assessment Summary Table.
IRIS: Integrated Risk Information System.
RfC: Reference concentration.
RfD: Reference dose.

TABLE 2-3

NONCANCER TOXICITY DATA SUMMARY
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

The chronic toxicity data available for oral exposures have been used to develop oral RfDs. As was the case with carcinogenic data, dermal RfDs can be extrapolated from oral values by applying an adjustment factor as appropriate. No adjustment was needed, and the oral values were used as the dermal RfDs for these contaminants. The uncertainty factor is used to account for uncertainty when deriving the RfD from experimental data.

TABLE 2-4

FUTURE CHILD RESIDENT RISK CHARACTERIZATION SUMMARY – CARCINOGENS
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Route Total
Upgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	3.0E-04	2.7E-05	NA	3.3E-04
						Upgradient groundwater risk total =	**3.3E-04**
Downgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	1.1E-04	1.0E-05	NA	1.2E-04
	Groundwater	Tap Water	Tetrachloroethene	1.3E-06	7.9E-07	NA	2.6E-06
	Groundwater	Tap Water	Trichloroethene	4.3E-05	4.9E-06	NA	4.8E-05
	Groundwater	Tap Water	Vinyl chloride	1.0E-03	3.3E-05	NA	1.0E-03
						Downgradient groundwater risk total =	**1.2E-03**

NA: Route of exposure is not applicable to this medium.

TABLE 2-5

FUTURE ADULT RESIDENT RISK CHARACTERIZATION SUMMARY – CARCINOGENS
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk			
				Ingestion	Dermal	Inhalation	Exposure Route Total
Upgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	4.4E-04	5.6E-05	1.6E-04	6.6E-04
						Upgradient groundwater risk total =	**6.6E-04**
Downgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	1.6E-04	2.1E-05	5.9E-05	2.4E-04
	Groundwater	Tap Water	Tetrachloroethene	2.6E-06	1.7E-06	1.0E-07	4.4E-06
	Groundwater	Tap Water	Trichloroethene	6.3E-05	1.0E-05	3.8E-05	1.1E-04
	Groundwater	Tap Water	Vinyl Chloride	1.5-03	7.0E-05	3.3E-04	1.9E-03
						Downgradient groundwater risk total =	**2.3E-03**

TABLE 2-6

FUTURE CHILD RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Noncarcinogenic Hazard Quotient			
					Ingestion	Dermal	Inhalation	Exposure Route Total
Upgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	Liver	5.5E-01	4.9E-02	NA	0.6
Upgradient Groundwater Hazard Index Total =								**0.6**
Downgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	Liver	2.1E-01	1.9E-02	NA	0.23
	Groundwater	Tap Water	cis-1,2-Dichloroethene	Blood	3.4E+00	1.9E-01	NA	3.6
	Groundwater	Tap Water	Diethyl ether	--	1.3E+00	1.8E-02	NA	1.3
	Groundwater	Tap Water	Tetrachloroethene	Liver	3.5E-02	1.5E-02	NA	0.05
	Groundwater	Tap Water	Trichloroethene	--	6.5E+00	7.5E-01	NA	7.3
Downgradient Groundwater Hazard Index Total =								**12.5**

NA: Route of exposure is not applicable to this medium.

TABLE 2-7

FUTURE ADULT RISK CHARACTERIZATION SUMMARY – NONCARCINOGENS
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Noncarcinogenic Hazard Quotient			
					Ingestion	Dermal	Inhalation	Exposure Route Total
Upgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	Liver	2.4E-01	3.0E-02	NT	0.3
Upgradient Groundwater Hazard Index Total =								**0.3**
Downgradient Groundwater	Groundwater	Tap Water	1,1-Dichloroethene	Liver	8.8E-02	1.1E-02	NT	0.1
	Groundwater	Tap Water	cis-1,2-Dichloroethene	Blood	1.4E+00	1.2E-01	NT	1.5
	Groundwater	Tap Water	Diethyl ether	--	5.4E-01	1.1E-02	NT	0.6
	Groundwater	Tap Water	Tetrachloroethene	Liver	1.5E-02	9.3E-03	1.1E-03	0.03
	Groundwater	Tap Water	Trichloroethene	--	2.8E+00	4.6E-01	NT	3.3
Downgradient Groundwater Hazard Index Total =								**5.5**

NT: Toxicity criteria are not available to quantitatively address this route of exposure.

TABLE 2-8

SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Evaluation Criterion	Alternative 1 – No Action	Alternative 2 – Monitored Natural Attenuation	Alternative 3 – In-Situ Bioremediation
Threshold Criteria			
Overall Protection of Human Health and the Environment	No reduction in potential risks.	Groundwater use restrictions and monitoring would reduce risks to human health and the environment.	Groundwater treatment, groundwater use restrictions, and monitoring would reduce risks to human health and the environment.
Compliance with ARARs			
Chemical-specific	Would not comply.	Would eventually comply.	Would comply.
Location-specific	No ARARs.	No ARARs.	No ARARs.
Action-specific	Not applicable.	Not applicable.	Can be designed to attain ARARs.
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence	Allows uncontrolled risks to remain.	Groundwater use restrictions would reduce risks to human health. Monitoring and use restrictions would provide adequate and reliable controls. Removal of potential DNAPL could enhance effectiveness.	Treatment would be expected to be effective over the long term. Additional applications may be needed to completely degrade the chlorinated COCs. Removal of potential DNAPL and addition of proper bacteria could enhance effectiveness.
Reduction of Toxicity, Mobility, or Volume through Treatment	No treatment.	No treatment.	In-situ biological treatment would reduce toxicity of hazardous substances in groundwater.

TABLE 2-8

SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Evaluation Criterion	Alternative 1 – No Action	Alternative 2 – Monitored Natural Attenuation	Alternative 3 – In-Situ Bioremediation
Primary Balancing Criteria (continued)			
Short-Term Effectiveness	Not applicable.	No impacts to community, workers, or environment. One month to implement. Approximately 70 years to attain PRGs. Potential DNAPL could increase time to attain PRGs.	No impacts to community, workers, or environment. Short-term impacts on traffic during HRC and ORC injection. Two months to construct. May take several years to attain PRGs in source area, and could take longer to naturally attenuate mid-plume area. Expected to attain PRGs in less time than the other alternatives in the source area plume and downgradient plume area. Potential DNAPL could increase time to attain PRGs.
Implementability	Not applicable.	Groundwater use restrictions could be strictly enforced because site is located within a military facility.	Alternative consists of common remediation practices that are readily available and implementable. Care would need to be taken to avoid damage to underground utilities.
Cost			
Capital	$0	$9,700	$541,000 (plus $182,000 for retreatment of Area 1 in Year 3)
Annual O&M	$0	$45,000 (plus $15,000 every 5 years)	$54,000 (Years 1 and 2), $53,000 (Years 3 to 6), $50,000 (Years 7 to 30) (plus $15,000 every 5 years)
Present worth	$0	$604,000	$1,358,000 (includes retreatment of Area 1 at 3 years)

TABLE 2-8

SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Evaluation Criterion	Alternative 1 – No Action	Alternative 2 – Monitored Natural Attenuation	Alternative 3 – In-Situ Bioremediation
Modifying Criteria			
State Acceptance	Not acceptable.	Acceptable.	Acceptable.
Community Acceptance	Not acceptable.	Acceptable.	Acceptable.

TABLE 2-8

SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Evaluation Criterion	Alternative 4 – Permeable Reactive Barrier	Alternative 5 – Extraction and Treatment
Threshold Criteria		
Overall Protection of Human Health and the Environment	Groundwater treatment, groundwater use restrictions, and monitoring would reduce risks to human health and the environment.	Groundwater extraction and treatment, groundwater use restrictions, and monitoring would reduce risks to human health and the environment.
Compliance with ARARs		
Chemical-specific	Would comply.	Would comply.
Location-specific	No ARARs.	No ARARs.
Action-specific	Can be designed to attain ARARs.	Can be designed to attain ARARs.
Primary Balancing Criteria		
Long-Term Effectiveness and Permanence	Treatment would be expected to be effective over the long term. Treatability studies needed to confirm effectiveness. Monitoring and use restrictions would provide adequate and reliable controls. Removal of potential DNAPL could enhance effectiveness.	Extraction and treatment would be effective over the long term. May be a point at which concentrations approach a constant value and contaminant mass is no longer being removed at significant levels. Monitoring and use restrictions would provide adequate and reliable controls. Removal of potential DNAPL could enhance effectiveness.
Reduction of Toxicity, Mobility, or Volume through Treatment	Treatment using PRB would reduce toxicity of hazardous substances in groundwater.	Treatment using air stripping would reduce toxicity of hazardous substances prior to discharge to surface water.
Short-Term Effectiveness	No impacts to community, workers, or environment. Short-term impacts to traffic during PRB construction. Three months to construct. Need additional studies to evaluate time to achieve clean-up goals. Potential DNAPL could increase time to attain PRGs.	No impacts to community, workers, or environment. Short-term impacts to traffic during installation of wells and piping. Five months to construct. Approximately 19 years to attain PRGs. Potential DNAPL could increase time to attain PRGs.

TABLE 2-8

SUMMARY OF COMPARATIVE ANALYSIS OF GROUNDWATER ALTERNATIVES
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Evaluation Criterion	Alternative 4 – Permeable Reactive Barrier	Alternative 5 – Extraction and Treatment
Primary Balancing Criteria (continued)		
Implementability	Alternative consists of common remediation practices that are readily available and implementable. Care would need to be taken to avoid damage to underground utilities.	Alternative consists of common remediation practices that are readily available and implementable. Care would need to be taken to avoid damage to underground utilities.
Cost		
Capital	$782,000 (plus $334,000 in Year 15 for reactive medium replacement)	$470,000
Annual O&M	$31,500 (plus $15,000 every 5 years)	$79,000 (plus $15,000 every 5 years)
Present worth	$1,326,000 (includes barrier replacement at 15 years)	$1,308,000
Modifying Criteria		
State Acceptance	Acceptable.	Acceptable.
Community Acceptance	Acceptable.	Acceptable.

ARARs Applicable or Relevant and Appropriate Requirements.
COCs Chemicals of concern.
DNAPL Dense non-aqueous-phase liquid.
HRC Hydrogen release compound.
O&M Operation and maintenance.
ORC Oxygen release compound.
PRB Permeable reactive barrier.

TABLE 2-9

CAPITAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 57 - BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
CAPITAL COST YEAR 0											
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	500	hr			$35.00		$0	$0	$17,500	$0	$17,500
2 MOBILIZATION/DEMOBILIZATION & SITE SUPPORT											
2.1 Office Trailer	2	mo				$340.00	$0	$0	$0	$680	$680
2.2 Field Office Support	2	mo		$145.00			$0	$290	$0	$0	$290
2.3 Storage Trailer (1)	2	mo				$109.00	$0	$0	$0	$218	$218
2.4 Utility Connection/Disconnection (phone/electric)	1	ls	$1,500.00				$1,500	$0	$0	$0	$1,500
2.5 Construction Survey	2.5	ac	$2,000.00				$5,000	$0	$0	$0	$5,000
2.6 Equipment Mobilization/Demobilization	2	ea			$151.00	$350.00	$0	$0	$302	$700	$1,002
2.7 Site Utilities	2	mo	$150.00				$300	$0	$0	$0	$300
2.8 Field Construction Mgt. (5p * 5 days/week)	8	mwk			$6,250.00		$0	$0	$50,000	$0	$50,000
3 DECONTAMINATION											
3.1 Decontamination Services	2	mo		$1,100.00	$1,850.00	$1,200.00	$0	$2,200	$3,700	$2,400	$8,300
3.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$200	$3,700
3.3 Decon Water	2,000	gal		$0.20			$0	$400	$0	$0	$400
3.4 Decon Water Storage Tank, 6,000 gallon	2	mo				$645.00	$0	$0	$0	$1,290	$1,290
3.5 Clean Water Storage Tank, 4,000 gallon	2	mo				$580.00	$0	$0	$0	$1,160	$1,160
3.6 Disposal of Decon Waste (liquid & solid)	2	mo	$950.00				$1,900	$0	$0	$0	$1,900
4 IN-SITU BIOLOGICAL TREATMENT											
4.1 Subcontractor's Mobilization & Demobilization	1	ea	$4,000.00				$4,000	$0	$0	$0	$4,000
4.2 Area 1 Probe/Pump/Injection Subcontractor	3	day	$3,070.00				$9,210	$0	$0	$0	$9,210
4.3 Area 1 Core & Repair Injection Points	64	ea		$14.51	$50.50	$14.75	$0	$929	$3,232	$944	$5,105
4.4 Area 1 HRC Cost (6,420 lb. + 10%)	7,062	lb		$5.86			$0	$41,383	$0	$0	$41,383
4.5 Area 3 Probe/Pump/Injection Subcontractor	1	day	$3,070.00				$3,070	$0	$0	$0	$3,070
4.6 Area 3 Core & Repair Injection Points	100	ea		$14.51	$50.50	$14.75	$0	$1,451	$5,050	$1,475	$7,976
4.7 Area 3 ORC Cost (2,400 lb. + 10%)	2,640	lb		$7.90			$0	$20,856	$0	$0	$20,856
5 MONITORING WELLS											
5.1 Install Monitoring Wells (4 wells)	105	lf	$65.00				$6,825	$0	$0	$0	$6,825
5.2 Well Development (4 hr/well)	16	hr	$35.00				$560	$0	$0	$0	$560
5.3 Collect/Containerize IDW	9	drum	$55.00				$495	$0	$0	$0	$495
5.4 Transport/Dispose IDW	9	drum	$170.00				$1,530	$0	$0	$0	$1,530
6 GROUNDWATER SAMPLING											
6.1 Collection (labor)	1	ls			$16,000.00		$0	$0	$16,000	$0	$16,000
6.2 Equipment/Supplies	1	ls		$500.00		$1,600.00	$0	$500	$0	$1,600	$2,100
6.3 Analytical Cost	1	ls	$19,050.00				$19,050	$0	$0	$0	$19,050
Subtotal							$53,440	$69,509	$97,784	$10,667	$231,400
Local Area Adjustments							100.0%	102.8%	89.7%	89.7%	
							$53,440	$71,455	$87,712	$9,568	$222,176

TABLE 2-9

CAPITAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 57 - BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
Overhead on Labor Cost @ 30%									$26,314		$26,314
G & A on Labor Cost @ 10%									$8,771		$8,771
G & A on Material Cost @ 10%								$7,146			$7,146
G & A on Equipment Cost @ 10%										$957	$957
G & A on Subcontract Cost @ 10%							$5,344				$5,344
Total Direct Cost							$58,784	$78,601	$122,797	$10,525	$270,707
Indirects on Total Direct Cost @ 35%											$94,747
Profit on Total Direct Cost @ 10%											$27,071
Subtotal											$392,525
Health & Safety Monitoring @ 2%											$7,851
Total Field Cost											$400,376
Contingency on Total Field Costs @ 25%											$100,094
Engineering on Total Field Cost @ 10%											$40,038
TOTAL COST											**$540,507**

TABLE 2-9

CAPITAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 57 - BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
CAPITAL COST YEAR 3											
1 PROJECT PLANNING & DOCUMENTS											
1.1 Prepare Documents & Plans including Permits	500	hr			$35.00		$0	$0	$17,500	$0	$17,500
2 DECONTAMINATION											
2.1 Decontamination Services	1	mo		$1,100.00	$1,850.00	$1,200.00	$0	$1,100	$1,850	$1,200	$4,150
2.2 Temporary Equipment Decon Pad	1	ls		$1,500.00	$2,000.00	$300.00	$0	$1,500	$2,000	$200	$3,700
2.3 Decon Water	1,000	gal		$0.20			$0	$200	$0	$0	$200
2.4 Decon Water Storage Tank, 6,000 gallon	1	mo				$645.00	$0	$0	$0	$645	$645
2.5 Clean Water Storage Tank, 4,000 gallon	1	mo				$580.00	$0	$0	$0	$580	$580
2.6 Disposal of Decon Waste (liquid & solid)	1	mo	$950.00				$950	$0	$0	$0	$950
3 IN-SITU BIOLOGICAL TREATMENT											
3.1 Field Construction Mgt. (1p * 5 days/week)	1	mwk			$1,250.00		$0	$0	$1,250	$0	$1,250
3.2 Subcontractor's Mobilization & Demobilization	1	ea	$4,000.00				$4,000	$0	$0	$0	$4,000
3.3 Area 1 Probe/Pump/Injection Subcontractor	3	day	$3,070.00				$9,210	$0	$0	$0	$9,210
3.4 Area 1 Core & Repair Injection Points	64	ea		$14.51	$50.50	$14.75	$0	$929	$3,232	$944	$5,105
3.5 Area 1 HRC Cost (6,420 lb. + 10%)	7,062	lb		$5.86			$0	$41,383	$0	$0	$41,383
Subtotal							$14,160	$45,112	$25,832	$3,569	$88,673
Local Area Adjustments							100.0%	102.8%	89.7%	89.7%	
							$14,160	$46,375	$23,171	$3,201	$86,908
Overhead on Labor Cost @ 30%									$6,951		$6,951
G & A on Labor Cost @ 10%									$2,317		$2,317
G & A on Material Cost @ 10%								$4,638			$4,638
G & A on Equipment Cost @ 10%										$320	$320
G & A on Subcontract Cost @ 10%							$1,416				$1,416
Total Direct Cost							$15,576	$51,013	$32,440	$3,522	$102,550
Indirects on Total Direct Cost @ 35%											$35,892
Profit on Total Direct Cost @ 10%											$10,255
Subtotal											$148,697
Health & Safety Monitoring @ 2%											$2,974
Total Field Cost											$151,671
Contingency on Total Field Costs @ 10%											$15,167
Engineering on Total Field Cost @ 10%											$15,167
TOTAL COST											**$182,006**

TABLE 2-10

ANNUAL COST ESTIMATE SUMMARY FOR THE SELECTED REMEDY
SITE 57 - BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Item	Item Cost Years 1 and 2	Item Cost Years 3 through 6	Item Cost Years 7 through 30	Item Cost every 5 years	Notes
Sampling	$24,700	$24,700	$24,700		Labor and field supplies per sampling roun
Analysis/Water ORC Monitoring	$1,025				Analyze groundwater samples, including blanks and duplicates, for ORC evaluation parameters.
Analysis/Water HRC Monitoring	$2,575	$2,575			Analyze groundwater samples, including blanks and duplicates, for HRC evaluation parameters.
Analysis/Water MNA Monitoring	$15,450	$15,450	$15,450		Analyze groundwater samples, including blanks and duplicates, for MNA evaluation parameters.
Report	$10,000	$10,000	$10,000		Document sampling events and result
Site Review				$15,000	Five year site reviews
TOTALS	$53,750	$52,725	$50,150	$15,000	

HRC: Hydrogen release compound
MNA: Monitored natural attenuaiton
ORC: Oxygen release compound

TABLE 2-11

PRESENT-WORTH ANALYSIS FOR THE SELECTED REMEDY
SITE 57 - BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 7%	Present Worth
0	$540,507		$540,507	1.000	$540,507
1		$53,750	$53,750	0.935	$50,256
2		$53,750	$53,750	0.873	$46,924
3	$182,006	$52,725	$234,731	0.816	$191,540
4		$52,725	$52,725	0.763	$40,229
5		$67,725	$67,725	0.713	$48,288
6		$52,725	$52,725	0.666	$35,115
7		$50,150	$50,150	0.623	$31,243
8		$50,150	$50,150	0.582	$29,187
9		$50,150	$50,150	0.544	$27,282
10		$65,150	$65,150	0.508	$33,096
11		$50,150	$50,150	0.475	$23,821
12		$50,150	$50,150	0.444	$22,267
13		$50,150	$50,150	0.415	$20,812
14		$50,150	$50,150	0.388	$19,458
15		$65,150	$65,150	0.362	$23,584
16		$50,150	$50,150	0.339	$17,001
17		$50,150	$50,150	0.317	$15,898
18		$50,150	$50,150	0.296	$14,844
19		$50,150	$50,150	0.277	$13,892
20		$65,150	$65,150	0.258	$16,809
21		$50,150	$50,150	0.242	$12,136
22		$50,150	$50,150	0.226	$11,334
23		$50,150	$50,150	0.211	$10,582
24		$50,150	$50,150	0.197	$9,880
25		$65,150	$65,150	0.184	$11,988
26		$50,150	$50,150	0.172	$8,626
27		$50,150	$50,150	0.161	$8,074
28		$50,150	$50,150	0.150	$7,523
29		$50,150	$50,150	0.141	$7,071
30		$65,150	$65,150	0.131	$8,535
				TOTAL PRESENT WORTH	**$1,357,801**

TABLE 2-12

DESCRIPTION OF CHEMICAL-SPECIFIC ARARs FOR THE SELECTED REMEDY
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

Media	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Groundwater	SDWA standards serve to protect public water systems. Primary drinking water standards consist of federally enforceable MCLs at the tap. An MCL is the highest level of a contaminant that is allowed in drinking water.	Impact to pubic water systems that have at least 15 service connections or serve at least 25 year-round residents. May also be clean-up standards for on-site groundwater that is a current or potential source of drinking water.	40 CFR 141.2, 141.24, 141.27, 141.28, 141.50, and 141.61	Relevant and appropriate	MCLs are the groundwater remediation goals for all COCs except diethyl ether.
Groundwater	Environmental Article, Title 9, Subtitle 4 contains standards to protect public water systems. Maryland has adopted the federal MCLs.	Impact to pubic water systems that have at least 15 service connections or serve at least 25 year-round residents. May also be clean-up standards for on-site groundwater that is a current or potential source of drinking water.	COMAR 26.04.01.01, 26.04.01.07, 26.04.01.15, 26.04.01.16, and 26.04.01.17	Relevant and appropriate if more stringent that Federal regulations	MCLs are the groundwater remediation goals for all COCs except diethyl ether.

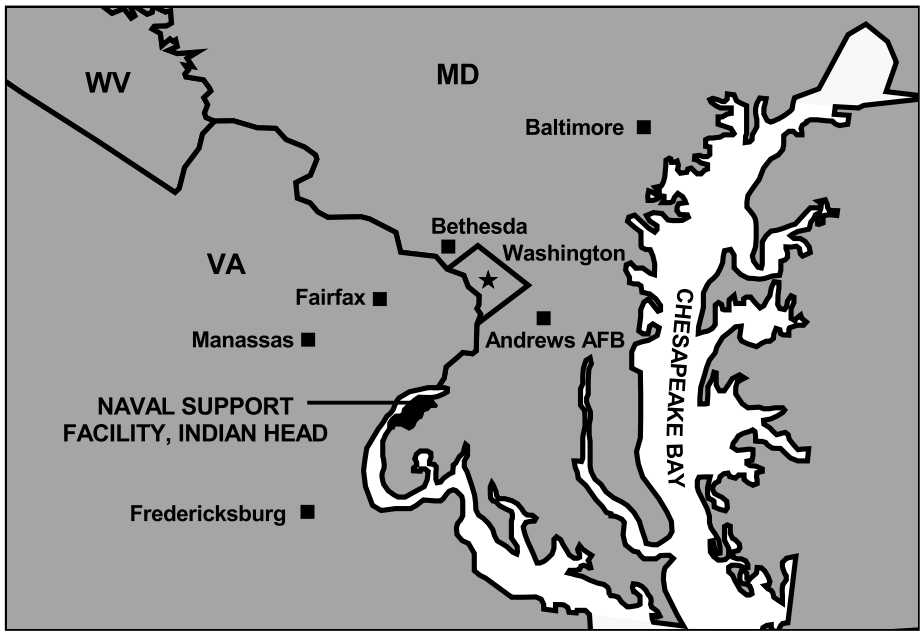
CFR Code of Federal Regulations.
COMAR Code of Maryland Regulations.
EPA United States Environmental Protection Agency.
MCL Maximum Contaminant Level.
SDWA Safe Drinking Water Act.

TABLE 2-13

DESCRIPTION OF ACTION-SPECIFIC ARARs FOR THE SELECTED REMEDY
SITE 57 – BUILDING 292 TCE CONTAMINATION
NSF-IH, INDIAN HEAD, MARYLAND

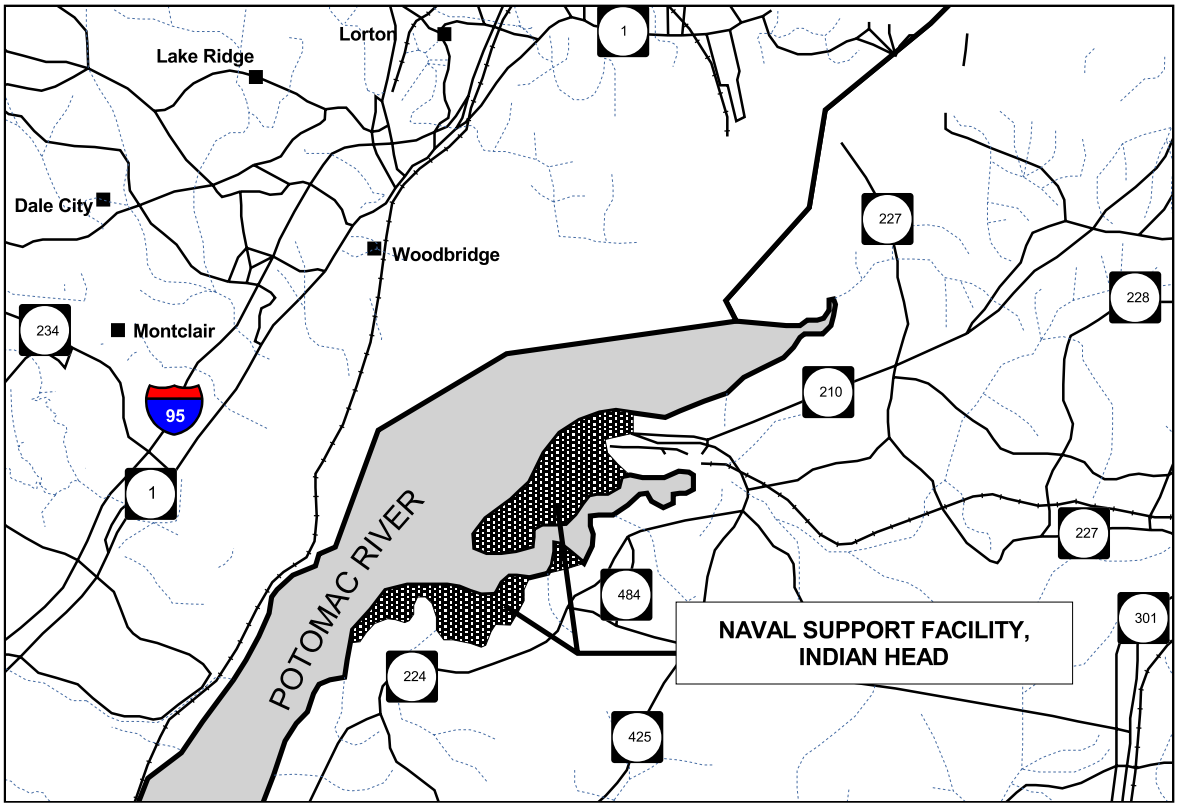
Action	Requirement	Prerequisite	Citation	ARAR Determination	Comment
Underground Injection	SDWA standards prevent underground injection of fluids unless it is in compliance with UIC regulations.	Underground injection of fluids. Wells used for injection of bioremediation chemicals are Class V.	40 CFR 144.3, 144.6, 144.12, 144.26, 144.27, 144.51, 144.52, 144.81, and 144.82; 40 CFR 146.3, 146.5, 146.6, 146.8, and 146.10(c); and 40 CFR 147.1050	Applicable	Wells used to inject bioremediation chemicals will comply with these regulations, including well construction, operation and maintenance, and abandonment requirements.
Underground Injection	Maryland has adopted the federal UIC regulations by reference.	Same as above.	COMAR 26.08.07	Applicable	Same as above.
Well Construction	Maryland carries out programs to prevent contamination of aquifers from improper well construction and well abandonment.	A well construction permit is required before installing any well that will explore for water, obtain or monitor groundwater, or inject water into any underground formation from which groundwater may be produced.	COMAR 26.04.04	Applicable (substantive only)	Wells used to inject bioremediation chemicals and to monitor groundwater quality will comply with these regulations, including well construction, operation and maintenance, and abandonment requirements.

CFR Code of Federal Regulations.
COMAR Code of Maryland Regulations.
SDWA Safe Drinking Water Act.
UIC Underground Injection Control.



LEGEND

- City
- Highway
- Railroad
- River



DRAWN BY K. PEILA — DATE 3/17/05	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2144	OWNER NO. 005
CHECKED BY K TURNBULL — DATE 4/23/07	FACILITY LOCATION MAP NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY G LATULIPPE — DATE 10/2/06	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2 - 1	REV 0

P:\GIS\INDIANHEAD_NSWC\APR\SITE57_PILOTSTUDY_SITELOCATION.APR FACILITY LOCATION MAP 4/23/07 KM

P:\GIS\INDIANHEAD_NSWC\APR\COMMUNITYRELATIONSPLAN.APR SITE 57 WORK PLAN 10/2/06 KM

DRAWN BY K. PEILA — DATE 3/17/05	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2144	OWNER NUMBER 005
CHECKED BY GJL — DATE 3/17/05	SITE LOCATION MAP SITE 57 - BUILDING 292 TCE CONTAMINATION NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY GJL	DATE 3/17/05
COST/SCHEDULE-AREA		APPROVED BY —	DATE —
SCALE AS NOTED		DRAWING NO. FIGURE 2-2	REV 0

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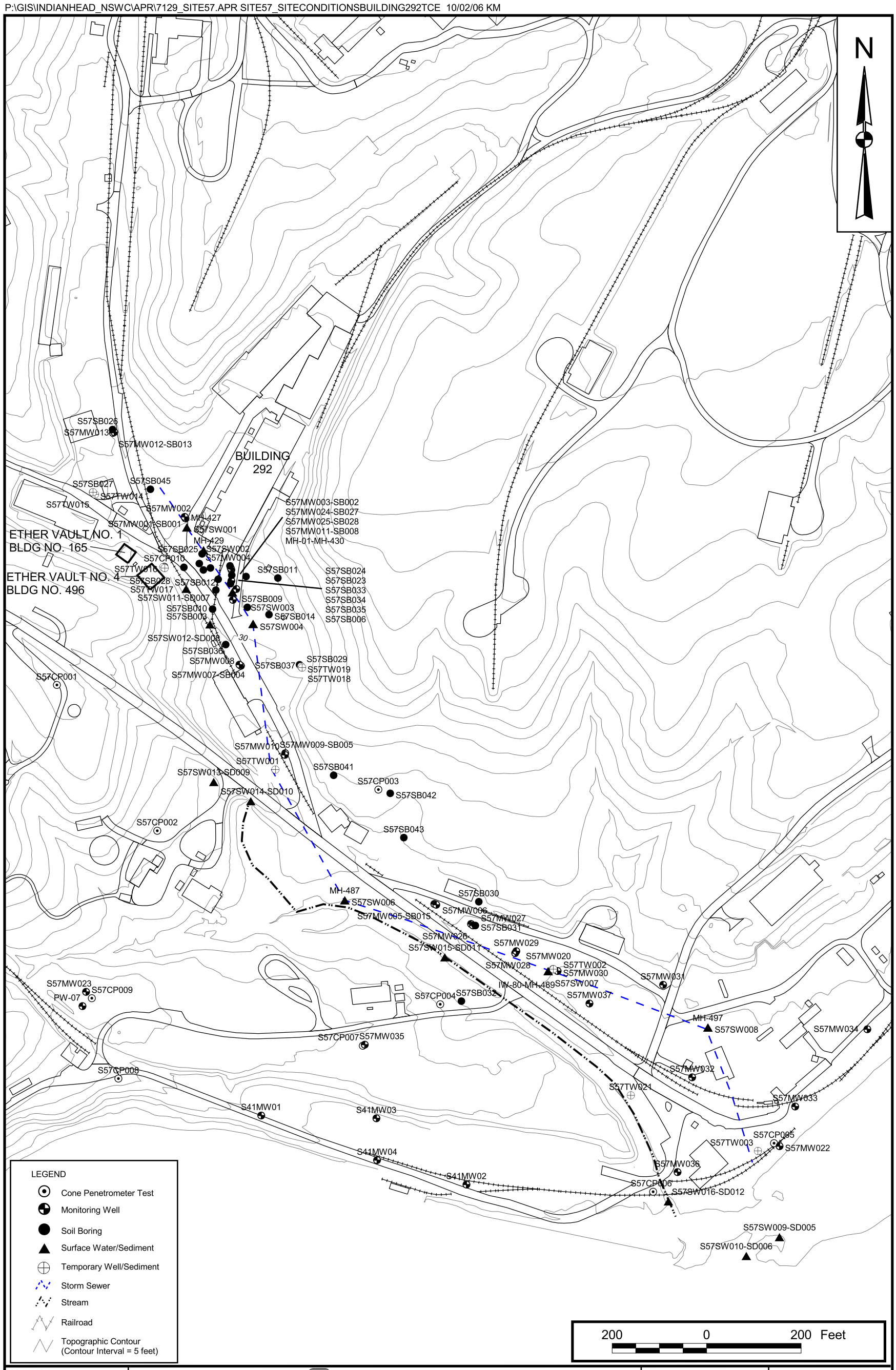

DRAWN BY K. PEILA — DATE 2/28/06	Tetra Tech NUS, Inc.	CONTRACT NUMBER 2144	OWNER NUMBER 005
CHECKED BY K. TURNBULL — DATE 9/06/06	SITE CONDITIONS MAP SITE 57 - BUILDING 292 TCE CONTAMINATION NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY G LATULIPPE — DATE 10/5/06	
COST/SCHEDULE-AREA		APPROVED BY — — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 2-3	REV 0

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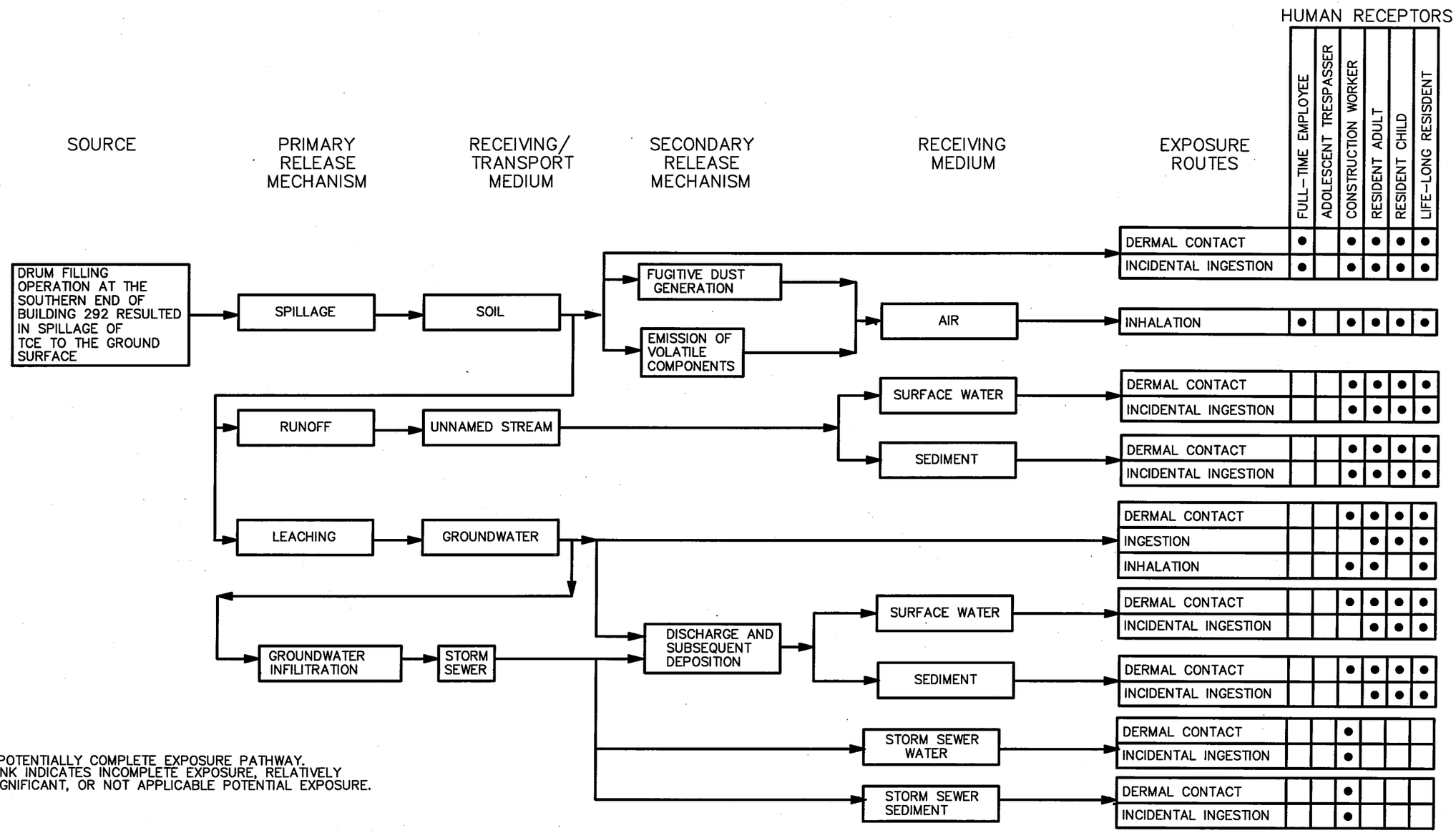


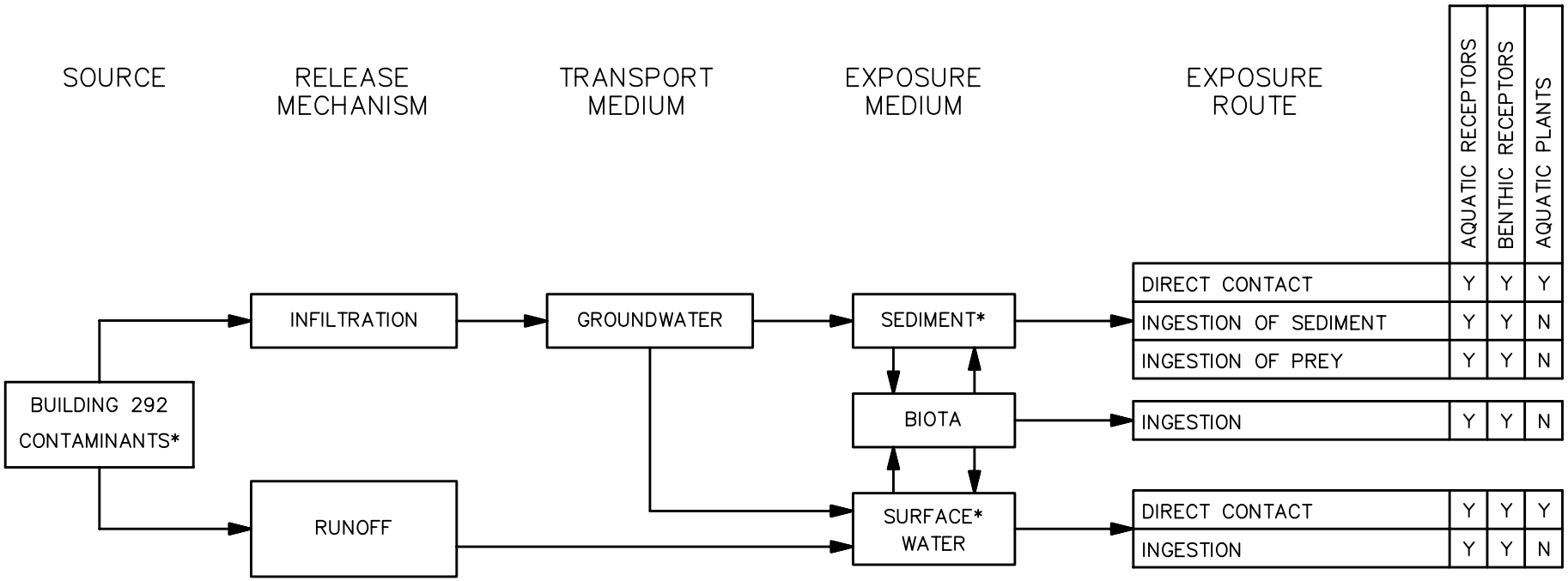
KEY:

● POTENTIALLY COMPLETE EXPOSURE PATHWAY.
BLANK INDICATES INCOMPLETE EXPOSURE, RELATIVELY INSIGNIFICANT, OR NOT APPLICABLE POTENTIAL EXPOSURE.

DRAWN BY MF	DATE 9/26/06	Tetra Tech NUS, Inc.	HUMAN HEALTH RISK ASSESSMENT SITE MODEL SITE 57 - BUILDING 292 TCE CONTAMINATION NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE NONE			

CONTRACT NO. 2144
OWNER NO. 005
APPROVED BY DATE
DRAWING NO. FIGURE 2-4
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98



LEGEND:

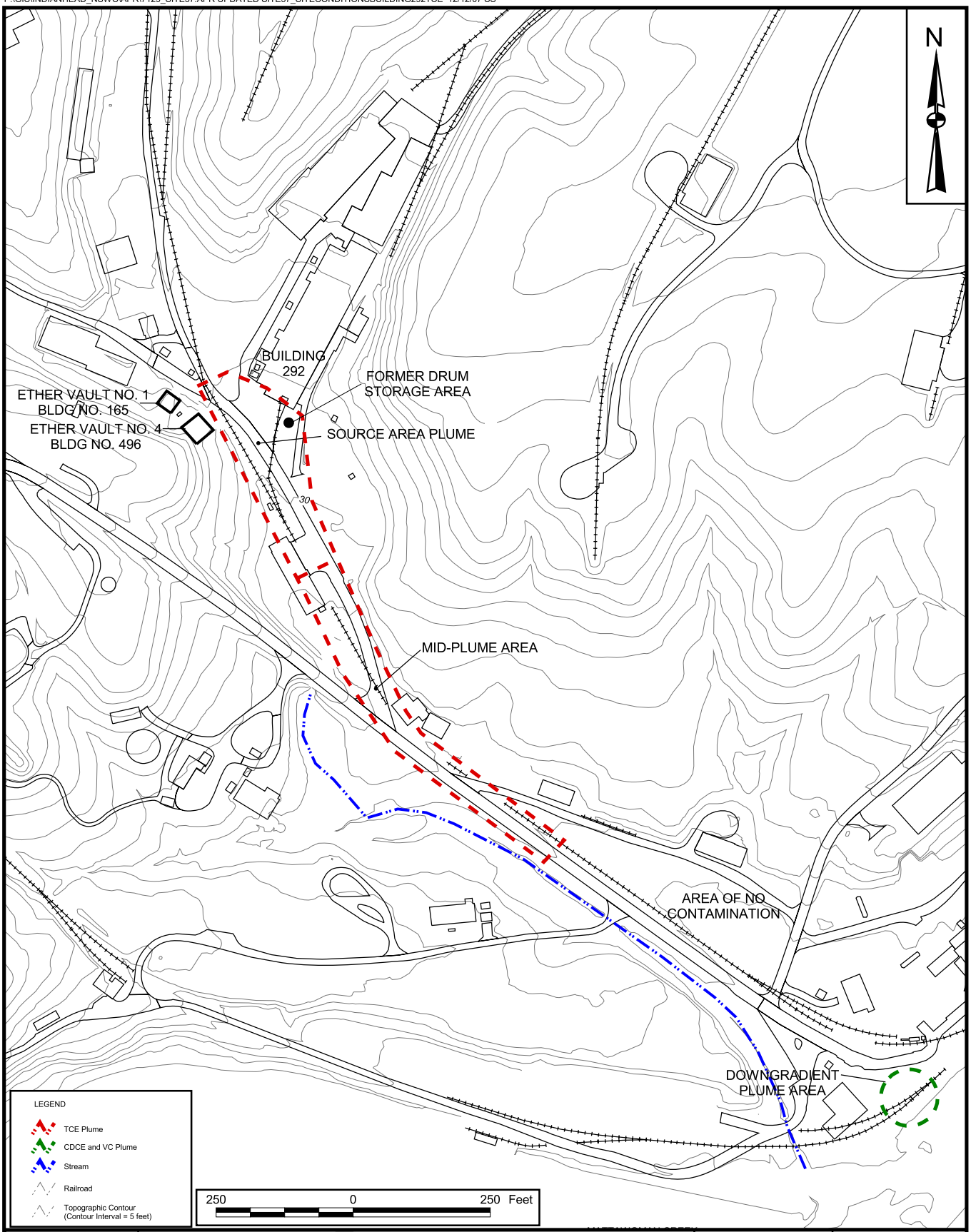
Y = COMPLETE EXPOSURE ROUTE

N = INCOMPLETE EXPOSURE ROUTE

* = INCLUDES SEWER, DITCH, STREAM AND MATTAWOMAN CREEK

DRAWN BY MF DATE 9/26/06	Tetra Tech NUS, Inc.	ECOLOGICAL CONCEPTUAL MODEL SITE 57 - BUILDING 292 TCE CONTAMINATION NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	CONTRACT NO. 2144
CHECKED BY DATE			OWNER NO. 005
REVISED BY DATE			APPROVED BY DATE
SCALE NONE			DRAWING NO. FIGURE 2-5 REV. 0

P:\GIS\INDIANHEAD_NSWC\APR\7129_SITE57.APR UPDATED SITE57_SITECONDITIONSBUILDING292TCE 12/12/07 SS



DRAWN BY K. PEILA	DATE 2/28/06	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0928 / OWNER NUMBER 447
CHECKED BY G. LATULIPPE	DATE 12/12/07	EXTENT OF GROUNDWATER CONTAMINATION SITE 57 - BUILDING 292 TCE CONTAMINATION NAVAL SUPPORT FACILITY, INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY G. LATULIPPE / DATE 10/14/07
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2-6 / REV 0

3.0 RESPONSIVENESS SUMMARY

3.1 BACKGROUND ON COMMUNITY INVOLVEMENT

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period from February 2 to March 9, 2007 for the proposed remedial action described in the Proposed Plan for Site 57. Public input is a key element in the decision-making process.

The Proposed Plan is available to the public in the Administrative Record. The RI and FS Reports are also available in the Administrative Record. The Information Repository for the Administrative Record is maintained by the NSF-IH General Library, 4163 North Jackson Road Suite 104, Indian Head, Maryland 20640-5117 (formerly Building 620, 101 Strauss Avenue, Indian Head, Maryland). The Proposed Plan was made available on January 29, 2007.

A public meeting to present the Proposed Plan for Site 57 was held at the Indian Head Senior Center, 100 Cornwallis Square, Indian Head, Maryland on February 21, 2007. Public notice of the meeting and availability of documents was placed in the *Maryland Independent* on February 2, 2007.

Representatives of the Navy, EPA, and MDE were available at the public meeting to present the Proposed Plan for Site 57 and to answer questions on the Proposed Plan.

3.2 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND NAVY RESPONSES

Following is a summary of the responses to comments received during the public comment period. None of the comments received would require a revision to the proposed remedy.

1. Comment: Although it may seem desirable to achieve a groundwater level of acceptance that would permit the use of groundwater for potable use, it is felt that such a choice might give a level of false confidence in the use of groundwater at the facility for human consumption that is unwarranted. Site 57 is not the only site that impacts groundwater at the facility. The facility has been identified as a Superfund site, and in order to provide for the necessary future human health, safety, and welfare, it is recommended that permanent restrictions on the use of shallow groundwater as a source of potable water be imposed at the entire facility.

   Response: The Navy does not currently use shallow groundwater at NSF-IH as a potable water source and does not intend to use it as a potable water source in the future. Although the entire

NSF-IH facility is a Superfund site, there are currently only 12 sites that have impacted or have the potential to impact shallow groundwater at NSF-IH and the Annex at Stump Neck. Most of these sites range in size from less than 1 acre up to 5 acres, and the impacted or potentially impacted groundwater from these sites represents a small portion of the total shallow groundwater at NSF-IH. Therefore, the Navy does not want to restrict use of all shallow groundwater at the facility in the rare case that a need arises that could be satisfied from using shallow groundwater.

In addition, using shallow groundwater as a potable water source would require permitting through the MDE via the Charles County Health Department. If the Navy were to be granted a permit, which is unlikely because shallow groundwater cannot produce enough water for potable use throughout the facility, then the shallow groundwater would be subject to the same sampling requirements as other potable water systems and contaminant levels would have to be below MCLs as provided in the Safe Drinking Water Act.

2. Comment: I have been told that no contamination from Site 57 is currently being detected in Mattawoman Creek. I feel, however, that Alternative 2 should be recommended to provide the assurance that such migration does not happen. Alternative 2 would be far less costly in terms of dollars and the use of human resources and yet would provide the necessary monitoring to confirm the effectiveness of the remedial action, to determine whether contaminants are migrating at unacceptable concentrations, and to evaluate whether future action is required. Such monitoring would provide the necessary safeguards to avoid any future contamination of Mattawoman Creek.

Response: The EPA has a preference at Superfund sites to seek a remedy involving some form of active or passive treatment that will provide long-term effectiveness and permanence. According to the NCP [40 CFR 300.430(a)(1)(iii)(F)], "EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site." According to the EPA *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites* (EPA/540/G-88/033), "Statutory mandates require that remedies be protective and utilize permanent solutions and treatment technologies to the maximum extent practicable. Consistent with these mandates, the goal of Superfund ground-water actions is to restore ground water to its beneficial uses within a reasonable time frame, given the particular site circumstances."

At Site 57, the Navy, EPA, and MDE have determined that the Selected Remedy involves treatment of groundwater to the maximum extent practicable and is consistent with the NCP and EPA guidance. EPA does not consider LUCs to be a permanent remedy.

REFERENCES

TtNUS (Tetra Tech NUS, Inc.), 2000. Remedial Investigation Report for IR Site 57, Former Drum Loading Area, Building 292, Indian Head Division, Naval Surface Warfare Center, Indian Head, Maryland. Prepared for Engineering Field Activity Chesapeake, Naval Facilities Engineering Command, Washington Navy Yard, D.C. King of Prussia, Pennsylvania.

TtNUS, 2005. Engineering Evaluation/Cost Analysis for Site 57 – Building 292 TCE Contamination, Naval District Washington, Indian Head, Maryland. Prepared for Naval Facilities Engineering Command Washington, Washington Navy Yard, D.C. King of Prussia, Pennsylvania.

TtNUS, 2006. Feasibility Study Report, Site 57 – Building 292 TCE Contamination, Naval Support Facility, Indian Head, Maryland. Prepared for Naval Facilities Engineering Command Washington, Washington Navy Yard, D.C. King of Prussia, Pennsylvania.

APPENDIX

GLOSSARY

APPENDIX – GLOSSARY

This glossary defines terms used in this Record of Decision (ROD) describing CERCLA activities. The definitions apply specifically to this ROD and may have other meanings when used in different circumstances.

Administrative Record file: A file that contains all information used by the lead agency to make its decision in selecting a response under CERCLA. This file is available for public review, and a copy is to be established near the site. Also, a duplicate is filed in a central location, such as a regional or state office.

Air stripping: A treatment system that removes VOCs from contaminated groundwater by forcing an airstream through the water causing the VOCs to evaporate and be discharged to the atmosphere.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state environmental laws and regulations that a selected remedy will meet. These requirements may vary among sites and remedial alternatives.

Aquifer: An underground formation of materials such as sand, soil, or gravel that can store and supply groundwater to wells and springs.

Aquitard: A geological formation that may contain groundwater but is not capable of transmitting significant quantities of it under normal hydraulic gradients. An aquitard could prevent or minimize the vertical migration of contaminants to deeper aquifers.

Baseline risk assessment: A study conducted as a supplement to a remedial investigation to determine the risks posed to public health and/or the environment.

Bioremediation: A treatment technology that uses bacteria to consume organic compounds. The bacteria can occur naturally in the groundwater, chemicals and/or nutrients can be added to increase the activity of naturally occurring bacteria, or bacteria can be added to the groundwater.

Carcinogen: A substance that may cause cancer.

Cleanup: Actions taken to deal with a release or threatened release of hazardous substances that could affect public health or the environment. It is often used broadly to describe various response actions or phases of remedial responses such as a remedial investigation and feasibility study.

Comment period: A time for the public to review and comment on various documents and actions taken, either by the Navy, EPA, or MDE. A minimum 30-day comment period is held to allow community members to review documents in the Information Repository and to review and comment on the Proposed Plan.

Community Relations Program: The Navy and NSF-IH program to inform and involve the public in the Superfund process and respond to community concerns.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). CERCLA establishes prohibitions and requirements concerning closed or abandoned hazardous waste sites and sets forth the liability scheme for those responsible for releases of hazardous substances at these sites. An important provision of SARA included federal facilities in the CERCLA process.

Contaminant: Any physical, biological, or radiological substance or matter that, at a great enough concentration, could have an adverse effect on human health or the environment.

Dense non-aqueous-phase liquid (DNAPL): Non-aqueous phase liquids such as TCE with a specific gravity greater than 1.0 that can sink through the groundwater until they reach a confining layer (aquitard). It may take a long time for DNAPL to reach a confining layer because it may adhere to soil particles within the aquifer above the confining layer. It is difficult to remove DNAPL, and it can be an ongoing source of groundwater contamination.

Drinking water standards: Minimum standards for the quality of drinking water that are set forth by EPA and MDE.

Ecological receptor: A plant or animal that may be exposed to a contaminant in the environment.

Feasibility Study (FS): See Remedial Investigation/Feasibility Study.

Groundwater: Water beneath the ground surface that fills spaces between materials such as sand, soil, or gravel to the point of saturation. In aquifers, groundwater occurs in quantities sufficient for drinking water, irrigation, and other uses. Groundwater may transport chemicals that have seeped downward from the ground surface as it flows toward its point of discharge.

Hazard Quotient (HQ): The ratio of the daily intake of a chemical from on-site exposure divided by the reference dose for that chemical. The reference dose represents the highest daily intake of a chemical that is not expected to cause adverse health effects.

Hazardous substance: Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.

Information Repository: A file containing information, technical reports, and reference documents regarding an NPL site. The Information Repository for NSF-IH is at the General Library; Naval Support Facility, Indian Head; 4163 North Jackson Road, Suite 104; Indian Head, Maryland 20640-5117.

In-Situ: In its natural or original place without being removed from the subsurface.

Land use controls (LUCs): Legal and administrative measures that restrict land use to protect human health and the environment. LUCs ensure that future land uses and on-site activities do not impair the effectiveness of a remedy or expose people to contamination in a manner that poses unacceptable risk. LUCs are included in the NSF-IH Geographic Information System (GIS).

Maximum Contaminant Levels (MCLs): National standards for acceptable levels of contaminants in public drinking water systems.

Metals: Metals are naturally occurring elements in the earth. Exposure to some metals, such as arsenic and mercury, can have toxic effects. Other metals, such as iron, are essential to the metabolisms of human and ecological receptors.

Monitoring: Ongoing collection of information about the environment that helps determine the effectiveness of a clean-up action. This includes the collection of samples and laboratory analysis for the chemicals of interest.

Monitoring wells: Wells drilled at specific locations on or near a site where groundwater can be sampled at selected depths and studied to assess the groundwater flow direction and the types and amounts of chemicals present.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): The purpose of the NCP is to provide the organizational structure and procedures for preparing for and responding to

discharges of oil and releases or threatened releases of hazardous substances, pollutants, or contaminants.

National Priorities List (NPL): The EPA list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response.

Net Present Worth: A present-worth analysis is used to evaluate costs that occur over different time frames by discounting all future costs to a common base year. It represents the amount of money that, if invested in the base year and dispersed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. Net present worth considers both capital (construction) costs and costs for annual O&M.

Organic compounds: Naturally occurring or man-made chemicals containing carbon. Volatile organics can evaporate more quickly than semivolatile organics. Some organic compounds may cause cancer; however, their strength as a cancer-causing agent can vary widely. Other organics may not cause cancer but may be toxic. The concentrations that can cause harmful effects can also vary widely.

Potable water: Water that is safe for drinking, cooking, showering, and bathing.

Proposed Plan: A public participation requirement of CERCLA used to facilitate public involvement in the remedy selection process. The document presents the lead agency's preliminary recommendation concerning how best to address contamination at the site, presents alternatives that were evaluated in the FS, and explains the reasons the lead agency recommends the preferred alternative. The document must actively solicit public review and comment on all alternatives under consideration.

Record of Decision (ROD): An official public document that explains which remedial alternative(s) will be used at an NPL site. The ROD is based on information and technical analysis generated during the RI/FS and includes consideration of public comments and community concerns. The ROD explains the remedy selection process and is issued by the Navy and EPA following the public comment period on the Proposed Plan.

Remedial action: The actual construction or implementation phase that follows the remedial design for the selected alternative at a site on the NPL.

Remedial design: The technical analysis and procedures that follow the selection of a remedy for a site and that result in a detailed set of plans and specifications for implementation of the remedial action.

Remedial Investigation (RI)/Feasibility Study (FS): Investigations and analytical studies usually performed at a site in an interactive process and together referred to as the "RI/FS." They are intended to gather data needed to determine the type and extent of contamination, to establish criteria for cleaning up the site, to identify and screen alternatives for remedial action, and to analyze in detail the technology and costs of the alternatives.

Remedial response: A long-term action that stops or substantially reduces a release or threatened release of hazardous substances that is serious but does not pose an immediate threat to public health or the environment.

Remedy: Actions taken to deal with a release or threatened release of hazardous substances that could affect public health or the environment.

Response action: As defined by CERCLA Section 101(25), means remove, removal, remedy, or remedial action, including enforcement activities.

Responsiveness Summary: A summary of significant public comments received during a comment period and the responses to these comments prepared by the lead agency. The Responsiveness Summary is an important part of the ROD, highlighting community concerns for decision-makers.

Risk assessment: Evaluation and estimation of the current and future potential for adverse human health or environmental effects resulting from exposure to contaminants.

Semivolatile organic compound (SVOC): A chemical compound that evaporates slowly at normal temperatures and pressures.

Shallow groundwater: Groundwater that is found just below the ground surface and is not confined or covered by an impermeable layer such as clay.

Soil gas: Gaseous elements and compounds in the small spaces between particles of the earth and soil. Such gases can be moved or driven out under pressure.

Superfund: The program operated under the legislative authority of CERCLA and SARA that funds and carries out EPA solid waste emergency and long-term removal and remedial activities. These activities include establishing the NPL, investigating sites for inclusion on the list, determining their priority, and conducting and/or supervising cleanup and other remedial actions.

Superfund Amendments and Reauthorization Act (SARA): The public law enacted to amend the authorities and requirements of CERCLA and associated laws. Section 120 of SARA requires that all federal facilities be subject to and comply with this act to the same extent as any non-government entity.

Surface water: Bodies of water that are above ground, such as rivers, streams, lakes, and ponds.

TCE degradation products: If natural conditions in groundwater are suitable or conditions are made suitable by adding special additives, TCE, which has three chlorine atoms, can degrade to other chemical compounds with two, one, or zero chlorine atoms. Key TCE degradation products detected in shallow groundwater at Site 57 are cis-1,2-dichloroethene and vinyl chloride.

Volatile organic compound (VOC): A chemical compound that evaporates readily at normal temperatures and pressures.